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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-5 of IJIER** which is scheduled to be published on **01st May 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

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Innovation and performance in Brazilian football clubs

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Abstract

The purpose this study is to evaluate the influence of innovation on the performance of Brazilian soccer clubs, aiming to deepen the interrelationship between the themes and provide answers and possibilities for more effective decisions by managers. With data from the years 2015 to 2017, a sample of 26 clubs soccer clubs participating in Series A of the Brazilian Football Championship used. Brands registration and the representation of intangible assets serve as proxies for innovation. Club performance measured by revenue logarithm (financial performance), return on equity (economic performance) and CBF ranking (sports performance). In order to meet the general objective of the research, linear regression applied. Considering the study variables registration of brands and representativeness of intangible assets as proxies for measuring innovation, it was inferred that there is significant and positive influence of innovation on financial and sports performance, this is, innovation contributes to the increase of performances. Thus, it inferred that innovation is a potential source of competitive advantage as it results in increased performance.

Keywords: Intangible assets, Brands, Competitive advantage.

1 Introduction

Organizations competing in the market must adopt practices that guarantee their continuity and growth. Therefore, these organizations need to use some strategies, including innovation that is considered the main element of the economic development and prosperity of companies, industries and countries (Schettino, Sterlacchini, & Venturini, 2013).

Innovation is understood as the response of the creation of a new product or also a new quality of an existing product or process, providing direct and indirect effects on the growth of companies and contributing to the economic development of the country.

Innovation comes through different forms such as a new idea or behavior (Jiménez-Jiménez & Sanz-Valle, 2011) and affecting viability and serving as the driving force for economic and social changes (Santos, Hoffmann, Jara, & Coral, 2014). Companies that do not adapt to innovation and criteria established by the market certainly will face difficulties and fail (González-Fernández & González-Velasco, 2018).

Companies need to value their financial resources and invest efficiently because of the dynamism of the market. We highlight the intangible resources that are the knowledge, the experience of the employees, the reputation and the brands, for example, that increase the economic value of the company and create competitive advantage (Santos, Vasconcelos, & De Luca, 2013; Santos *et al.*, 2014).

According to Arrighetti, Landini, & Lasagni (2014) we can compare the investments in intangible assets as a product of a set of resources that are directly related to the innovation in the organizations, and thus are considered the main indicators that elevate the organizational performance (Liao & Rice, 2010). In other studies when intangible assets was use as a source of innovation, a positive impact on the performance of the company is perceived, improving its position in the market, also aiding in its competitive advantage.

The existence of the relationship between innovation and corporate performance is reflected in many studies that analyze different types of innovation and organizational typologies. According to Ecer & Boyuskaslan (2014), soccer clubs are growing more than other businesses in the last decades and undergo significant changes, because teams become competitive businesses, a good opportunity to make money without losing the essence of the world's most popular sport (Leite & Pinheiro, 2014), and becoming the main mean of generating revenues in the current market (Nicolau, 2011).

Thus, we understand that innovation and performance have any relationship with each other (Dimitropoulos & Koumanakos, 2015; Galvão & Dornelas, 2017; González-Fernández & González-Velasco, 2018; Rohde & Breuer, 2016; Surroca, Tribó, & Waddock, 2010), that football clubs are similar to large companies in relation to their assets (Ecer & Boyukaslan, 2014; Yang & Sonmez, 2005) and they need the financial resources to innovate. The present study asks: what is the influence of innovation on the performance of Brazilian Football clubs?

The purpose of this study was to analyze the influence of innovation on performance in Brazilian football clubs and has as an additional objective to outline the innovation profile in these clubs.

To achieve that, about 26 Brazilian football clubs were studied and these clubs participated once at least in the A series of the Brazilian Football Championship, in the years 2015 to 2017, having a proxies the representativeness of the intangible asset and the registration quantity of brands in each year of analysis. Performances are considered as financial, economic and financial contexts.

The research is different because of the characteristics of the models used, and the clubs analyzed were considered the best in Brazilian football and after the FIFA World Cup in 2014 the innovative and performance potential of these clubs has improved. Despite, recent research focuses on the analysis of publicly traded companies and foreign football clubs, for example. Besides, the study does not consider traditional proxies for innovation and performance, but it adopts the brand registration and the ranking of the Brazilian Football Confederation (CBF).

2 Literature review

2.1 Organizational innovation and its use of brands as a competitive differential.

Innovation is the implementation of a new or significantly improved product (goods or service), a process, a new marketing method or a new organizational method, in the organization of the workplace or in external relations (OCDE, 2005).

The federal law n° 10.973 on 2 December 2004 is about the incentive to innovation and scientific research in the workplace, defines innovation as the introduction of novelty or improvement in the productive or social environment, resulting in new processes or services (*Law 10.973/2004*).

Great companies need innovation, because many competing companies constantly present innovations in the market, being better to attract and maintain their customers.

In the current competitive market, business value changes from tangible assets such as real estate and machinery to intangible assets such as brands and patents, because the economic value of a business is the sum of all its tangible and intangible assets, and intangible assets are becoming more important in the commercial value of the companies, perceived by the growth of the market value related to the book value (Kayo, Kimura, Martin, & Nakamura, 2006).

Some renowned authors state that intangible assets create competitive differentials that are harder to copy. Patents, brands, copyrights or intellectual capital generate competitive advantages that are difficult to eliminate, for example (Perez & Famá, 2015).

And for this reason, the investments made by companies in intangible assets are increasing in recent years with a focus on knowledge in order to achieve excellent results.

Research and development investments generate competitive differentials through new products and / or services, know-how, brand appreciation, and development of new production systems. Companies are always introducing new features in the marketplace to attract and retain their customers through the use of their brands.

The brand is the most appropriate strategy by companies to differentiate themselves in the market, because it is the way of exposure of image with the stakeholders in demanding and competitive markets. According to the National Institute of Intellectual Property of Brazil (INPI) the brand is a differentiated sign, its main functions are to identify origin and distinguish products or services from other identical, similar products or services from different origins.

The brand is considered an intangible asset of the companies for presenting market value, some organizations focus their strategy basically on activities and research and development and the brand, in order to add more value to the products and services delivered to the market.

In the sporting context, specifically in soccer, teams do not have their brands valued, and are considered as secondary meaning. The secondary meaning is when a common sign devoid of distinguishability acquires entrepreneurial ability to differentiate a product or service while taking the protection of its brand. Football club brands are very important because companies relate the love of the club to products and services, thereby increasing the financial results. Sports sponsorship drives approximately \$ 50 billion annually worldwide, representing approximately 35% of the sports market, which also includes ticket sales, broadcasting rights and merchandising (Amorim & Almeida, 2017).

The results presented by the clubs attract large sponsorships and also develop partnerships with companies with brands with higher market potential.

For this reason, the pressure for results in football clubs is intense. The difference between football club and a company is in the immediate results. Usually companies evaluate results annually, while football clubs evaluate their results weekly. Football coaches are often criticized and even fired when there are no good results in a sequence of two or three games.

2.2 The performance of Brazilian Football Clubs

Performance-measurement studies confirm that effective management is achieved when a system of measures or performance indicators, financial or otherwise, is incorporated to confirm the alignment of activities with the objectives of organization (Dani, Kaveski, Santos, Leite, & Cunha, 2017; Pace, Basso, & Silva, 2003).

Football clubs are organizations similar to large corporations in relation to the structure of assets and these clubs organize and structure their operation through responsible management (Yang & Sonmez, 2005). With the advent of the club-business concept, football clubs became units with economic autonomy, which profit from the sale of goods and services to the community. Football clubs have created their own income and lines of business and have turned companies (Maia & Vasconcelos, 2016). It is possible to measure their performance by taking into account aspects related to internal and external environments, based on both the economic-financial question and the maximization of sporting achievements and performances (Dantas, Machado, & Macedo, 2015).

It is important for the manager to know the measures and indicators of organizational performance, and then select the ones that are more consonant with the reality of the company (Galvão & Dornelas, 2017). Financial statements are more reliable sources because they provide current and periodic information on the financial and economic status of organizations (Ecer & Boyukalash, 2014).

It is possible to trace new strategies when analyzing economic-financial performance, reshape operational policies and implement corrections or inefficiencies, while economic-financial indices are essential management tools and increase profits for organizations (Tian & Ketsaraporn, 2013). In this study we used the logarithm of gross revenue to measure financial performance (Galvão & Dornelas, 2017; Leite & Pinheiro, 2013; Rohde & Breuer, 2016). It is utilized return on net worth, represented by the profit and net worth, and it is also used to measure economic performance to demonstrate the profitability of resources invested (Santos, Góis, Rebouças, & Silva Filho, 2016).

The data and indexes collected in the structure of the financial statements are considered relevant, but to make an accurate assessment of the company's performance it is necessary to evaluate the financial and economic situation separately, and after the appropriate conclusions, effective decisions are taken (Antunes & Martins, 2007; Tian & Ketsaraporn, 2013).

Analyzing the sporting performance, the relationship between the performance in the games and the victory with the conquest of the titles in the championships has great positive impact in the increase of the profits of the football teams with the sale of tickets, partner fan, rental of the stadiums of football, sponsorships, games broadcasting revenues, merchandising and the sale of players (Rohde & Breuer, 2016). The ranking takes into account the ranking of the Brazilian Football Confederation, published on the institution's website, which establishes various scores for placement of the clubs in championships organized directly and indirectly by institutions (Dantas, Machado, & Macedo, 2015; Nascimento, Dantas, & Azevedo, 2019).

Thus, the next subsection lists national and international studies that discuss the relationship between innovation and performance, and with the review of the literature and with the result of these surveys a hypothesis is formulated.

2.3 Previous empirical studies and research hypothesis

This section presents previous empirical studies that investigated the relationship between innovation and performance in the business context and also in sports clubs and served as a basis for the elaboration of the research hypothesis.

The studies evaluated the effects of a company's intangible assets on the financial performance of 599 companies from 28 different countries (Surroca *et al.*, 2010). The authors used the Resource Based View (RBV) as a theoretical aspect and verified the existence of a positive influence of the intangible assets on the financial performance of the firms.

The data from the year 2015 with samples of 35 Brazilian football clubs from the A, B and C series, using Pearson's correlation, found no relation between the intangible, and it is a variable constantly used as proxy for innovation and performance measured by the total return on assets (ROA) and return on equity (ROE) (Cunha, Santos, & Haveroth, 2017).

On the other hand, the impacts of intellectual capital (innovation) on the profitability (performance) of 23 European football clubs in the years 2005 to 2010 were evaluated by other authors. There was a positive association between intellectual capital and profitability, that is, clubs that spend more with their employees (players, technical staff, etc.) add greater value to the organization (Dimitropoulos & Koumanakos, 2015).

Using data from the top 30 European football clubs from 2004 to 2013, it was evident that performance is improved with national and international sporting success, also by brand value, and this variable is used in several surveys as a proxy for innovation (Rohde & Breuer, 2016).

Using the Resource Based View (VBR) with samples of Brazilian football clubs between 2010 and 2013, and athlete as an intangible asset through a data analysis, it was verified that football clubs are not efficient in generating benefits, but the club revenues help to achieve better performance, assuming a relationship between innovation and performance (Galvão & Dornelas, 2017).

Intangible assets of Brazilian companies recorded in the financial statements presented a relationship between innovation and performance. The results of the studies suggest that there is a relationship between investments in intangible assets and organizational performance (Galvão & Dornelas, 2017).

In the relationship between corporate performance and innovation in Spanish companies, in the period 2007-2013, the authors found in a panel evidences that return on equity and in particular sales revenues are positively influenced by corporate innovation (González-Fernández & González-Velasco, 2018).

Based on foregoing analysis, football clubs resemble large companies in the structure of their assets (Nascimento *et al.*, 2017; Yang & Sonmez, 2005) and companies use intangible assets to develop innovation (Bartoloni, 2013; O'Brien, 2003; Teh, Kayo, & Kimura, 2008) and the following research hypothesis is developed: innovation influences the performance of Brazilian football clubs (H1).

3 Methodology

The study separates data from 200 Brazilian football clubs present in the ranking of the Brazilian Football Confederation in the year 2017. However, this study only considers the participating clubs of the Brazilian Championship series A from 2015 to 2017, totaling 26 clubs or 78 observations. The delimitation of time is for two reasons: the first reason is about the years after the 2014 FIFA Football World Cup, since

it is presumed the increase of the innovative potential and the performance of the clubs, taking into consideration the recommendation of the Oslo Manual (OECD, 2005), which states that innovation research must consider a given three-year period to ensure the veracity of the studies.

The football clubs that justify the research are: América Futebol Clube (Belo-Horizonte-MG), Associação Atlética Ponte Preta (Campinas-SP), Associação Chapecoense de Futebol (Chapecó-SC), Atlético Clube Goianiense (Goiânia-GO), Avaí Futebol Clube (Florianópolis-SC), Botafogo de Futebol e Regatas (Rio de Janeiro-RJ), Club de Regatas Vasco da Gama (Rio de Janeiro-RJ), Clube Atlético Mineiro (Belo Horizonte-MG), Clube Atlético Paranaense (Curitiba-PR), Clube de Regatas do Flamengo (Rio de Janeiro -RJ), Coritiba Foot Ball Club (Curitiba-PR), Cruzeiro Esporte Clube (Belo Horizonte-MG), Esporte Clube Bahia (Salvador-BA), Esporte Clube Vitória (Salvador-BA), Figueirense Futebol Clube (Florianópolis-SC), Fluminense Football Club (Rio de Janeiro -RJ), Goiás Esporte Clube (Goiânia-GO), Grêmio Football Porto Alegrense (Porto Alegre-RS), Joinville Esporte Clube (Joinville-SC), Santa Cruz Futebol Clube (Recife-PE), Santos Futebol Clube (Santos-SP), São Paulo Futebol Clube (São Paulo-SP), Sociedade Esportiva Palmeiras (São Paulo-SP), Sport Club Corinthians Paulista (São Paulo-SP), Sport Club do Recife (Recife-PE) and Sport Club Internacional (Porto Alegre-RS).

Football clubs are intangible-intensive entities (Galvão & Miranda, 2016), and intangibles are sources for implementing innovative potential (Bartoloni, 2013; O'Brien, 2003; Teh *et al.*, 2008), and innovation is analyzed through indicators such as brand registration (TDM) and representativeness of intangible assets (RIA). Brand information is taken from the website of the National Institute of Intellectual Property (INPI) and considers the natural logarithm of the number of brand registrations made in each year of the study period (Kayo, Teh, & Basso, 2006; Teh *et al.*, 2008). Information on Intangible Assets Representativeness (RIA) was obtained indirectly from the financial statements of football clubs, specifically the balance sheet, which is available on each club's website, taking into account the ratio between the values of intangible assets and assets total (Leite & Pinheiro, 2013; Maia & Vasconcelos, 2016).

This research used as proxies: the natural logarithm of gross sales revenue obtained in the clubs' income statements each year to measure financial performance (FP) (Galvão & Dornelas, 2017; Leite & Pinheiro, 2013; Rohde & Breuer, 2016). Economic performance (EP) was obtained directly from the financial statements (Income Statement and Balance Sheet), as a result of the ratio of profit to equity (Brito, Brito, & Morganti 2009; Santos *et al.*, 2016). Thus, sports performance (SP) was measured using the information contained in the CBF rankings available on the Confederation website for the years 2015 to 2017, in which the score of each team to create the respective variable was logarithmized.

The following control variables were also included: club age (AGE), represented by the year of institution of the company until each year surveyed (Mcdougall & Oviatt, 2000; Shearmur, Doloreux, & Laperrière, 2015); Size (SIZE) represented by the asset value logarithm (Boehe, Larentis, Toni, & Mattia, 2011; Shearmur *et al.*, 2015); and the dummies referring to the years of analysis. Data referring to the control variables were taken from club websites on their financial statements.

Initially, for the first specific objective, the characteristics of the sample clubs were outlined by presenting the innovative scenario based on the number of brands and the composition of their assets during the period analyzed and then listing the most innovative clubs.

Then organizations for innovation, performance and control were created according to their distribution quartiles, creating four categories: low, medium-low, medium-high and high (Chart 1). Table 1 is the categorization for the variables mentioned above.

Chart 1 – Categorization of control variables.

Quart	Interval	Categorization
1°	minimum value at 24° percentile	Low (L)
2°	25° percentile to 49° percentile	Medium-low (ML)
3°	50° percentile to 74° percentile	Medium-high (MH)
4°	75° percentile to maximum value	High (H)

Source: made by the authors.

Table 1 - Categorization of study variables.

Quart	Categorization	RIA	FP	EP	SP	SIZE	AGE
1°	Low (L)	To 0,07 37	To – 17,8979	To 0,2195	To 8,8771	To 18,1609	To 89
2°	Medium-low (ML)	Fro m 0,07 38 to 0,15 11	From 17,8980 to 18,5646 to 0,15 11	From- 0,2196 to 0,0055	From 8,8772 to 9,2031	From 18,1610 to 19,1935	From 90 to 104
3°	Medium-high (MH)	Fro m 0,15 12 to 0,22 37	From 18,5647 to 19,4750 to 0,22 37	From 0,0056 to 0,2814	From 9,2032 to 9,4823	From 19,1936 to 20,0334	From 105 to 112
4°	High (H)	Fro m 0,22 38	From 19,4751	From 0,2815	From 9,4824	From 20,0335	From 113

Subtitles: RIA - Representativeness of the intangible asset. FP - Financial performance. EP – Economic performance. SP – Sport performance. SIZE – Size. AGE – Age.

Source: Research data.

Then, Multiple Correspondence Analysis was proceeded – MCA, it is a technique that shows associations between a set of non-metric variables in a perceptual map and thus allows a visual examination of any pattern or data structure (Fávero, Belfiore, Silva, & Chan, 2009). Therefore, the technique was used to examine the association between constructs regarding innovation, performance, size and age.

In order to meet the general objective of the research, a linear regression was performed for financial, economic and sports performance, according to the following econometric models:

Equation (1): $FPI =$

Table 3 - Ranking of Serie A Football Clubs for Brand Registration.

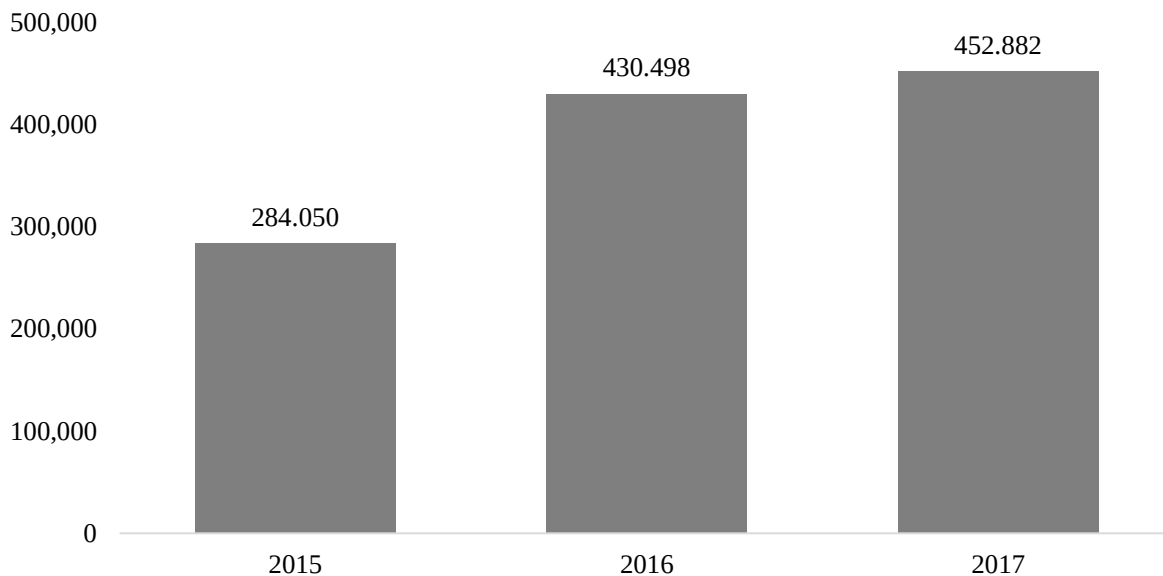
Club	2015	2016	2017	Total	Representativeness
Clube de Regatas do Flamengo	4	16	1	21	15,22%
Clube Atlético Mineiro	1	15	0	16	11,59%
Sociedade Esportiva Palmeiras	0	16	0	16	11,59%
Grêmio Football Porto					
Alegrense	9	4	0	13	9,42%
Sport Club Corinthians Paulista	6	6	0	12	8,70%
Cruzeiro Esporte Clube	8	2	0	10	7,25%
São Paulo Futebol Clube	6	2	0	8	5,80%
Clube de Regatas Vasco da					
Gama	0	7	0	7	5,07%
Fluminense Football Club	2	4	0	6	4,35%
Clube Atlético Paranaense	1	4	0	5	3,62%
Associação Atlética Ponte Preta	5	0	0	5	3,62%
Botafogo de Futebol e Regatas	1	3	0	4	2,90%
Santos Futebol Clube	0	4	0	4	2,90%
Sport Club do Recife	0	4	0	4	2,90%
América Futebol Clube	0	3	0	3	2,17%
Esporte Clube Bahia	0	2	0	2	1,45%
Associação Chapecoense de					
Futebol	0	0	1	1	0,72%
Sport Club Internacional	1	0	0	1	0,72%
Atlético Clube Goianiense					
Avaí Futebol Clube					
Coritiba Foot Ball Club					
Figueirense Futebol Clube					
Goiás Esporte Clube	0	0	0	0	0,00%
Joinville Esporte Clube					
Santa Cruz Futebol Clube					
Esporte Clube Vitória					
Total	44	92	2	138	----

Source: Research data.

In Table 3, considering the registration of brands as a variable for innovation the Clube de Regatas Flamengo is considered most innovative because it was responsible for the registration of 15.22% of brands in the period studied. Then, the Clube Atlético Mineiro and Sociedade Esportiva Palmeiras are responsible for the registration of 11.59% of total brands. It is important to mention that the clubs Atlético Clube Goianiense, Avaí Futebol Clube, Coritiba Foot Ball Club, Figueirense Futebol Clube, Goiás Esporte Clube, Joinville Esporte Clube, Santa Cruz Futebol Clube and Esporte Clube Vitória are not considered innovative

because they did not register any brands in the period analyzed. It is important to note that clubs in southeastern Brazil are the ones that register the most brands because of their visibility in the national sports scene. In relation to value of intangibles, there is an evolution relative the value of this asset (Figure 1).

Figure 1 - Evolution of the total values of intangible assets of Brazilian football clubs of series A
(in thousands of dollars)



Source: Research data.

The information presented in Figure 1, the values of intangible assets of clubs grew during the time period studied, from US\$ 284,050,000 in 2015 to US\$ 430,498,000 in 2016, representing a growth of 14.55%. From 2016 to 2017, there was an increase in intangible assets by 23.10%. Thus, it is argued that the sample clubs are increasingly investing in intangible assets and so their innovative potential has been increasing. Complementing Figure 1, Table 4 presents a ranking of football clubs, into account the registration of values as intangible assets.

Table 4 - Ranking of Brazilian football clubs, series A, as Intangible Assets (in dollars).

Club	2015	2016	2017	Total
Sociedade Esportiva Palmeiras	29,261,163	52,133,231	88,824,699	170,219,092
Sport Club Corinthians Paulista	34,442,093	50,894,769	46,557,831	131,894,694
São Paulo Futebol Clube	37,408,605	45,798,769	39,822,590	123,029,964
Cruzeiro Esporte Clube	23,891,550	45,364,158	38,654,497	107,910,204
Sport Club Internacional	19,141,034	30,637,144	26,206,229	75,984,407
Associação Atlética Ponte Preta	19,267,341	26,297,253	24,752,217	70,316,810
Santos Futebol Clube	18,754,419	24,985,538	26,522,590	70,262,547
Grêmio Football Porto				
Alegrense	15,674,651	25,016,923	21,948,494	62,640,068
Clube de Regatas do Flamengo	10,921,628	15,236,308	28,171,386	54,329,321
Clube de Regatas Vasco da				
Gama	18,469,302	20,462,769	11,906,928	50,838,999
Fluminense Football Club	19,454,651	15,172,923	10,670,783	45,298,357
Clube Atlético Mineiro	9,294,399	18,271,102	14,378,367	41,943,868
Sport Club do Recife	2,421,962	11,877,166	23,496,889	37,796,017
Coritiba Foot Ball Club	6,954,505	10,458,284	9,311,979	26,724,767
Esporte Clube Bahia	3,487,209	9,232,000	7,638,855	20,358,065
Clube Atlético Paranaense	4,372,740	6,215,967	7,844,954	18,433,661
Esporte Clube Vitória	3,834,221	6,225,220	7,486,341	17,545,782
Botafogo de Futebol e Regatas	1,435,581	5,360,923	5,683,434	12,479,938
Figueirense Futebol Clube	1,866,674	2,690,271	2,303,258	6,860,203
Associação Chapecoense de				
Futebol	329,660	1,231,761	3,472,970	5,034,391
Goiás Esporte Clube	1,109,763	1,620,455	1,663,870	4,394,088
Santa Cruz Futebol Clube	415,830	1,704,203	1,444,661	3,564,694
Avaí Futebol Clube	570,523	1,021,576	1,798,880	3,390,979
América Futebol Clube	0	1,905,194	1,436,036	3,341,230
Joinville Esporte Clube	465,632	682,470	453,345	1,601,446
Atlético Clube Goianiense	805,638	2,492	430,402	1,238,532
Total	284,050,773	430,498,870	452,882,482	1,167,432,126

Source: Research data.

The information in Table 4 shows that Sociedade Esportiva Palmeiras was the club with the highest value of intangible assets in the period analyzed and its investments grew year by year. Sport Club Corinthians Paulista was in second place and only from 2015 to 2016 their intangible increased, decreasing the following year in 2017. Two teams were the best in this period, Palmeiras with one title and Corinthians with two titles, both were the clubs that won the last three editions of the national tournament, the Brazilian Football Championship, years 2015, 2016 and 2017. The clubs that were in the last places of the ranking

or increased from series B to Series A and / or downgraded from series A to Series B, in the period analyzed. With the results, it is concluded that the investment in intangible assets may be determinant for the conquest of national titles or the downgrade to the second division.

After analyzing Tables 3 and 4, it was noted that Sociedade Esportiva Palmeiras and Sport Club Corinthians Paulista are the most innovative clubs taking into consideration the registration of brands and the value of intangible assets, as both are present in the first five places in the rankings.

In Figure 2, through a perceptual map, it was concluded that there is an association between the variables representing innovation and club characteristics, such as size and age. It is highlighted the variables RIA, Age and Size that were categorized according to quartiles, as follows: L - low level; ML - medium-low level; MH - medium-high level; H - high level.

Figure 2 - Perceptual Map: Club Innovation and Characteristics.



Subtitle: TDM registered (Innov) or not (Noinnov) marks in the period analyzed; RIA: representativeness of intangible assets; AGE: age of clubs in the years 2015 to 2017; SIZE: company size. L - low level; ML - medium-low level; MH - medium-high level; H - high level.

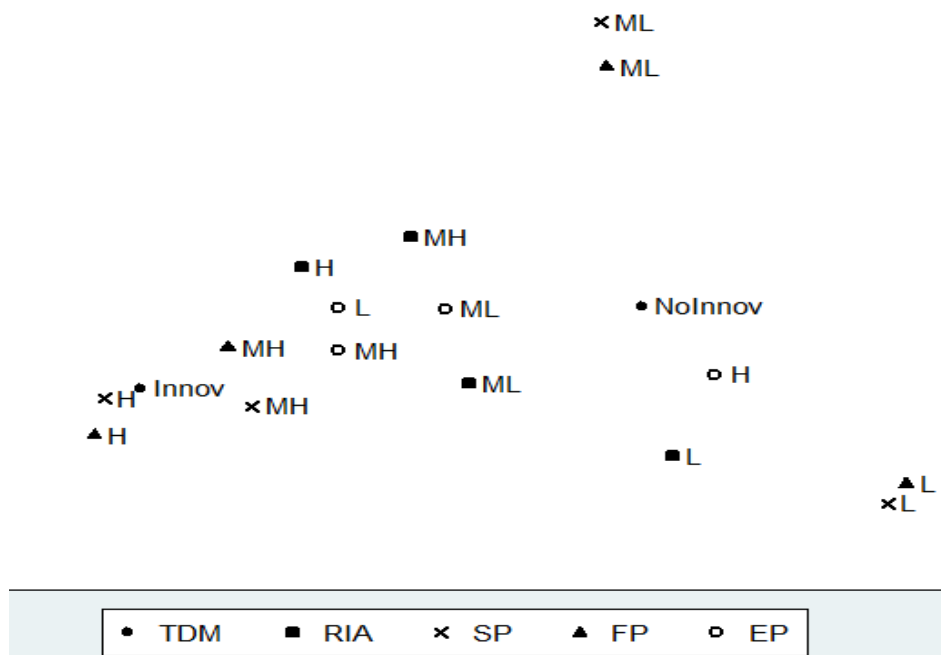
Source: Research data.

In Figure 2 there is an association between non-brand registration and representativeness of intangible assets (RIA) in the medium-low category. There is also an association between medium-high RIA and size and medium-low age, and there is an association between clubs with high RIA, high age and medium-high size. In the analyzed period, intangible assets are a means for the club to achieve its innovative potential, and the representation of intangible assets (RIA) is an important factor in brand registration, as the lower RIA, the greater the probability that the club will not register. Another inference is that clubs of high age and size, those of smaller size and age are also likely to have a higher RIA, since early on a club prefers to

make investments in intangible assets (innovation) as a way to keep financial, economic and competitive sportive. Through these associations, it is assumed that most of a club's assets are intangible assets, and clubs with higher (medium-high and high) RIA are associated with medium-low and medium-high size levels.

In sequence in Figure 3 contains a perceptual map, an association between innovation and performance.

Figure 3 - Perceptual map innovation and performance of Brazilian football clubs of series A.



Subtitle: TDM registered (Innov) or not (Noinnov) marks in the period analyzed; RIA: representativeness of intangible assets; SP: sport performance; FP: financial performance; EP: economic performance. L - low level; ML - medium-low level; MH - medium-high level; H - high level.

Source: Research data.

From Figure 3 the clubs with sporting and financial performance categorized as high level are associated with those who have registered brands. Clubs that have not registered brands are associated with high-level economic performance. Thus, the innovation represented by the registration of brands contributes to the clubs to have a high performance in revenues, and it is assumed as a consequence that this financial return helps the clubs in the expansion of investments and / or to hire players, coaches and better quality structure aimed at winning championships or higher final score in championships organized by the Brazilian Football Confederation (CBF). This investment also contributes to improving its ranking in this entity. In turn, clubs that did not register brands in the period under review have high economic performance, ie the high level of profitability may be related to the lack of resources invested by the club to register their brands.

In relation to the representativeness of intangible assets (RIA) we have: clubs with high RIA associated with low economic performance and medium-high financial; Medium-low-RIA clubs are associated with

medium-high economic performance. Thus, investing resources in intangible assets (innovation), clubs reduce their economic performance, as there is an inverse association between these variables (Figure 3) in contrast to the study by Dimitropoulos and Koumanakos (2015) that used data regarding intellectual capital and performance measured by the economic performance of European clubs to verify such a relationship. This figure also demonstrates that there are positive associations between financial performance and sports performance, previously explained about the association between performances.

As a general research objective, initially the descriptive statistics of the study variables were presented (Table 5).

Table 5 - Descriptive statistics of variables.

Variables	Obs.	Mean	Standard deviation	Minimum	Maximum	Coefficient of variation
TDM	78	0,5594	0,8487	0,0000	2,8332	151,71%
RIA	78	0,1673	0,1217	0,0000	0,5755	72,73%
SP	78	9,1621	0,3498	8,3687	9,6348	3,81%
FP	78	18,5207	1,0560	15,5242	20,2905	5,70%
EP	78	-0,2928	3,1606	-26,8839	2,9321	-1.079,35%
AGE	78	97,3846	20,3733	39,0000	122,0000	20,92%
SIZE	78	19,0603	1,2722	15,9383	21,0246	6,67%

Subtitle: TDM: brand registration; RIA: representativeness of intangible assets; SP: sport performance; FP: financial performance; EP: economic performance; AGE: club age; SIZE: company size.

Source: research data.

The information in Table 5 indicates that the age variable has the highest average because of some clubs that have advanced ages, such as the Clube de Regatas Vasco da Gama and Clube de Regatas Flamengo, for example, which in 2017 were 119 and 122 years old respectively. Other clubs as Joinville Esporte Clube and Associação Chapecoense de Futebol may be considered new or underage because in 2017 were 41 and 44 years old respectively. About pattern deviation for the age variable remains the highest value. This allows us to infer that data distribution has values with greater dispersion than the average. The various representatives of innovation, brands (TDM), and the representativeness of intangible assets (RIA) show greater heterogeneity, since the coefficients of variation are 151.71% and 72.73%, but this changes due to the variability of the sample clubs.

Table 6 shows the correlations between the study variables. In advance, the Spearman correlation was chosen because, according to the Kolmogorov-Smirnov test, the variables do not present a normal distribution.

Table 6 - Spearman Correlation.

	TDM	RIA	AGE	SIZE	SP	FP	EP
TDM	1						
RIA	0,0928	1					
AGE	0,2515**	0,2003*	1				
SIZE	0,4765***	0,0047	0,4559***	1			
SP	0,4558***	0,3534***	0,3854***	0,7579***	1		
FP	0,4926***	0,274**	0,383***	0,8065***	0,8494***	1	
EP	-0,2164*	-0,1095	-0,11	-0,1053	-0,172	-0,1804	1

Subtitle: TDM: brand registration; RIA: representativeness of intangible assets; AGE: club age; SIZE: company size; SP: sport performance; FP: financial performance; EP: economic performance.

(*) Statistical significance at the 10% level; (**) Statistical significance at the 5% level;

(***) Statistical significance at the 1% level.

Source. Research data.

The data presented in Table 6 shows a significant and positive correlation at level 1% between brand registration (TDM) and financial and sports performance, and a significant and negative relationship at level 10% for the variable innovation and economic performance. Therefore, another variable to assess study innovation (RIA) is related to the 1% level of sports performance, the 10% level of financial performance. There is also a positive correlation (1%) between financial and sports performance. The relationship between innovation and performance confirms the studies of Galvão and Dornellas (2017) and contrasts with the results of Cunha *et al.* (2017), who found no relationship between these variables in their research with Brazilian football clubs. These results suggest that clubs that register their brands, and in investment, value their employees (players, coaching staff) more, add value, excel in sportsmanship and achieve better financial returns, assuming that innovation can be a potential source of competitive advantage that results in superior performance (Dimitropoulos and Koumanakos, 2015). The existence of a negative relation between innovation and economic performance may be linked to the long-term return on investments made with innovation, as there is an incipient registration of brands by clubs in the analyzed period.

There is a significant and positive relationship between age and the innovation variables (TDM and RAI) showing the club's ability to innovate over time. There is a positive correlation between the size variable (SIZE) and brands, understanding that the more the club invests in assets, the more probability it is to register its brands.

Then, the multiple linear regression analysis was performed according to the econometric models developed to test the research hypothesis. The models were processed with the robust application of White, in order to test the homoscedasticity of variation of the residues (Fávero *et al.*, 2009). No problem was found according to Variance Inflation Factor (VIF) statistics. The representative dummy variable for the year 2016 (D2016) was excluded to eliminate multicollinearity. Table 7 is showed the results of multiple linear regressions.

Table 7 - Multiple linear regressions for variance homoscedasticity test from data obtained from Serie A Football Clubs.

Variables	Eq. 1 Dependent variation: FP			Eq. 2 Dependent variation: EP			Eq. 3 Dependent variation: SP		
	Coef.	t	Sig.	Coef.	t	Sig.	Coef.	t	Sig.
TDM	0,173	1,92	0,059*	0,039	0,13	0,901	0,053	1,97	0,053*
RIA	2,323	4,74	0,000***	-2,957	-0,9	0,373	0,986	5,58	0,000***
AGE	-0,005	-1,15	0,253	0,019	0,88	0,382	-0,001	-1,27	0,209
SIZE	0,651	9,38	0,000***	-0,478	-0,98	0,331	0,210	10,65	0,000***
D2015	-0,175	-1,09	0,281	1,187	1,1	0,274	0,062	1,17	0,246
D2017	0,014	0,08	0,937	1,766	1,34	0,184	0,035	0,65	0,519
_cons	6,168	5,26	0,000***	6,446	0,98	0,333	5,081	16,21	0,000***
N	78			78			78		
F	34,44***			1,2			50,53***		
p-value	0,000			0,315			0,000***		
R ²	0,735			0,084			0,727		
VIF	1,610			1,610			1,610		
Shapiro-Francia	0,031**			0,000			0,551*		

Subtitle: TDM: brand registration; RIA: representativeness of intangible assets; AGE: club age; SIZE: company size; SP: sport performance; FP: financial performance; EP: economic performance.

(*) Statistical significance at the 10% level; (**) Statistical significance at the 5% level;

(***) Statistical significance at the 1% level.

Source: Research data.

As observed in Table 7, only models 1 and 3 were tested presented significant ($P < 0.01$), with explanatory power (R^2) of 73.5% and 72.7% respectively. The normality of the residues was tested by the Shapiro-Francia test ($P < 0.05$) for equation 1 and for equation 3 ($P < 0.10$). However, no significance was found for equation 2. Thus, nothing can be concluded about the influence of innovation on the economic performance of clubs.

About the variables, brand registration (TDM), and representativeness of intangible assets (RIA), as proxies for measuring innovation, it is inferred that there is a significant and positive influence of innovation on financial and sports performance, and that innovation contributes to increase performance in Brazilian football clubs, according to studies by Rohde and Breuer (2016) with European football clubs. Thus, it is understood that innovation is a potential competitive source, as it results in increased performance.

Another significant 1% variable that contributes to increased performance is club size (SIZE). This variable corresponds to the natural logarithm of the asset, it is clear that investing in assets is a factor that increases the financial and sports potential of clubs and, in addition, it is noteworthy that among these assets are intangibles.

According to the results presented, it eliminates the study hypothesis that innovation influences the performance of Brazilian football clubs, since the influence of innovation on performance was not fully verified, since nothing can be concluded about economic performance.

5 Conclusions

The present study has considered that innovation is measured by the registration of brands and the representativeness of intangible assets influencing the financial and sports performance of Brazilian football clubs. In both, these proxies were adopted to fill blanks on the themes studied, serving to deepen their interrelationship and provide answers and possibilities for more concrete decisions by managers.

Initially, the profile of innovation in Brazilian football clubs was based on the number of brands registered in the period analyzed. Thus, 138 brands were registered, and 2016 was the most favorable year with 66.67% of brands. The Sociedade Esportiva Palmeiras registered more brands and won the Brazilian Championship in 2016. The Clube de Regatas Flamengo is considered the most innovative with 15.22% of the brand registrations in the analyzed period. In the study period from 2015 to 2017, the variation in intangible assets increased by 23.10%. The Sociedade Esportiva Palmeiras presented the highest value in intangible assets in the period analyzed, and won the Brazil Cup in 2015 and the Brazilian Championship in 2016.

It is noticed that there is an association between the representativeness of intangible assets (RIA) and non-registration of brands. Notwithstanding this result, intangible assets (RIA) are the means for the club to achieve its innovative potential, as they are the relevant factors in brand registration, on the other words the lower the representativeness of intangible assets (RIA), the greater the possibility that the club will not register brands. It is also noticed that most assets are intangibles (RIA), because clubs with higher (medium-high and high) intangible assets are associated with medium-low and medium-high size levels.

In addition, football clubs with high sports and financial performance are associated with those other brand clubs. Clubs that have registered brands are associated with high-level economic performance. With this result, innovation, when represented by brand registration, helps clubs increase their financial performance and consequently invest and/or hire players, technical team and quality structure in order to win championships or have a good final score in championships organized by the Brazilian Football Confederation (CBF), improving their ranking qualification. However, clubs that have not registered their brands during the reporting period have good economic performance and this has to do with applying funds to the club to register their brands. It is also conjectured that clubs that invest in intangible assets (innovation) reduce their economic performance because of the inverse association.

The variables, brand registration and representativeness of intangible assets as proxies for measuring innovation indicate that there is significant and positive influence of innovation on financial and sports performance, on other words, the innovation contributes to the increase of these performances. It is unclear about the influence of innovation on the economic performance of clubs, and this resulted in the rejection of the research hypothesis, as such relationship was not fully verified.

This research contributed in theory and practice, since academic research involving innovation and performance, specifically in Brazilian football clubs, is uncertain. The study is limited to only three years,

according to the Oslo Manual (OCDE 2005) and the incipient preoccupation with innovation about brand registrations. In future, research is important to expand the sample analyzed and also consider other indicators of innovation, economic, financial and sports. There is still a possibility in future research to incorporate other means to add further analysis, such as measuring the efficiency of innovation in club performance and verifying the relationship of innovation with the internationalization of clubs, as well as examining the relationship between sponsorship, innovation and performance.

The results of this study are expected to contribute both to the incipient literature on the issues in the context of football clubs, as well as to highlight and assist managers as to the importance of investments in innovation as a propellant of performance and as a potential source of competitive advantage.

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Party Halls in African Town: Case of Economic Capital of Burundi, Bujumbura.

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Abstract

This paper proposes a classification of some halls very modern in Bujumbura economic capital of Burundi. A survey whose target population is the set of individuals regularly participating in the various festivals in Bujumbura, the economic capital of Burundi was put into action. An analysis of the data and interpretation of the results is made. These results conclude that there is a visible lack of well-developed halls on international measures in Bujumbura.

Keywords: Party halls; sound system; Table of honor; Comfort; Security; Decoration.

1. Introduction

A party hall is defined as a building which is similar to a multi-purpose hall with possibly the space which surrounds it, a flagship structure within a city [Gressey, 1934], [Annee-Laure, 2015]. In Africa, some party system is institutionalized [Anja, 2012]. In Burundi, parties are collective moments organized in honor of a person, important events or in commemoration of the birthday. In general, this is an occasion for rejoicing; but there are also serious or sad festivals (feast of mourning). The celebrations are periodic (annual, monthly, weekly) or accidental (to celebrate a victory, an inauguration, a birth, and a death), public and private. The working population of Bujumbura, the economic capital of Burundi, exceeds 1,155,678 inhabitants [Sibaye, 2014]. A growing part of employees work in the tertiary sector [Achikbache, 2014].

Bujumbura's attraction is explained by the presence of activities and its economic dynamism in comparison with the rest of the country. This is the fundamental reason for migration to the Burundian economic capital. Bujumbura airport and port play an essential role in the flow of economic flows [Achikbache, 1981]. Given its active population and economic dynamism, the economic capital Bujumbura-Burundi is home to several holiday celebrations which bring together several categories of people (administrative authorities, civil servants, traders ...). Despite the efforts made by individuals and the town hall, the economic capital Bujumbura is finding it difficult to have adequate, modern, multipurpose party halls. Halls that are available to residents to host all kinds of events (weddings, birthdays, meetings, concerts, dance, mourning, etc.). Halls that are arranged with everything necessary: sound system, security, comfort, head tables, stage parking, changing halls, toilet. The objective of this article is to highlight the situation of day-to-day party halls, i.e to check whether the party halls in the economic capital of Burundi are in admirable conditions by the users and then to suggest improvements necessary to make these user-friendly places. The rest of the paper is organized as follows. We give the materials and methods in Section 2. Results and discussion are showed in Section 3 and finally the conclusion and recommendations appear in Section 4.

2. Materials and methods

2.1. Study area

The city of Bujumbura, the economic capital of Burundi, is located in the west of the country in the Bujumbura province, on the shore of Lake Tanganyika. The municipality of Bujumbura is an administrative entity with legal personality and management autonomy. The economic capital of Burundi is subdivided into three urban communes: Ntahangwa, Mukaza and Muha including six zones for Ntahangwa commune namely Kamenge, Kinama, Cibitoke, Ngagara, Buterere and Gihosha. Four zones for Mukaza commune: Rohero, Nyakabiga, Bwiza and Buyenzi zones and finally for the Muha commune, we have three zones such as Musaga, Kanyosha and Kinindo zones. Each zone is subdivided into as many districts as its extent requires [Mwindulwa, 2007]. The 70% of active people in Bujumbura are employed in the tertiary sector, 16% in the secondary sector, only 14% are in the primary sector. Bujumbura is not only the seat of government but also the highest military, political and union bodies. Finally, all banks credit and savings organizations have their headquarters in Bujumbura, which is particularly dynamic for the development of commercial activities. The economic capital gathers 70% of the official traders of Burundi. In trade, Burundian wholesalers, hotels and restaurants are constantly increasing, although the foreign, Asian (Pakistanis, Indians, Arabs of the Gulf Emirates) and European (Greeks especially) presence remains significant [Holzschuch, 1994, [Xavier, 2000]. In popular neighborhoods, small shops are everywhere. The number of traders is greater the more the trade is more fragmented in order to allow the less fortunate to buy products individually or in very small quantities (for example cigarettes or sugar).

2.2. Sampling method

Our study is based on accidental sampling method. This technique is often used by journalists to paint a picture of the variety of opinions that people may have on a hot topic. The target population is the set of all individuals who participate massively in different festivals taking place in Bujumbura, the economic capital

of Burundi. We consider that an individual or statistical unit is any person who has already participated in at least one party which took place in one of the halls in the economic capital of Burundi. Here we report that the sample size $n = 51$. To allow checks that the terms are understandable, unequivocal and unambiguous, logical order of the questions, questionnaire in accordance with the objective sought; we actually tested our questionnaire on a small sample, different from the one made for the survey. Data analysis was done using statistical software called Sphinx.

2.3. Data

Each respondent chooses one of the party-halls deemed to be very accepted; and then he responds all questions of the questionnaire on the hall that he chooses. For this, the most frequented halls as indicated by the participants on the survey are the following: Youca Beach (=Youca_B), Petit seminaire (=Petit_S) : (Small seminar), Détente (Relaxation), Cristal Palace (=Cristal_P), Kadesh. Other party-halls chosen with a small proportion were indicated overall with an indicator "Others". Note that the evaluation criteria are related to the following measures: Sound system, table of honor, Comfort, Security, Decoration.

3. Results and Discussion

Here, we discuss the results that we have found from our analysis as well as the significance of our research work. These results must be presented with absolute clarity since they constitute the very essence of the paper and the idea that they convey. Above all, it is a matter of highlighting significant or positive results, possibly with tables and graphs, but it is also profitable to point out non-significant results or negative aspects.

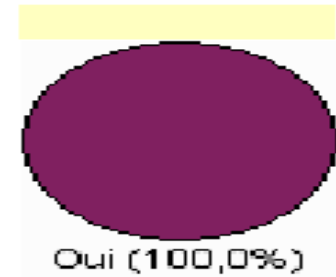
3.1 Results

The results are given in absolute frequency and in relative frequency (%). In this first part, we present the tables and graphs of the results obtained. **Nb** indicates the number of respondents (absolute frequency) and **%cit** represents the relative frequency as said above. In order to facilitate analysis and discussions, we consider two choices of answers: rather satisfied and very satisfied and we attribute to the rather satisfied a consideration of 60% and to the very satisfied a consideration of 90%. Note that the other possibilities of the answers show already that the improvement of the party halls is necessary. The results are presented in the form of tables and graphs.

Table 1: Frequencies (absolute and relative) of yes and no for participation at least in a party. Here Oui means Yes and Non means No.

Participer dans une fête

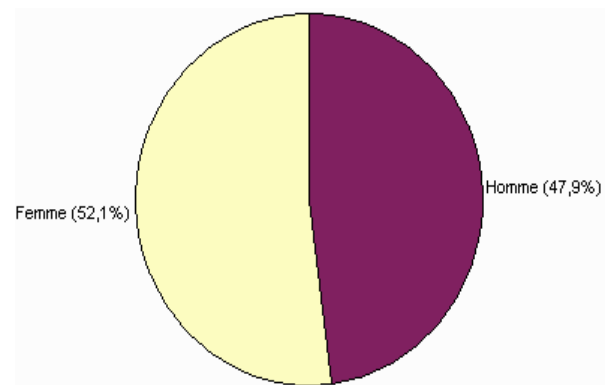
	Nb	% cit.
Oui	51	100,0%
Non	0	0,0%
Total	51	100,0%



Participation in the ceremonies has been 100% confirmed. This is explained by the Burundian culture where wedding parties are more famous and highly regarded.

Table 2: Frequencies (absolute and relative) of respondents taking into account their gender : Female (Femme) and Male (Homme).

	Nb	% cit.
Male (Homme)	23	47.9%
Female (Femme)	25	52.1%
Total	48	100.0%

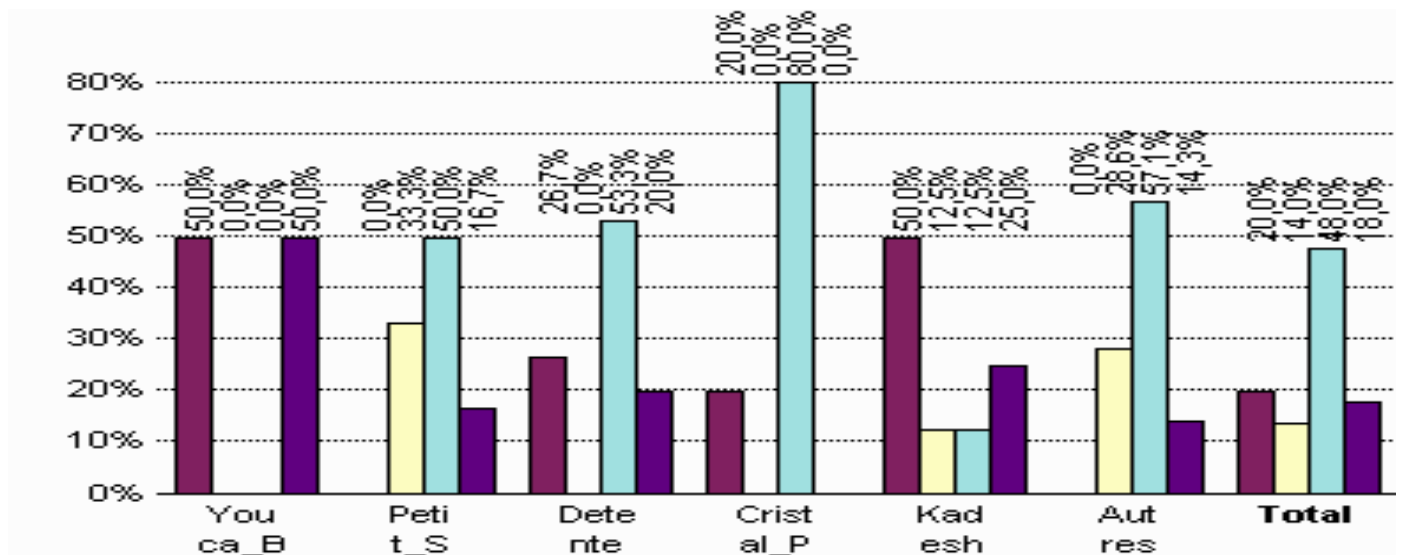


Participation was 47.9% for men and 52.1% for women. more than men in Burundi, especially in the Bujumbura.

This is very normal, since women like parties

Table 3: Relative frequencies of respondents for each room, taking sound system into account

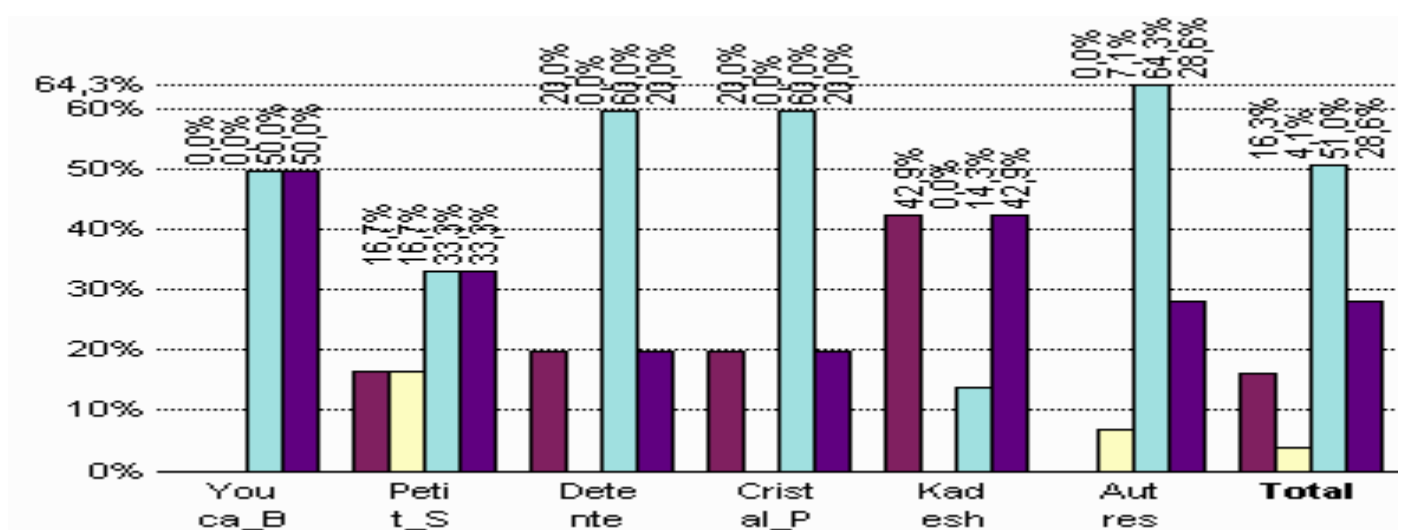
	Youca_B	Petit_S	Detente	Cristal_P	Kadesh	Autres	Total
Not at all satisfied	50.0%	0.0%	26.7%	20.0%	50.0%	0.0%	20.0%
Rather not satisfied	0.0%	33.3%	0.0%	0.0%	12.5%	28.6%	14.0%
Rather satisfied	0.0%	50.0%	53.3%	80.0%	12.5%	57.1%	48.0%
Very satisfied	50.0%	16.7%	20.0%	0.0%	25.0%	14.3%	18.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%



Overall, 48% of the participants on this survey are rather satisfied with the sound system and 18% are completely satisfied. Among these halls, Le Petit séminaire (Small seminar) satisfies the participants well to 50% and dominates in sound system compared to others. Cristal palace also comes in a good position with 80% on the "rather satisfied" consideration.

Table 4: Relative frequencies of respondents taking into account the head table

	Youca_B	Petit_S	Detente	Cristal_P	Kadesh	Autres	Total
Not at all satisfied	0.0%	16.7%	20.0%	20.0%	42.9%	0.0%	16.3%
Rather not satisfied	0.0%	16.7%	0.0%	0.0%	0.0%	7.1%	4.1%
Rather satisfied	50.0%	33.3%	60.0%	60.0%	14.3%	64.3%	51.0%
Very satisfied	50.0%	33.3%	20.0%	20.0%	42.9%	28.6%	28.6%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

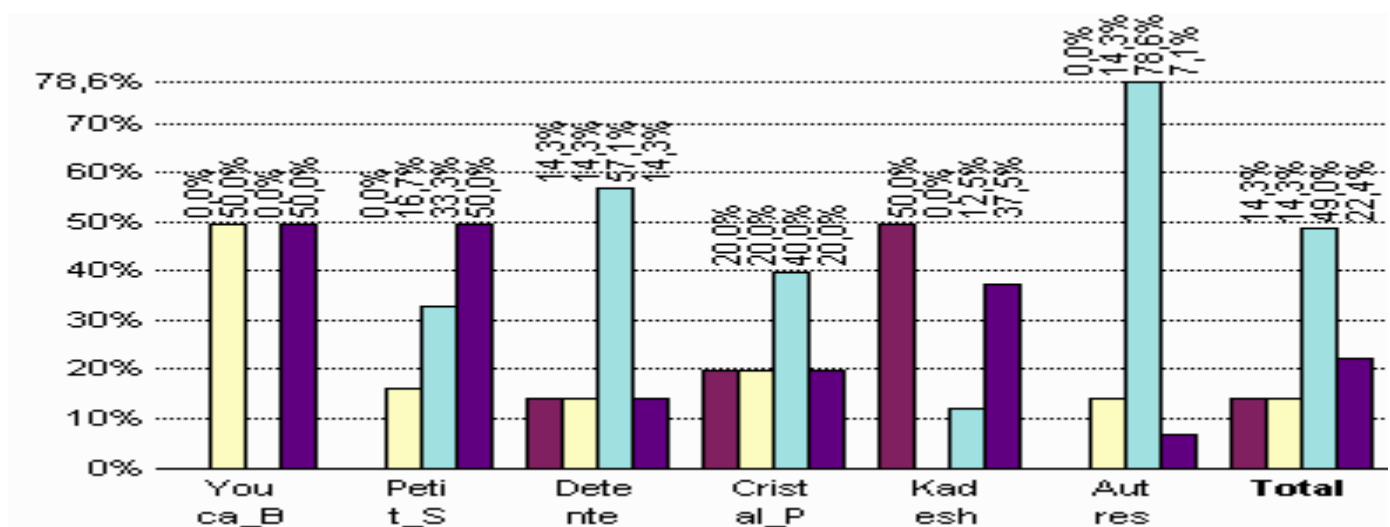


Youca beach takes the place of satisfying participants well at 50% (very satisfied). Detente and Cristal

palace occupy 60% for rather satisfied. Note that overall, only 20.6% are completely satisfied and 51% are somewhat satisfied with regard to the head table.

Table 5: Relative frequencies of respondents taking confort into account

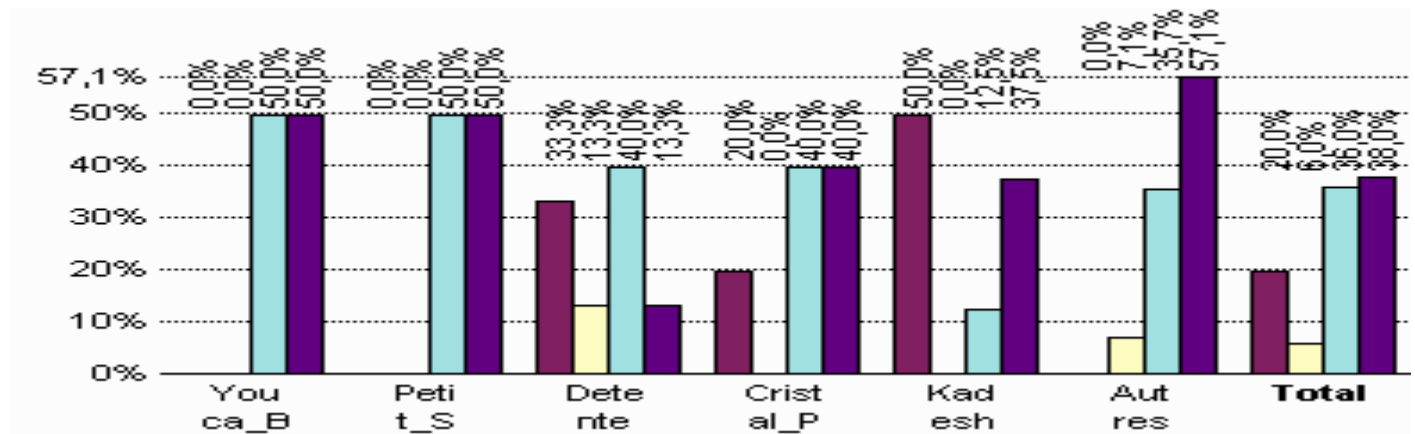
	Youca_B	Petit_S	Detente	Cristal_P	Kadesh	Autres	Total
Not at all satisfied	0.0%	0.0%	14.3%	20.0%	50.0%	0.0%	14.3%
Rather not satisfied	50.0%	16.7%	14.3%	20.0%	0.0%	14.3%	14.3%
Rather satisfied	0.0%	33.3%	57.1%	40.0%	12.5%	78.6%	49.0%
Very satisfied	50.0%	50.0%	14.3%	20.0%	37.5%	7.1%	22.4%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%



Youca beach still takes the place of satisfying participants well at 50% and Détente (Relaxation) occupies 57.1% for those who are rather satisfied. Overall, completely satisfied occupies 22.4% and most satisfied 49%.

Tableau 6 : Relative frequencies of respondents considering security

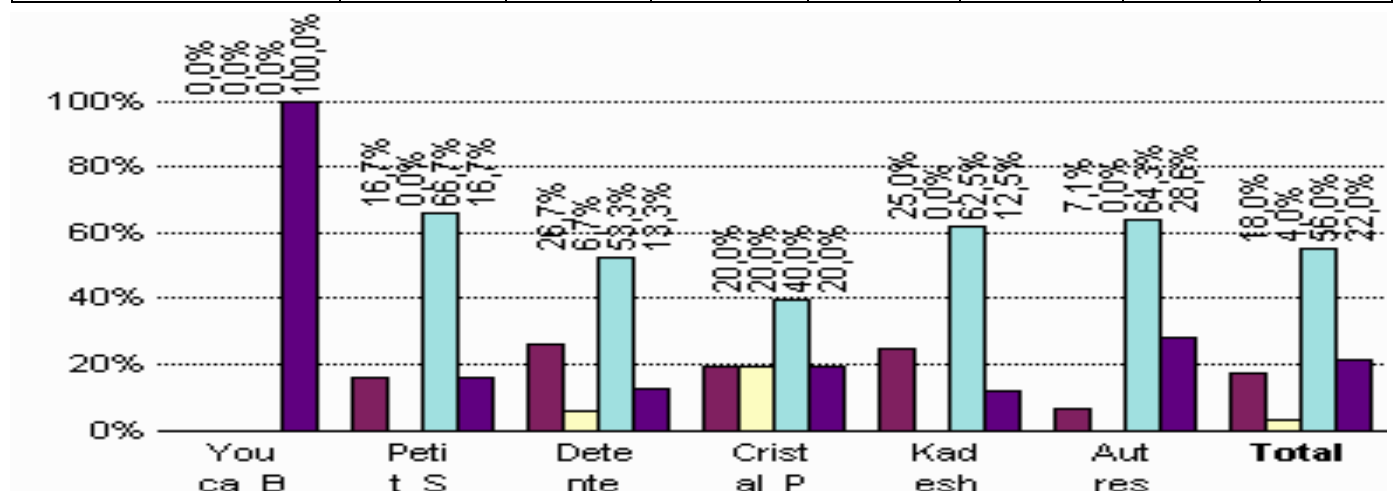
	Youca_B	Petit_S	Detente	Cristal_P	Kadesh	Autres	Total
Not at all satisfied	0.0%	0.0%	33.3%	20.0%	50.0%	0.0%	20.0%
Rather not satisfied	0.0%	0.0%	13.3%	0.0%	0.0%	7.1%	6.0%
Rather satisfied	50.0%	50.0%	40.0%	40.0%	12.5%	35.7%	36.0%
Very satisfied	50.0%	50.0%	13.3%	40.0%	37.5%	57.1%	38.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%



Small seminar and Youca beach completely satisfy the participants to 50% and take the first place compared to the others. We find that 38% are completely satisfied overall considering the totals and rather satisfied at 38 %.

Table 7 : Relative frequencies of respondents considering the decoration

	Youca_B	Petit_S	Detente	Cristal_P	Kadesh	Autres	Total
Not at all satisfied	0.0%	16.7%	26.7%	20.0%	25.0%	7.1%	18.0%
Rather not satisfied	0.0%	0.0%	6.7%	20.0%	0.0%	0.0%	4.0%
Rather satisfied	0.0%	66.7%	53.3%	40.0%	62.5%	64.3%	56.0%
Very satisfied	100.0%	16.7%	13.3%	20.0%	12.5%	28.6%	22.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%



Youca beach takes the record with 100% completely satisfied with the decor followed by the Petit Seminaire (small seminar) with 66.7% of everything satisfied. Note that it is the 22% in the totals that are completely satisfied with regard to the decoration.

3.2 Discussion

Ultimately, we find all participants in non-satisfaction by considering all the measures in different party halls. The relative frequencies linked to the indicators: rather satisfied and very satisfied on all measures

considered do not reach 50%. Note that if we consider each measure separately, some halls try to adapt to the needs of the participants. We note for example Youca beach and Petit seminaire (Small seminar).

4. Conclusion et Recommendations

This study can help who want to invest for an admirable party halls.

An improvement is urgent to be able to keep this good culture of celebration of the parties in well-appointed places. There should be halls that welcoming, technical and multipurpose. They would be available to residents to host all kinds of events (weddings, birthdays, meetings, concerts, dance, mourning, etc.). They must be arranged with everything necessary: sound system, comfort, security, decoration; etc. In addition, these party halls should have scenes, changing rooms, toilets and storage rooms. They will have to be surrounded by modern parking lots and decoration with green spaces. The interior should be equipped with tables, chairs, suitable air conditioning. Public accessibility standards for such a room would be ensured.

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Internet of Things-Aided Smart Home Off-Grid Photovoltaic-Powered

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Abstract

Nowadays, smart devices which can be controlled remotely by the Internet appear in the preference setting rather than the manual control to improve the standard of living. In this paper, a domotic system integrated into PV power generation has been developed on the Internet of Things (IoT). The system uses sensors for fire detection and monitoring of the temperature and relative air humidity. Based on real-time, the home automation off-grid system is developed so that makes the system cost-effective and portable.

Keywords: Control Platform; Domotic System; Internet of Things; Smart off-Grid.

1. Introduction

The resources interconnected to a home automation system and powered by photovoltaic panels have become a great ally to the use of alternative energies [1-4]. Generally, the home automation and security system consist of three modules: the hardware interface module, webserver, and smart device. In this sense, the control of domotic systems based on IoT (Internet of Things) platforms is one of the most effective in availability. The IoT platform has as objective the integration of electronic equipment that uses internet-connected to a database, integrating the real world to a virtual world, facilitating the connectivity of people with things [5-6]. However, energy efficiency is hence one of the central issues that smart homes [7-9]. With the advent of smart inverters, energy monitors, and new generation battery storage, solar energy systems have joined the IoT, and they can become an essential piece of the puzzle of boosting energy efficiency in an automated, smart home [10]. This work aims to develop a prototype home automation system, using the concepts of home automation and the control of electrical loads responsible for triggering sensors.

2. Materials and Methods

In this work, the methodological development has been done in four stages, being: Correct sizing of the PV system, Install of Photovoltaic Generator, IoT acquisition and control platform, and home automation system.

2.1 Photovoltaic off-grid System

The development of this work is based entirely on the formulations of an off-grid generation with its autonomy (bank of batteries) [11]. A charge controller with PWM (Pulse Width Modulation) technology was used to manage battery charge, whose input voltage can vary from 12V to 24V and a maximum current of 20A. This power is regulated with enough levels to safely charge the battery, protecting the system from possible high loads and discharges, thus increasing battery life [12].

The inverters use materials with semiconductor characteristics with the function of static switches to carry out the switching responsible for DC-AC conversion. This conversion takes place through transformers, and the main characteristics of the output signal shape are generated through integrated circuits and control devices, which use PWM techniques [13]. Thus, the power will be following the standards for electrical equipment, which require AC voltage of substantially sinusoidal waveform with low harmonic distortion; usually, volts 127 V. Figure 1 illustrate the assembly of the photovoltaic system.

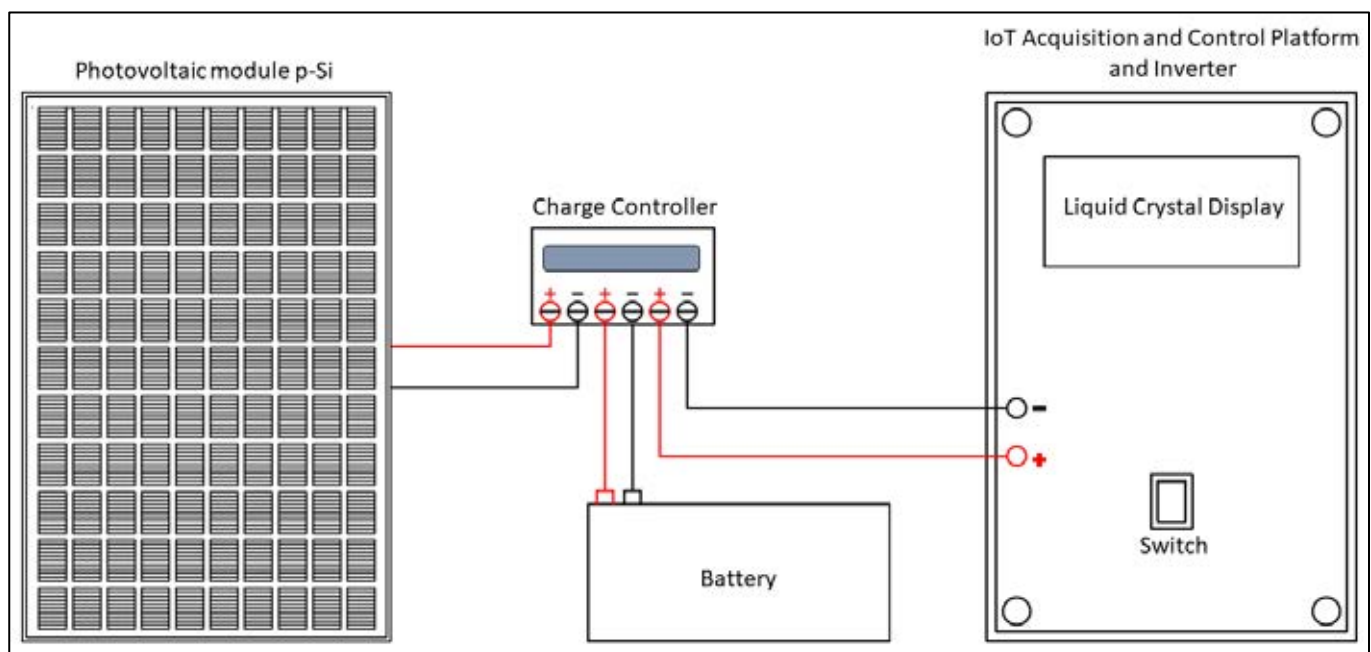


Figure 1. Single-line diagram of the photovoltaic system.

2.2 IoT Acquisition and Control Platform

The system proposed uses low-cost equipment, including the Arduino Mega microcontroller, which acts in the acquisition and control of an off-grid photovoltaic system. The objective is to integrate the generation and control data of the photovoltaic system into a home automation system. The acquisition and control platform is designed to monitor and control the photovoltaic system remotely. For the implementation of the platform, the Arduino programmable controller was used. This equipment controls the generation and distribution of isolated electrical power through sensors and actuators connected to its digital or analog ports. The Arduino uses the ATmega2560 microcontroller, and this model has 54 digital I/O (Input/Output) pins and 16 ADC (Analog Digital Converter) inputs, 4 UARTs (serial hardware ports), 16 MHz clock speed and rated voltage of 5V.

2.2.1 Hardware Architecture

The data acquisition of the photovoltaic system measured by sensors and connected in the Arduino are AC and DC, AC and DC voltage, the internal temperature of the inverter, and efficiency in the conversion of energy. These data help in decision making about the operation of the system. Figure 2 illustrates the proposed platform diagram.

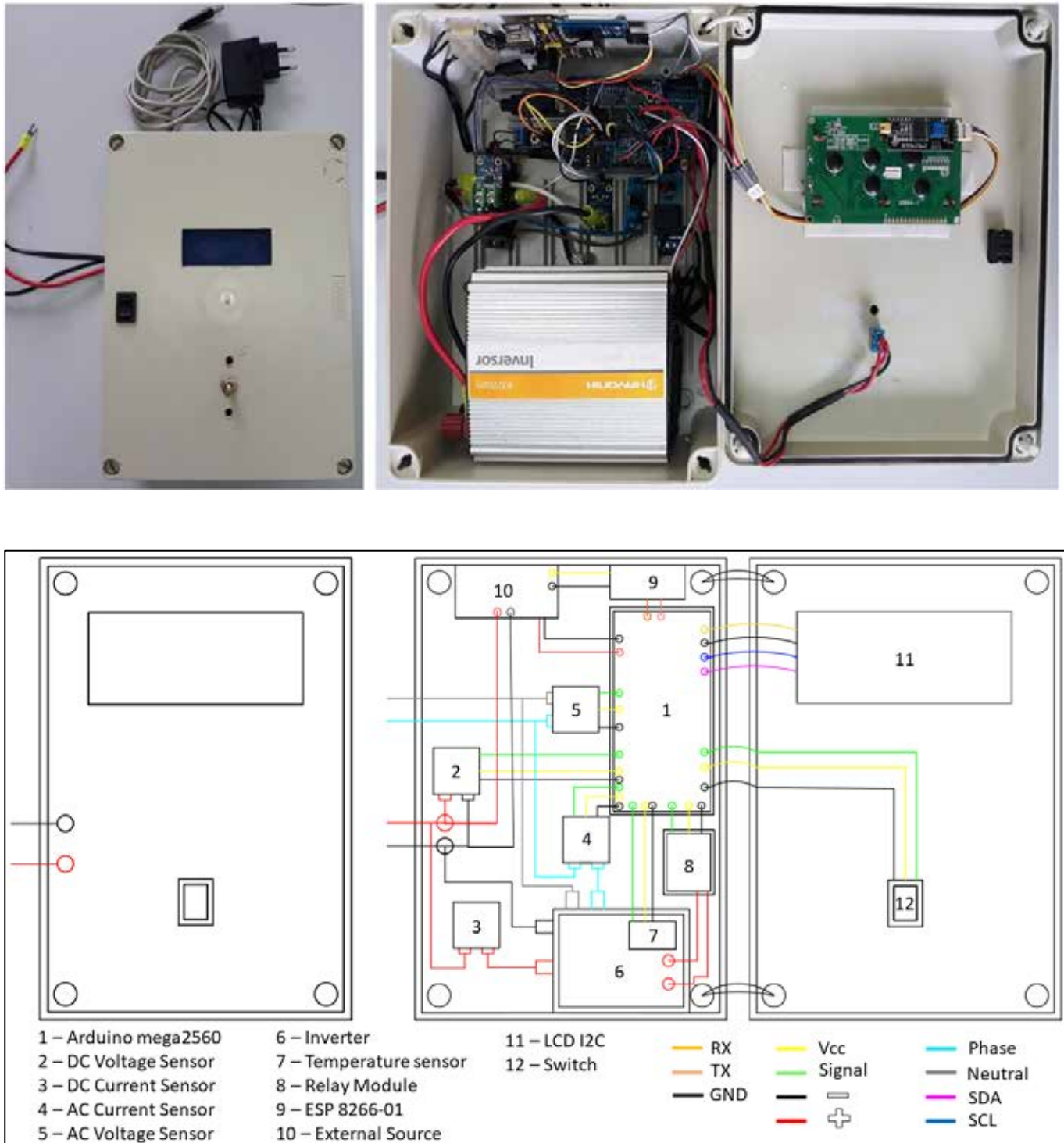


Figure 2. IoT acquisition and control platform.

2.2.2 Data Acquisition and Processing by IoT

The programming of the microcontroller was made from the Arduino IDE that is based on the computational language C. The reference voltage is 5V, and the relation between the ADC value and reference voltage in the analog terminal is given by Eq. (1).

$$V_{Read} = ADC \times \frac{V_{Ref}}{2^n} \quad 1$$

Consider: V_{Read} – Analog voltage input; V_{Ref} – Arduino reference voltage; n – Number of bits.

Relating the variable to be analyzed, the input voltage at the analog port allows the processing of data from analog sensors, considering that the output voltage of the sensor is usually linear. So, due to the analog sensor, the programming code of the DC voltage sensor takes into consideration Eq. (1).

However, it is necessary to multiply the result obtained by five, to calculate the actual voltage that was measured, because this sensor reduces 5 times the measured voltage when sending the data to the Arduino. Then, when it is measured 25V the sensor returns just 5V to the Arduino, to protect the port that does not support voltages greater than 5V.

The data processing of the DC current sensor is also related to Eq. (4) but, to obtain the proper current in the sensor is necessary to divide V_{Read} by 66 mV. However, when measuring the AC current generated by the inverter circuit, it is necessary to carry out measurements with a sampling time of 166.86

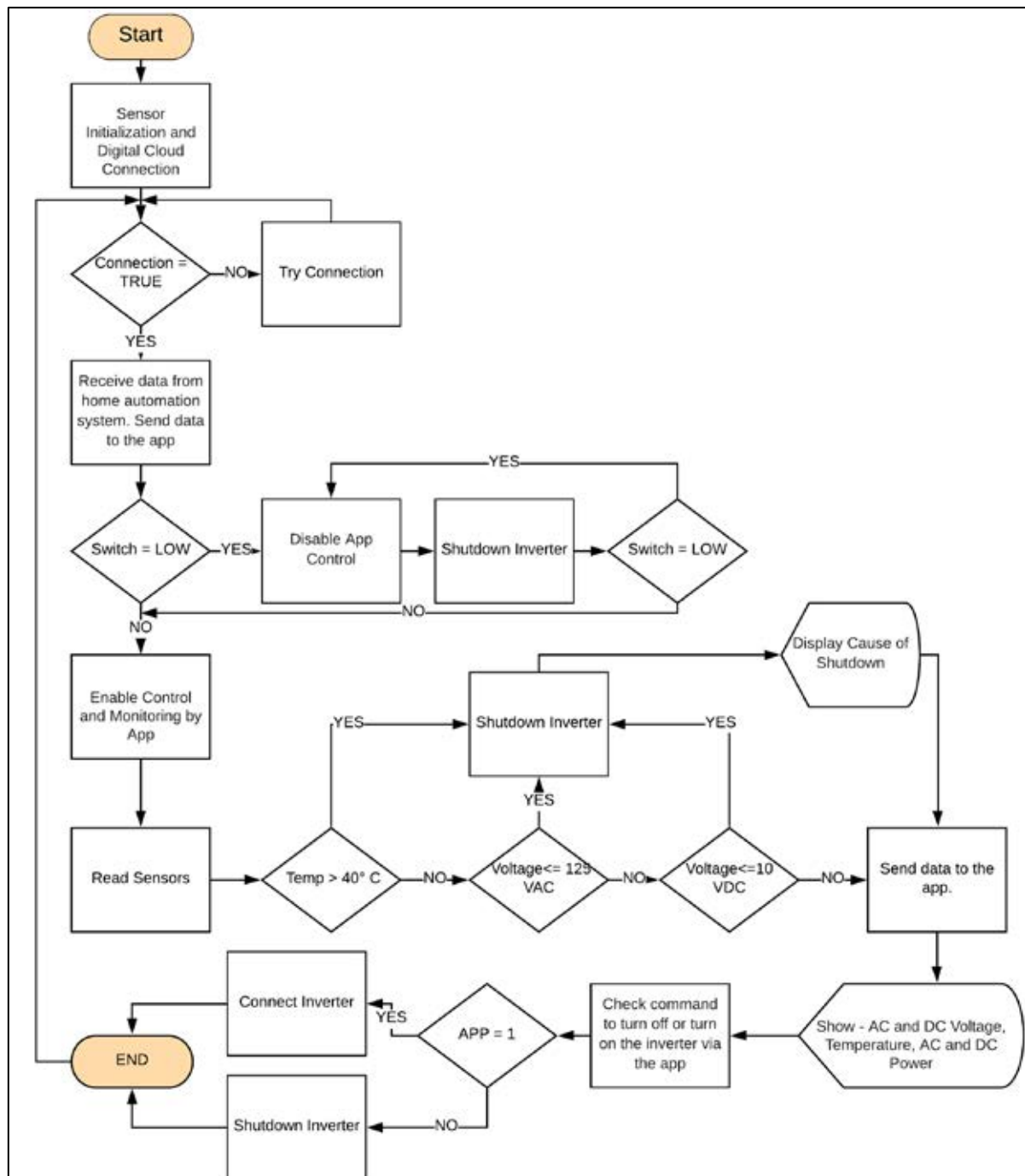


Figure 3. Flowchart of the developed program.

3. Results and Discussion

These results are related to photovoltaic modules integrated to a domotic system. It was based on values obtained by the temperature sensor and air humidity for fire alarm and access control. Thus, the monitoring system operates with minimum voltage values up to 11 V, and a battery of 8Ah was used, resulting in autonomy for approximately 29 hours.

3.1. Monitoring System Performance

The main variables during the operation of a photovoltaic generator are voltage and current, the

measurement of these variables correctly is a critical point in a monitoring system of electrical quantities, thus generating reliability of the data presented by the sensors. Thus, a true RMS multimeter (Fluke) was used as a reference device, since this device has certified quality. With this, the performance of the DC/AC voltage and current sensors was evaluated.

Firstly, the DC voltage sensor and the multimeter were connected in parallel with the positive and negative terminals of the inverter input, in order for the two devices to measure voltages at the same point. The AC voltage was measured with the measurement point located in parallel with the phase and neutral terminals of the inverter. For DC measurements, Fluke was placed in series with the DC current sensor, using the negative terminal of the inverter's power input, repeating the AC measurement method. However, the measuring point is located on the neutral conductor of the inverter output. To perform the tests, it was necessary to supply DC power to the inverter at 12 V nominal. Thus, a load with a nominal power of 12 W to 127 V was connected to the AC terminals, and measurements were made. This load was not dimensioned by the calculations of the electrical characteristics of the system, therefore changing the battery autonomy. Table 1 shows the processed data.

Table 1 - Data analysis of multimeter and DC voltage sensor measurements.

The DC variable sensors, in general, showed satisfactory results about the cost, presenting low standard deviation and small variations concerning the Fluke average in the voltmeter function. The average variations of the DC voltage sensor with the DC voltmeter result in approximately 1,6688% less, the resistors that perform the voltage division of this sensor each have 1% accuracy. Another fact that can explain the variation is the capacity of the voltmeter's full-scale selection, thus increasing accuracy. This method of analysis was also used in the research by [14], because where they obtained results similar to the application carried out in this project. Figure 4 shows the data presented.

The DC variation to the ammeter was approximately 0.40% more when the two averages are compared. However, as much as this sensor has a low standard deviation in its measurements, considering the desired application, it presented a current peak of 0.02 A, higher than the ammeter and minimum currents with the same intensity. The difference between the delay measurements is related to the ammeter reading the instantaneous power since the sensor needs to do the processing with the Arduino that has a response time.

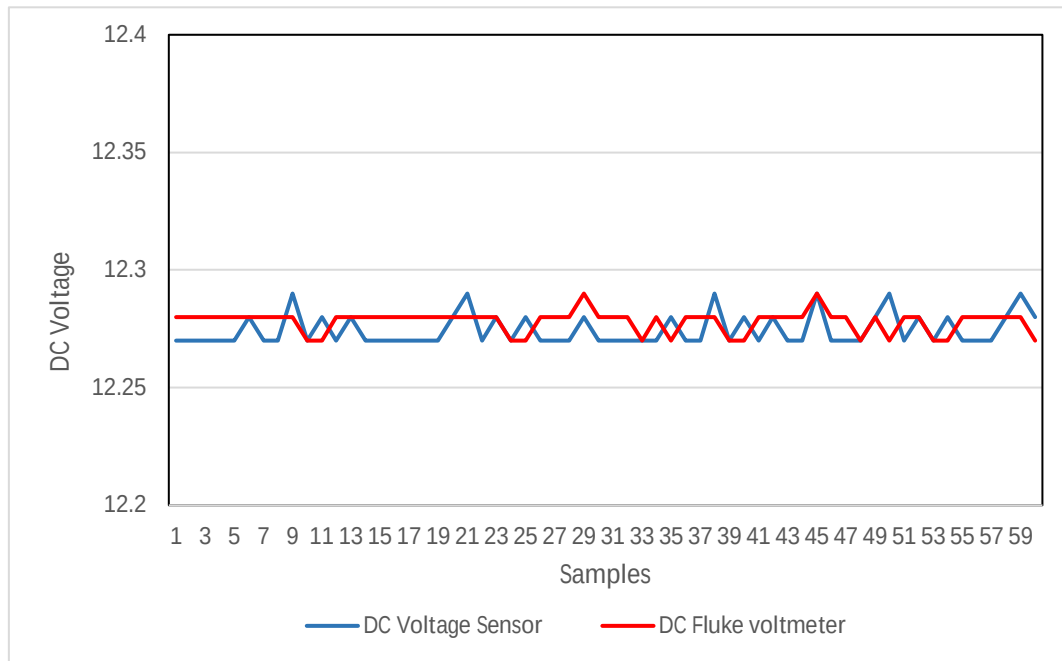


Figure 4. Voltage graphs between sensor and voltmeter.

For signal correction, it is observed in Table 1 that the DC averages present close values, showing an effective measure in adjusting the values obtained by the sensor to values that can represent a measurement made with the ammeter. Figure 5 shows the graph between data from the DC sensor and the DC ammeter.

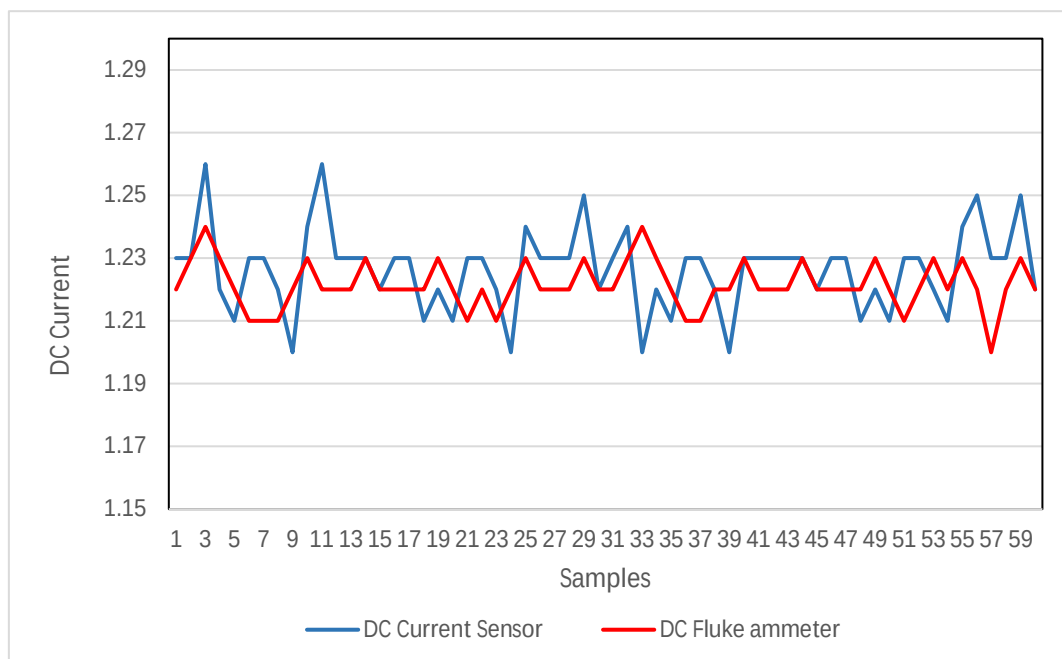


Figure 5. DC graphics.

The measurements of the AC variables were performed by processing the ADC values of the sensors. Then, the processed data is temporarily stored in two vectors with 600 positions each, such that these vectors are

filled with AC voltage and current data. An algorithm tracks the maximum and minimum values of voltage and current, that is, peak to peak values within the vectors.

The maximum values are extracted separately and divided by $\sqrt{2}$, to obtain the RMS values, since the sensors measure alternating voltages and currents in a sinusoidal signal. However, the inverter used operates with an output signal adjusted to modified sine wave characteristics, these characteristics generate harmonic distortions in the signal and which, in turn, can present several variations in the signal measurement. Figure 6 shows the inverter signal measured on an oscilloscope with a frequency range from 45Hz to 440Hz.



Figure 6. Oscilloscope output signal.

The data presented by the voltage and current sensors showed considerable variations with the multimeter (Table 1). These variations can be explained by the harmonic distortions, due to the sensor monitoring the evolution of voltages and currents and the multimeter measuring the instantaneous power in the signal, not necessarily measuring at the same time of the sensor. Figure 7 shows the signal with the effect of harmonic distortions, and lower Vpp voltages (peak-to-peak voltage) are observed when compared to the signal that does not intensely present such distortions. However, this type of deformation is usually generated by devices that have a non-linear relationship between voltage and current, such as transformers and motors, subject to saturation of their ferromagnetic core. Another explanation is due to the magnetic saturation of transformers, which can, for instance, be produced by the fast switching of electronic power converters. The ideal solution for reducing harmonic distortions in current signals in electrical systems is the use of tuned filters connected in derivation at the source, functioning as a current divider [15]. However, when analyzing the correlation between voltages and currents measured by the AC sensors and the Fluke in the AC voltmeter and AC ammeter configuration. Through the use of the simple linear regression model taking into account the power observed by the two measuring devices is obtained that there is a 71.57% relationship between the measurements of the AC sensors representing a probable power value measured by the multimeter. Figure 7 shows the result of the simple regression as well as the linear model adjustment equation.

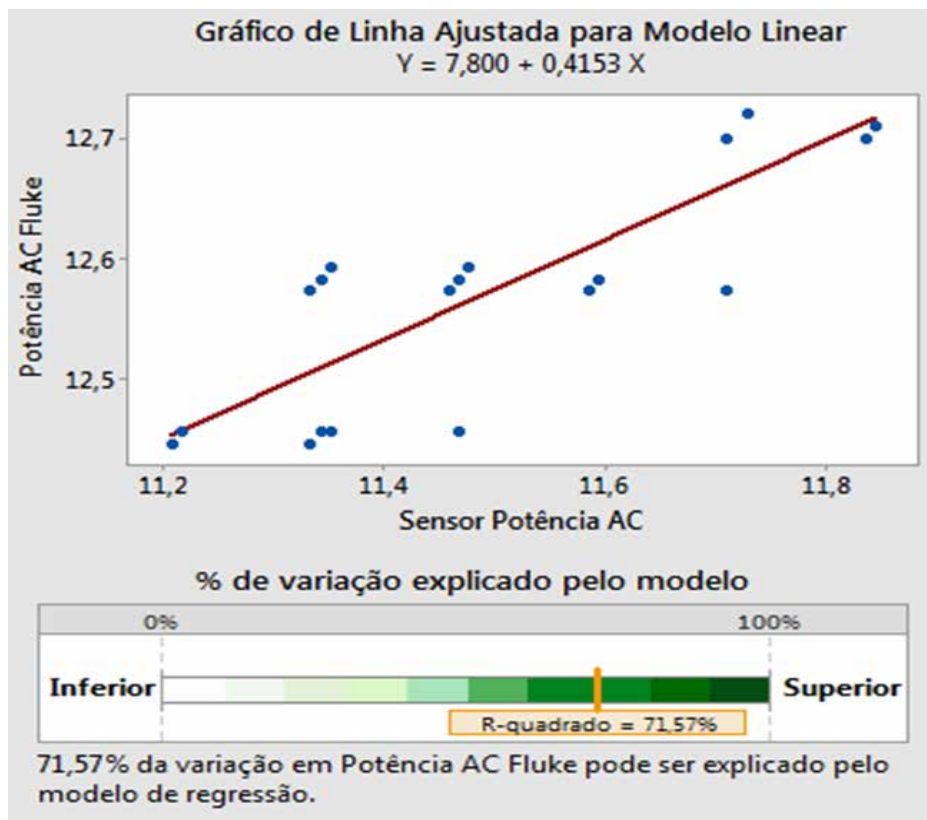


Figure 7. Line graph adjusted for the linear model.

3.2. Photovoltaic Generation

The 12W load coupled to the inverter output was disconnected, and from the measurements of the sensors, the photovoltaic generator was subjected to operation tests. Initially, the evolution of battery and photovoltaic module voltages connected to the charge controller was analyzed. For such analysis, it was necessary to connect the DC voltage sensor to the battery terminals next to the charge controller and Fluke to the photovoltaic module terminals. Figure 8 shows the evolution of battery and photovoltaic module voltages over 12 hours, taking measurements every 5 minutes.

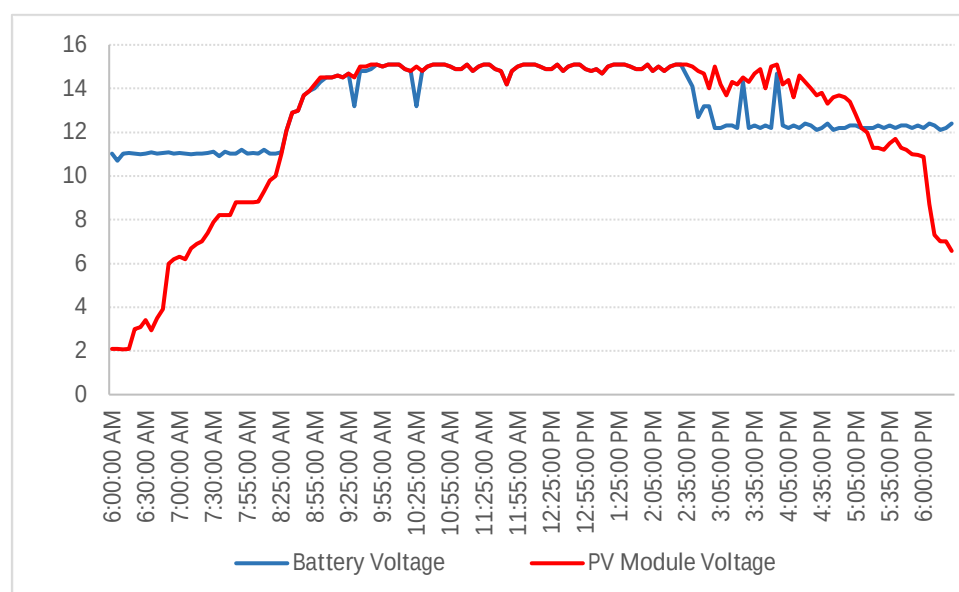


Figure 8. Evolution of battery and photovoltaic module voltages throughout the day.

The battery has entered a state of fluctuation (maximum voltage), which is when the source (PV module) is supplying the consumption and the maximum charge level of the battery. In the graph in Figure 8, it is seen that when the panel voltage drops, shortly after that, the battery voltage also drops, as it started to discharge (it left the float). Between 14:35 and 15:05, it is observed that the battery left the float, which is because the photovoltaic module is no longer providing the necessary power. Thus, the battery starts to discharge because it is feeding the load with less intensity. Subsequently, the photovoltaic module was disconnected from the system in order to obtain battery autonomy with the monitoring and control equipment operating uninterruptedly, fed only with the power supplied by the battery. Figure 9 shows the battery discharge.

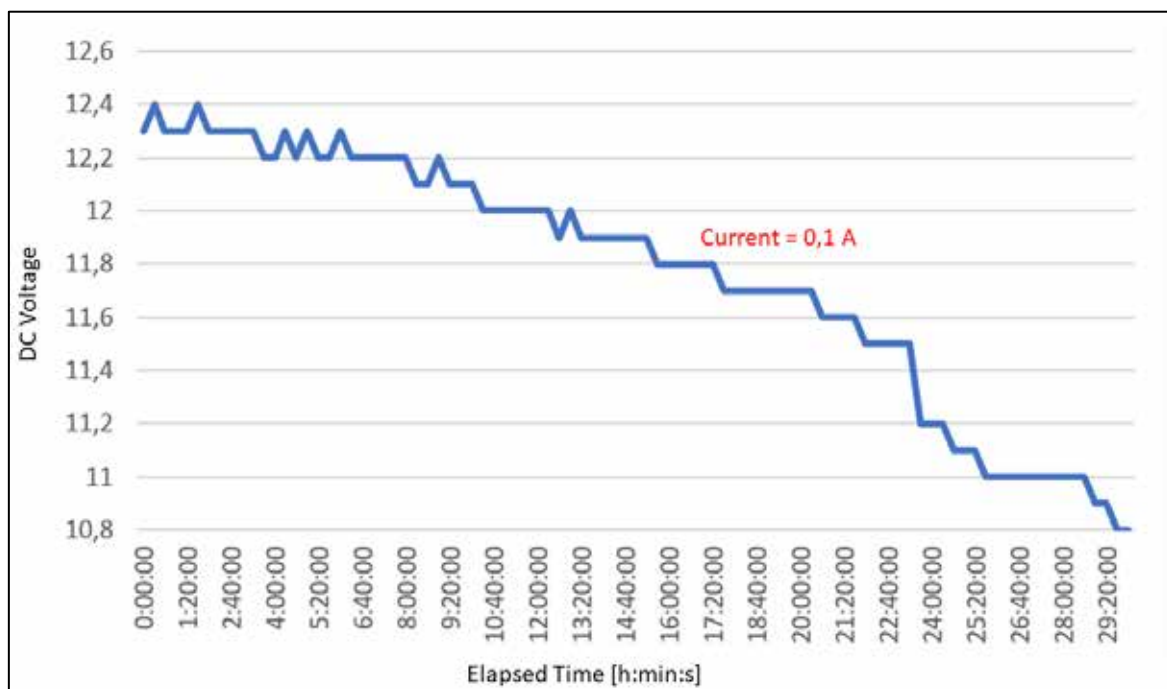


Figure 9. Battery discharge graph.

The monitoring system operates with minimum voltage values up to 11V, and it is noted that the battery can supply the load in up to 29 hours. The dimensioning of the battery predicted that it would supply the demand in up to 1.5 days. However, an 8 Ah battery was used, when the ideal would be 8.91 Ah, resulting in the autonomy of 29 hours, still showing a result satisfactory.

3.3. Domotic System Prototype

For detection and warning in fire situations, an initial step was necessary to calibrate the sensor. The calibration is the fundamental basis for the correct functioning of the device to measure the sensor output voltage on the analog pin and to the detection of the flame sources. The system converts the ADC value into a voltage signal, and from then, it can begin to analyze. In the fire simulation, 150g of cotton moistened with 15ml of ethyl alcohol was used in 70%, located approximately 2 meters away from the infrared receptor of the flame sensor. This analog sensor can detect flames when the wavelength is between 760 nm

to 1100 nm. A potentiometer can alter the sensitivity adjustment of the sensor according to the need.

In the experiments, this sensor obtained a more expressive performance when the focus of the flames of fire was more approximate, presenting values of lower voltages compared to the data.

In this way, the alert system has been configured to send an alert via app and trigger buzzer when the sensor has ADC value below 800 nm, resulting in a voltage of approximately 3.90 V. It is important to emphasize that the fire warning system just becomes in the operation when activated via the app. Another function of this domotic system is the measurement of temperature and relative air humidity; these data are vital for the comfort of living beings. The DHT22 sensor has been used and presenting data consistent with the measurement. Figure 10 shows an image of the developed domotic hardware.



Figure 10. Hardware Prototype.

3.4. IoT Platform

The communication system on the Blynk digital cloud platform is carried out via Wi-Fi with the ESP8266-01 module. This module is connected to a router with internet access, and the data transmission occurs through port 8433 (SSL). The digital cloud used in connection and authentication of the Arduino Mega with the online platform is about 37s on a stable Internet connection and an average speed of 15 Mb/s. Considering the time of sending and receiving data (latency) in average 13ms.

The app can be used simultaneously on multiple devices, requiring an administrator user. So, the user has a 32-character access key sent to the email when the application has been created. In this version of the app (administrator), it is possible to add or remove the requirement for monitoring and control systems, as well as to make changes to the app in case of maintenance, and the changes occur synchronously between the connected devices.

To this application, the platform has three screens to analyze the monitored variables. The first screen contains side-by-side information of the photovoltaic system off-grid DC and AC. The second screen contains the monitored electric data graphs with a capacity to store values about one year of operation, and the data stored in charts can be exported to other platforms. The third and last screen contains the variables monitored in the home automation system; besides this, an on/off control buttons on the inverter and fire alarm system. Figure 5 shows the visualization screens of the monitoring system in the Blynk IoT design.

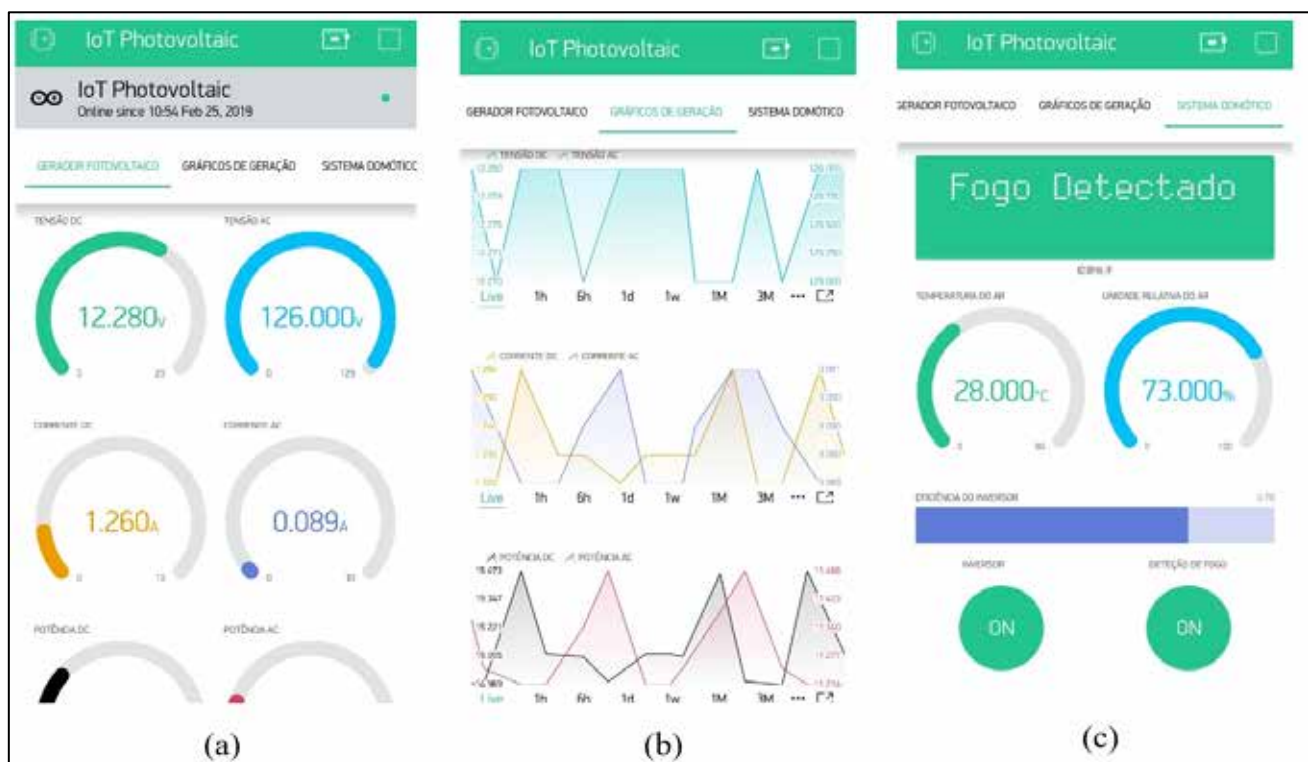


Figure 5. IoT information of the photovoltaic system.

4. Conclusion

The objective of this project was to develop a PV controlled system for home automation by IoT. The results showed the operation of a photovoltaic generator, with the use of DC/AC voltage sensors and

DC/AC for performance analysis, to alert against fires and control the access in the residence where the system is installed. It was verified the necessity of a study in more detail regarding devices of lower power consumption, to improve the efficiency in the energy autonomy of the proposed system. The results obtained presented feasibility of the implementation of this work, due to the operation of the system present excellent efficiency, and because it is a low cost, compared to proprietary systems. The differentials presented in this work are related to the possibility of altering the hardware and software, if necessary and inserting additional sensors in both the photovoltaic generator and the home automation system. Besides, it allows the easy replacement in the exchange of spare parts, integration of data with the home automation, and the photovoltaic system in a single platform, not requiring additional applications for its monitoring and control.

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Patents and Articles Related to Cooperation in Universities, Using Poisson Regression Models

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Abstract

University-industry cooperation is the formation of partnership relationships that exist in Science and Technology Institutions with industries, that is, it is the cooperation that exists between universities and industries. In this sense, there are several ways of forming relations between universities and industry, and for this to happen, it all boils down to cooperation, since both agents need to agree with certain achievements, there must be communication between them. Despite all the existing benefits, even if there is reciprocity between these agents that seek a common denominator, there are still divergences that remain as a difficulty factor for this cooperation, since there are several differences found in the academic and industrial environment. Thus, we sought to analyze how are the production of articles aimed at university-industry cooperation, as well as patents related to this subject, through specific bases. A forecast analysis was also carried out using the Poisson Regression models, where it was found, in the data of patents and articles, a superdispersion, therefore, it was necessary to adjust the deviation G^2 or as known deviance, and with the adjustment of overdispersion the models were adequate and confirmed in the forecast made. We thank Capes and CNPq for their support and financial support.

Keywords: University-industry; Cooperation; Regression Poisson Models

1. Introduction

The existing cooperation in the university-industry triggered as a primordial phenomenon with respect to the focus of several studies that have been taking place over the years. Therefore, this relationship of mutual support concerns the interaction between the higher education system and the industries, whose main objective of universities is to promote the transfer of knowledge and consequently the technologies resulting from technological development projects (ANKRAH; AL-TABAA, 2015 apud RUSSO et al, 2017).

Interaction within universities and industries plays a significant role in technological innovation, since it contributes to the economic growth of countries, and currently the results for the development of countries and organizations are relevant, as well as scientific production on this topic has increased (ROSA et al., 2018). This interaction represents a fundamental factor for technological development, innovation and entrepreneurship (ALMEILDA, 2019).

There is a new scenario in which the university begins to acquire a new role in its mission, since the commercialization of knowledge that is produced at the university contributes significantly to improvements in the industries, in this sense it leads to local and regional development, through technological innovation, however, even with the existing conservative objectives, it is still possible to observe that there is a priority to focus on teaching and research, however the transfer of knowledge to industry is still something new for universities.

The contribution of this work is to analyze scientific production through articles and technological production, as well as through university-industry cooperation patents at the bases, using a statistical technique, Poisson regression model.

For Bockenholt (1999) a set of discrete data in which the response variable cannot be transformed into a normal distribution, these data are more difficult to analyze. Many studies have been concerned with finding the regularity of the data, assuming it is a Poisson process and are often analyzed using Poisson regression models.

The Poisson Regression models do not take into account a possible dependence between the observations, however, for data collected over time it is necessary to take into account the dependence between the observations, in order to obtain a correct statistical analysis (ZEGGER; LIANG, 1986).

The research aims to understand the existing cooperation between university and industry, and in this sense to analyze patents as well as the production of articles focused on the theme, using the Poisson model, to consolidate the results of this study.

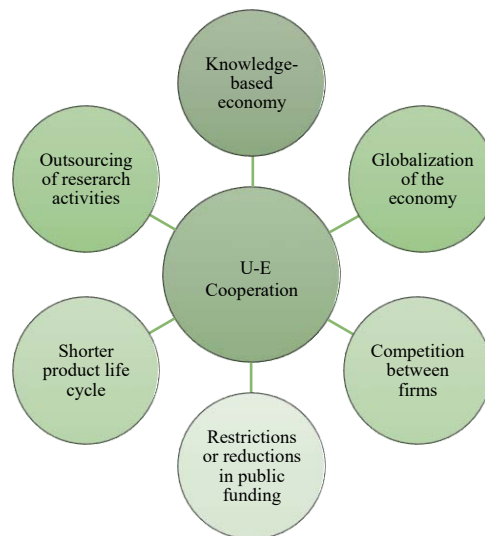
2. Theoretical Foundation

2.1 Cooperation with a focus on University-industry

At the university there is the development of basic research, while in industry there is applied research, however for this interaction to occur there are some challenges, but for scientific research not to be only at universities they must be transferred so that society can have access to knowledge (AGUSTINHO; GARCIA, 2018). And, the technology transfer process allows the construction of a partnership relationship between the offerer and the receiver, so that both benefit (DIAS; PORTO, 2014).

According to Gusmão (2002) there are several factors that favor the existence of the cooperation process, and among these there are those that stand out as inducers for university-industry cooperation, this can be seen in Figure 1.

Figure 1 - Induction factors for university-industry cooperation



Source: Elaborated by the authors based on Gusmão (2002)

On the other hand, Perkmann et al. (2011) apud Russo et al (2017), complement that there are five specific forms of relationships established between universities and industries, that is, joint and / or collaborative research, contracted, consulting, licensing, and finally academic entrepreneurship. And each of these forms of relationship can be seen in Figure 2, explicitly.

Figure 2 - Forms of the relationship between university and industry



Source: Prepared by the authors based on Perkmann et al. (2011); Bercovitz and Feldman (2006); Mansfield (1995) and Russo et al (2017).

In this sense, university-industry cooperation arises, where it generates benefits for industries and universities, with the process of transferring technology from universities, there is the promotion of innovation, and for universities the transfer of technology allows obtaining resources that allow for an increase development of scientific research (ETZKOWITZ, 2004).

Authors such as Santana and Porto (2009) complement that the cooperation between universities and industries generates benefits not only for agents directly involved in the interaction, but for the whole country, as it improves industrial, regional and local competitiveness, and for all these agents involved in the process are able to have their needs met, it is necessary that policies at the university level are not an impediment to make this cooperation model effective.

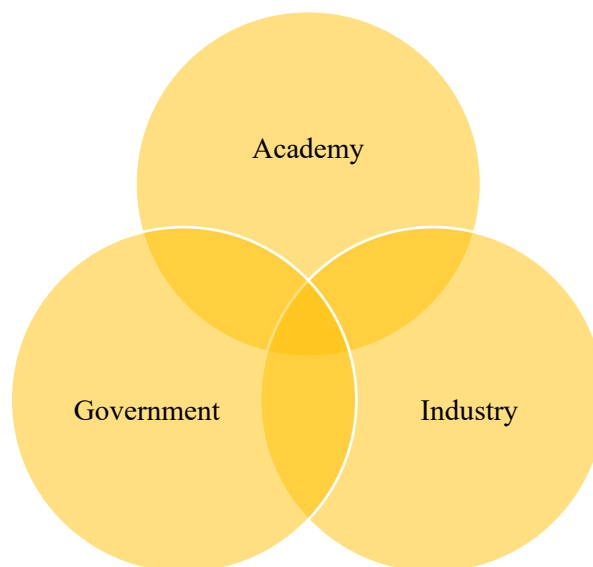
In this regard Santana and Porto (2009) explain that initially, the relations of university-industry cooperation were based only on the sponsorship of industries for research carried out in universities, however there was an evolution in the cooperation process that at the university level revolutions arose academic.

Garnica (2007) describes that the results of research carried out in universities if protected have become intellectual property, that is, it becomes a good with which it can be commercialized, through the possibility of transferring the intellectual property produced in universities to the productive sector. , where there is collaboration with the economy.

To explain the model of the triple helix Etzkowitz and Leydesdorff (2004) affirm that it is one of the most referenced in relation to the different agents of the process of innovation, technology transfer and university-industry cooperation.

Figure 3 presents the Triple Helix model, where it characterizes the connections of three segments, being universities, industries and the government, where together they lead to favorable environments for technological innovation.

Figure 3 - Triple Helix Model



Source: Adapted from Etzkowitz and Leydesdorff (1997) apud Miranda; Santos; Russian (2017).

2.2.1 Existing challenges in cooperation and technology transfer in the university-industry category

There is a need for innovation to be disseminated through academic entrepreneurship, to strengthen the interaction between universities and industries, where research on cooperation models is necessary (TATUM et al, 2018; SANTOS, BENNEWORTH, 2019).

Even with all the benefits present in university-industry cooperation, Santos, Toledo and Lotufo (2009)

report that the relationships are complex and sensitive, because for the process to work, industries must be prepared to relate to the university, where there should be interest in both parties.

The transfer of technology and cooperation between universities and industries presents obstacles due to the need for qualified labor (GARNICA, 2007).

Finally, the result of the failures and lack of communication between the productive sector and the research institutions is still the main difficulty encountered in carrying out the technology transfer process in the sense of the university-industry, since most of the challenges and / or difficulties encountered in this context is summed up in the absence of a culture of cooperation between both involved.

3. Poisson's Regression Models

The Poisson Regression models were introduced by Nelder and Wedderburn in 1972, they are a useful alternative to the traditional methods of data analysis that require transformations (Russo, 2002), being a specific type of the Generalized Linear Models (MLG).

The response variable of a Poisson regression must follow a Poisson distribution and the data must have equal dispersion, that is, the average of the response variable must be equal to the variance. However, when working with experimental data, this property is often violated. Thus, one can have an overdispersion when the variance is greater than the average; or a sub-dispersion when the variance is less than the average. In these cases, it is still possible to apply the Poisson Regression model by making some adjustments (TADANO, et al. 2009).

Next, the Poisson distribution will be described and then the development of a Poisson regression model for the analysis of discrete series over time will be presented.

3.1 Poisson distribution

According to Russo (2002), the Poisson distribution is a discrete probability distribution, applicable to the occurrence of an event at a specified interval, it is the main reference for the analysis of count data and its probability function is presented below.

Let Y be a random variable with Poisson distribution, denoted by $Y \sim P(\lambda)$, where parameter $\lambda > 0$. Then the probability function of Y is given by:

$$P(Y=y) = \frac{e^{-\lambda} \lambda^y}{y!}, \quad y = 0, 1, 2, 3, \dots, \lambda > 0$$

If the events under counting occur independently and subject to a constant rate $\lambda > 0$, under the Poisson model, for an exposure interval of size t we have:

$$P(Y_t = k) = \frac{e^{-\lambda t} (\lambda t)^k}{k!}, \quad k = 0, 1, 2, 3, \dots$$

Among the main properties of the Poisson distribution, there are: Following the following properties (adapted from ZEVIANI; JÚNIOR and TACONELI, 2016):

- 1 - Mean: $E(Y) = \lambda$
- 2 - Variance: $\text{Var}(Y) = \lambda$;
- 3 - Successive probability ratio: $(P(Y = y)) / (P(Y = y-1)) = (\lambda) / y$, generating the recurrence ratio: $P(Y = y) = P(Y = y-1) \lambda / y$;

4 - If $Y_1, Y_2, \dots, Y_n$ are v.a.s independent with $Y \sim P(\lambda)$, and $\sum \lambda_i < \infty$, then $\sum Y_i \sim \text{Poisson}(\sum \lambda_i)$.

3.1.1 Poisson Regression Model

Ender (2002) apud Russo (2002) states that in the last 20 years interest in the study of analysis of count data has grown. According to Russo (2002), after the logistic regression, the Poisson regression model is the most used of the Generalized Linear Models (MLG) and are applied when the answer is a count, such as the number of events occurred in a space of time.

Kroll (2018) mentions that the Poisson regression model is the most natural example of a counting data regression model, and when models with counting data response include models based on the negative binomial distribution they can deal with an overdispersion of the data.

These are useful for traditional methods of data analysis that need transformations, that is, to improve experiments in different fields that involve variables and do not have a normal distribution, MLG generalize the traditional model of linear normal regression, creating options for the distribution of the response variable and generating greater flexibility in the connection between the mean and the systematic part of the model (PAULA, 1997 apud RUSSO 2002).

The MLG is written as follows (NELDER, WEDDERBURN, 1972; TAKAHASHI, KUROSAWA, 2016):

$$g(E(Y|X)) = \alpha + \beta^T X; Y|X \sim P(\theta)$$

where α is the intercept, it is the coefficient, T the time, X and Y independent variables and $P(\theta)$ a distribution of the exponential family of parameter θ .

Therefore, the Poisson regression model is given by:

$$\text{Log}(E(Y|X)) = \alpha + \beta^T X; Y|X \sim P(\theta)$$

onde $Y|X \sim P(\theta)$, então

$$E(Y|X) = \text{Var}(Y|X) = \exp(\alpha + \beta^T X)$$

To perform the adjustment of the Poisson regression model, it is common to have as a basis the maximum likelihood estimation method, a method where the estimators are obtained from maximizing the likelihood function (BOLFARINE; SANDOVAL, 2001).

According to Cordeiro (1992) apud Russo (2002), the Poisson regression model is a specific GLM that is used to estimate the model's parameters using the Maximum Likelihood method. The Likelihood Function is expressed by:

$$L = \prod_{i=1}^n \Pr\left(\frac{Y_i}{\lambda_i}\right) = \prod_{i=1}^n \frac{e^{-\lambda_i} \cdot \lambda_i^{Y_i}}{Y_i!}$$

and its Log-Likelihood function is equivalent to:

$$\begin{aligned} \log L &= \sum_{i=1}^n [-\lambda_i + Y_i \log(\lambda_i) - \log(Y_i!)] \\ \log L &= \sum_{i=1}^n (Y_i \cdot \log(\lambda_i) - \lambda_i) \end{aligned}$$

Schafer (1997) states that the statistic that serves to compare the significance of the adjusted and saturated models of the likelihood ratio test is given by the adjustment of the model evaluated through the G^2 deviation.

$$G^2 = -2 \log \left[\frac{L(\text{modelo com variável})}{L(\text{modelo saturado})} \right] \cap \chi^2_{n-p}$$

For the model without significant variables, this is given by:

$$G^2 = -2 \log \left[\frac{L(\text{modelo sem variável})}{L(\text{modelo saturado})} \right] \cap \chi^2_{n-p}$$

Used to verify the quality of the fit for the Poisson regression model, the G^2 deviation admits the following equation:

$$G^2 = 2 \sum_{i=1}^n \left(y_i \left(\frac{y_i}{\hat{\lambda}_i} \right) - (y_i - \hat{\lambda}_i) \right)$$

Complemented by Pearson's Chi-Square test, the equations together serve to verify the quality of the fit of the model represented by:

$$\chi^2 = \sum_{i=1}^n \frac{(y_i - \hat{\lambda}_i)^2}{\hat{\lambda}_i}$$

According to Coxe et al. (2009), for the Poisson regression model, the percentage of reduced G^2 can be calculated, that is, its variability through:

$$\left(1 - \frac{G^2 (\text{Modelo ajustado})}{G^2 (\text{Modelo nulo})} \right) \cdot 10$$

4. Methodology

The methodology used in this study was characterized as exploratory research of a quantitative character. For Boente and Braga (2004) exploratory research is characterized by an investigation of a study that presents little information. In the same sense, Vergara (2007, p. 47) states that exploratory research should not be confused with exploratory research, as it is carried out in an area for which there is little accumulated knowledge.

Richardson (1999) approached that, the quantitative research is characterized by quantifying the data in the collection of the research information, and in this way, statistical techniques are used.

For data collection and analysis, two bases were chosen, the International patent search base, Espacenet, which belongs to the European Patent Office, and the Scopus database belonging to the Elsevier group, which is a database of abstracts, citations from articles for academic newspapers and/or magazines.

For the present study, as it presents a more complete database in its base and presents journals with a large impact factor, the database selected for the research was Scopus for search of articles and the Espacenet database, which belongs to the Office European patent search for patents.

The first research was carried out with the terms “Cooperation and University”, which resulted in 274 articles, filters were applied restricting these publications to “article title”, the type of document was “article” in the period from 2000 to 2019.

In the search for patent documents, the keywords used in “Cooperation and University” were used in the title and summary field in order to find patent documents related to the study. 273 patent documents were found, between the years 2000 to 2018. The period ended in 2018 is justified for putting the research data still confidential to searches in the public domain.

Therefore, the figure below shows the procedures used to search for articles and patents, figure 4.

Figure 4 - Procedure for analyzing the article search and patent filings



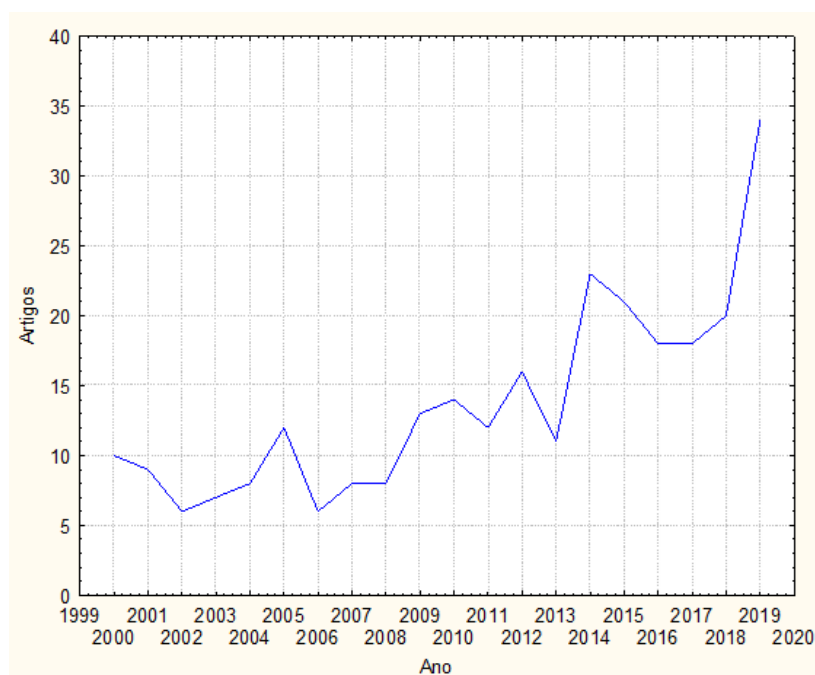
Source: Elaborated by the authors (2020)

5. Analysis and discussion of results

5.1 Analysis of the Poisson Regression Model - Articles

The series shown in figure 5 refers to the search for articles in the Scopus database in the annual period from 2000 to 2019 using the keyword cooperation and University and filters restricted to article title and type of document article, of which 274 articles are exposed based on the search.

Figure 5 - Annual evolution of articles 2000 – 2019



Source: Elaborated by the authors (2020)

Through Figure 5, it is possible to observe that the data have a randomness in the evolution of articles in the period from 2000 to 2019. The data, apparently, have a trend over the number of articles, which we will confirm by checking the Poisson Regression Model. observing whether the Deviance Scale and Pearson Scale are suitable for the model based on their Degrees of Freedom.

Table 1 shows the descriptive records of the variation and deviation related to the articles, as well as other measures:

Table 1: Descriptive Statistics

Value n	Average	Median	Fashion	Mín	Max	Var	Detour	Coef. Var
274	13,7	12	8	6	34	49,69	7,05	51,46%

Source: Elaborated by the authors (2020)

Table 1 shows an average of 13.7 articles, with a minimum and maximum value of 6 and 34 articles, respectively. The data variation was 49.69 articles and a deviation of 7.05 articles. The coefficient of variation in the number of articles was 51.46%, showing a high variation in the data.

5.1.1 Poisson Regression Models – Articles

Table 2 indicates the parameters of the Poisson Regression mode

Table 2: Summary of model parameters

	Coef	Standard Error (SE)	Coef (SE)	P-value
Z	-145,51	22,22	42,88	0

Source: Elaborated by the authors (2020)

The Poisson Regression model was:

$$Z = -145,51 + \text{erro} \\ (22,21)$$

Table 3 shows the criteria for evaluating these articles through modeling in the Poisson Regression Models.

Table 5: Criteria for evaluating the model

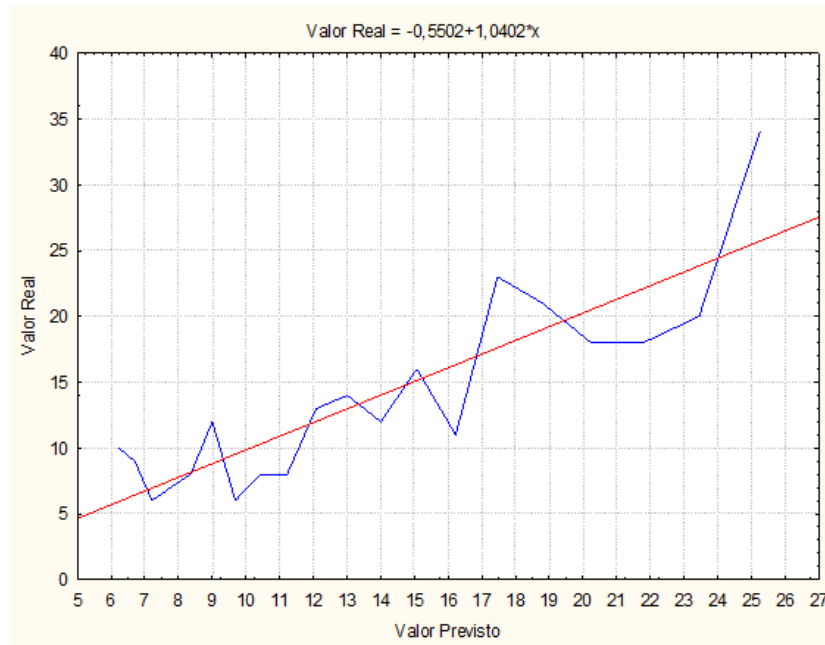
Criteria	Dregress of freedom	Values	Values/GL
Climing “Deviance” (G^2)	18	18	1
Scale of (X^2)	18	18,35	1,02
Likelihood		32,38	

Source: Elaborated by the authors (2020)

As the Pearson's G^2 and Chi-Square Statistics in Table 5 of the model approach 1, then the Poisson regression model is adequate.

Figure 6 shows the short-term forecast of the model, once again demonstrating that the model is adequate. The forecast was growing, as the months went by.

Figure 6 - Representative of Forecasts



Source: Elaborated by the authors (2020)

After confirming the model in question, short-term forecasting is now performed using values from the series that were considered out of the ordinary. Table 6 shows the actual and expected values of the model:

Table 6: Short-term forecast

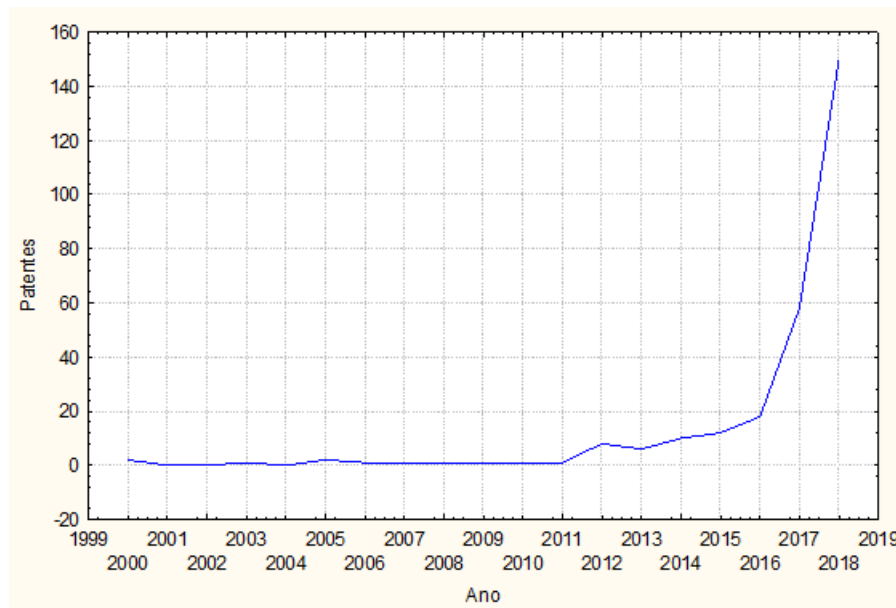
Real Value	Pred. Value	Linear Pred.
6	7,22	1,98
7	7,77	2,05
8	8,36	2,12
13	12,08	2,49
14	13,01	2,57
16	15,07	2,71
18	20,24	3,01
20	23,45	3,15

Source: Elaborated by the authors (2020)

5.2 Analysis of the Poisson Regression Model – Patents

The series shown in Figure 7 has as a reference the search for patents on the espacenet basis in the annual period from 2000 to 2018. This presented a total of 273 patents based on the search. As the search data is not yet available in the public domain, 2019 will not be included in the study.

Figure 7 - Annual evolution of patents 2000 – 2018



Source: Elaborated by the authors (2020)

From Figure 7, it is possible to observe that the data have a randomness in the evolution of patents in the period from 2000 to 2018. The data, apparently, have a trend over the number of patents, which we will confirm by checking the Poisson Regression Model. observing whether the Deviance Scale and Pearson Scale are suitable for the model based on their Degrees of Freedom.

Table 7 shows the descriptive records of the variation and deviation related to patents, as well as other measures:

Table 7: Descriptive Statistics

Value n	Average	Median	Fashion	Mín	Max	Var	Detour P.	Coef. Var
273	14,37	1	1	0	150	1256,91	35,45	246,74

Source: Elaborated by the authors (2020)

Table 7 shows an average of 14.37 patents, with a minimum and maximum value of 0 and 150 patents, respectively. The variation in the data was 1256.91 patents and deviation of 35.45 patents. The coefficient of variation in the number of patents was 246.74%, demonstrating a high variation in the data.

5.2.1 Poisson Regression Models – Patents

Table 8 indicates the parameters of the Poisson Regression model.

Table 8: Summary of model parameters

	Coef	Standard Error (SE)	Coef (SE)	P-value
Z	-1082,99	66,71	263,52	0

Source: Elaborated by the authors (2020)

The Poisson Regression model was:

$$Z = -1082,99 + \text{erro} \\ (66,71)$$

Table 9 shows the evaluation criteria for these articles through modeling in the Poisson Regression Models.

Table 9: Criteria for evaluating the model

Criteria	Degree of freedom	Values	Values/GL
Climbing "Deviance" (G^2)	17	71,27	4,19
Climbing Pearson (X^2)	17	672,23	39,55
Likelihood		-54,30	

Source: Elaborated by the authors (2020)

Table 9 shows that the "Deviance" Scale and the Pearson Scale are not suitable for the model, because their Degrees of Freedom are not equal to or close to 1. Therefore, data overdispersion should be analyzed.

Table 10 shows the parameters of the overdispersion, which is used to improve the model.

Table 10: Summary of model parameters

	Coef	Standard Error (SE)	Coef (SE)	P-value
Z	-1082,99	419,53	6,66	0,009839

Source: Elaborated by the authors (2020)

The Poisson Regression model was:

$$Z = -1082,99 + \text{erro} \\ (419,53)$$

Table 11 shows the criteria for evaluating these patents for λ if the model is adequate by applying the G^2 test and Pearson's chi-square test.

Table 11: Criteria for evaluating the model

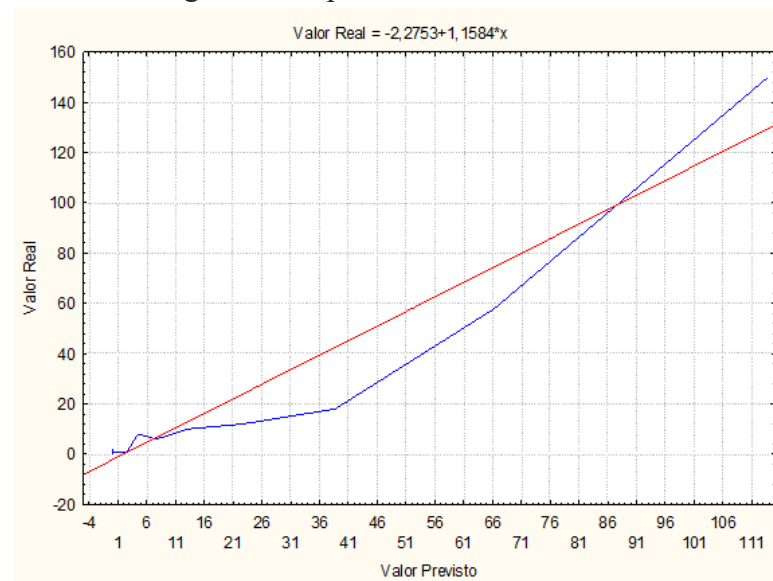
Criteria	Degree of freedom	Values	Values/GL
Climbing "Deviance" (G^2)	17	1,80	0,11
Climbing Pearson (X^2)	17	17,00	1
Likelihood		-847,22	

Source: Elaborated by the authors (2020)

As the Pearson's G^2 and Chi-Square Statistics in Table 11 of the model approach 1, then the Poisson regression model is adequate.

Figure 8 shows the model's short-term forecast, showing a forecast demonstrated once again that the model is adequate. The forecast was growing, as the months went by.

Figure 8 - Representative of Forecasts



Source: Elaborated by the authors (2020)

After confirming the model in question, the short-term forecast is now performed, using values from the series that were considered out of the ordinary. Table 12 shows the actual and expected values of the model:

Table 12: Short-term forecast

Real Value	Pred. Value	Linear Pred.
1	1,53	0,42
1	2,61	0,96
6	7,68	2,04
10	13,17	2,58
12	22,58	3,12
18	38,71	3,66
58	66,36	4,20
150	113,76	4,73

Source: Elaborated by the authors (2020)

6. Conclusion

In this article, an analysis of the scientific production of articles and technological production was carried out through the patents of university-industry cooperation based on a statistical technique called the Poisson regression model, in order to understand the existing cooperation between universities and industry, using the Poisson model, to consolidate the results of this study.

The methodology of this study was an exploratory research of quantitative character, for the collection and analysis of the data the International basis for patent search was chosen called Espacenet, which belongs to the European Patent Office, and the SciVerse Scopus base belonging to the Elsevier group that is a database of abstracts, citations of articles for newspapers and / or academic journals.

The first research was carried out with the terms “Cooperation and University”, which resulted in 274 articles and filters were applied, restricting these publications to “article title”. The type of document was “article” in the period from 2000 to 2019. In the search for patent documents, the keywords “Cooperation and University” were used in the title and summary field in order to find patent documents related to the study, resulting in 273 patent documents between the years 2000 to 2018.

A evolução anual de depósitos nas bases estudadas apresentou oscilações, o que tornou adequado a aplicação do modelo de regressão de Poisson. Após a aplicação desta modelagem nas duas buscas, a Escala de “Deviance” e a Escala de Pearson não se mostraram adequados para o modelo devido seus Graus de Liberdade não serem igual ou próximos de 1, sendo necessário a realização da análise da superdispersão dos dados, usado para melhorar o modelo. Realizado o ajuste do desvio G^2 (*deviance*) com o ajuste da superdispersão, os modelos apresentaram-se adequados para a análise, onde é confirmado na previsão realizada.

7. Acknowledgement

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Scientific and Technological Mapping in Essential Oils Therapists in Dentistry

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Abstract

Essential oils play a very important role in terms of applicability and economy, and their use in dentistry brings natural alternatives to diseases worldwide. Science needs incentives to generate knowledge and, when used in technology, it can benefit society. The aim of this study was to assess the balance between scientific and technological research. It is an exploratory and descriptive research of essential oils in dentistry, in two international databases, Scopus and Espacenet. In the results, there was an insignificant correlation between science and technology for essential oils in dentistry, even considering the period studied and the research limitation. As a conclusion, it was observed that there is a disparity between the financing for scientific and technological production.

Keywords: volatile oils; health; prospection; intellectual property.

1. Introduction

The use of essential oils is an old practice, where only copaiba oil has been used for more than 500 years in traditional folk medicine, with wide use in different applications (PIERI; MUSSI; MOREIRA, 2009). Markets such as pharmacy, cosmetics and food also seek the development of products with the greatest number of components of natural origin, especially those of vegetable origin, exploring biodiversity in a rational way, but there is little incentive from institutions to stimulate the applicability of research in technology, which can lead to a loss of commercial and economic opportunities (AMARAL; FIERRO, 2013). And speaking of economics, this is huge around the essential oils market, with a forecast of US \$12 billion by the year 2023, which will lead to an expansion of applications in different areas, as happened with orange oil, whose increased use by the elderly population led to an improvement in their therapeutic applications (CRYSTAL MARKET RESEARCH, 2018).

Essential oils extracted from plants can play a relevant role and are of great interest in the world community, given the great diversity of activities with antifungal functions (Scalas et al., 2018), antispasmodic activity (Makrane et al., 2019), activity antimicrobial (Helal et al., 2019), antioxidant and antibacterial effects (El Hamdaoui et al., 2018), among others, in addition to the fact that the use of natural substances can offer less risk to human health, as well as less resistance on the part of microorganisms due to their diverse nature.

In the health field, specifically dentistry, oral diseases such as periodontitis, dental caries and oral candidiasis are included in the list of the main health problems of people, in such a way that about 60% to 90% of school-age children and almost 100 % of adults have cavities, and there may be tooth loss in case of severe periodontal disease (BODIBA; SZUMAN; LALL, 2018). As for candidiasis, it is known that it is an opportunistic disease caused by fungi of the genus *Candida*, with several predisposing factors such as xerostomia, immunosuppression and use of dental prostheses, associated with factors such as host, parasitic load and fungal virulence. There are conventional treatments, but in recent decades, there has been a search for new antifungal agents, represented mainly by essential oils from plants (FERRÃO et al., 2020). Thus, the great need for research that can study the various forms of therapeutic applications of plants that may prove to be effective, safe and economical has its value (BODIBA; SZUMAN; LALL, 2018).

Based on the information above, the question arose as to whether there is a balance between what is researched and what is actually sought to patent, choosing the area of oral health, as it understands that health as a whole begins with the mouth, being the gateway to the organism, and the transfer of technology can play an important role in the economic development of a country. Therefore, the general objective of this research is to draw a comparative profile identifying whether the countries that are most financed for scientific production are the ones that have the most patents published in essential oils, in dentistry, from data collected in databases of publications scientific and technological, in addition to specific objectives, such as identifying quantitative data of scientific documents produced by affiliated entities in each country, profile of scientific production with support from funding entities, countries that have published scientific documents the most, international classification of patent applications and number of published patents.

2. Method

It was an exploratory and descriptive research of essential oils in dentistry, aiming to outline an overview regarding the financing of scientific production and registration of published patents, through the search in two international bases, Scopus and Espacenet. The Scopus database was chosen because it is perhaps considered one of the largest databases of abstracts and citations in peer-reviewed literature, covering several areas (ELSEVIER, 2015). The choice of the Espacenet database, on the other hand, for having a volume of around 90 million patent documents (CARVALHO; SANTOS, 2019), thus allowing a good evaluation for the desired research, but not covering all possibilities, a since there are other bases for research. It is worth mentioning that Technological Prospecting methods have been used for several decades in several countries, as a means of guiding the efforts undertaken for research, development and innovation (AMPARO; RIBEIRO; GUARIEIRO, 2012).

Thus, the Scopus database was analyzed on 2019/05/22, for scientific publications, and the Espacenet database on 2019/06/26, for published patent registrations, through the Capes Portal. The keywords chosen for the search were: 'Essential oil *' for Scopus, and 'Essential oil *' AND 'Dental' for Espacenet. The data were exported to the Microsoft Excel program (ID n. 00197-19045-27357-AA398) to analyze them in the form of graphs according to the research objectives. For the composition of the graphics in the Scopus database, it was necessary to perform a search of the country of origin, on the Google website, of each affiliation, financing and publication, aiming in all items to establish a quantitative by country. As for the

data on the technological part, we sought to extract from the International Patent Classification the subclass of greater quantity for filing patents, in addition to the countries that had more patents published until the date of the research. As for the statistical method, Pearson's correlation was used for the variables: most financed countries for the publication of scientific research versus countries that obtained the most published patents.

3. Results

The results obtained in this research will be presented in sequence, following the initial order for the Scopus database, where the scientific mapping was carried out, and later, for the Espacenet database (technological mapping) through patent research.

3.1 Results found in the scientific database

The Scopus database with the keyword 'essential oil *' returned 51,450 articles, 8,101 of which were open access and 43,349 from other categories, from 1825 to May 2019.

The number of scientific documents produced by the affiliated entities of each country indicates that Brazil has 5,342 publications, and Iran, 4,645, are the countries that most produce scientific documents by their affiliates. It should be noted that in the case of Brazil, the number of publications related to the theme is the result of a number of 24 Brazilian institutions, which have an average of around 223 publications. Among the 10 institutions that most produce scientific documents in the world, there are three Brazilian, one from the Southeast and two from the Northeast, namely: The University of São Paulo (USP) - 457 documents; Federal University of Sergipe - 364; and Federal University of Ceará - 362. The University of São Paulo - USP is the fourth institution that publishes the most, with the Federal University of Sergipe in 8th position, followed by the Federal University of Ceará, in 9th position.

Another result found in this research was the profile of scientific production with the support of financing entities (Figure 1), with Brazil standing out for having more than twice the amount of work financed in relation to China, and 9.5 times more than the United States. Among the five institutions that most finance in the world, according to the researched theme, there are three Brazilian women: the National Council for Scientific and Technological Development (CNPq) with 1,134 funding, the Coordination for the Improvement of Higher Education Personnel (CAPES) with 788, and the São Paulo State Research Support Foundation (FAPESP) with 236.

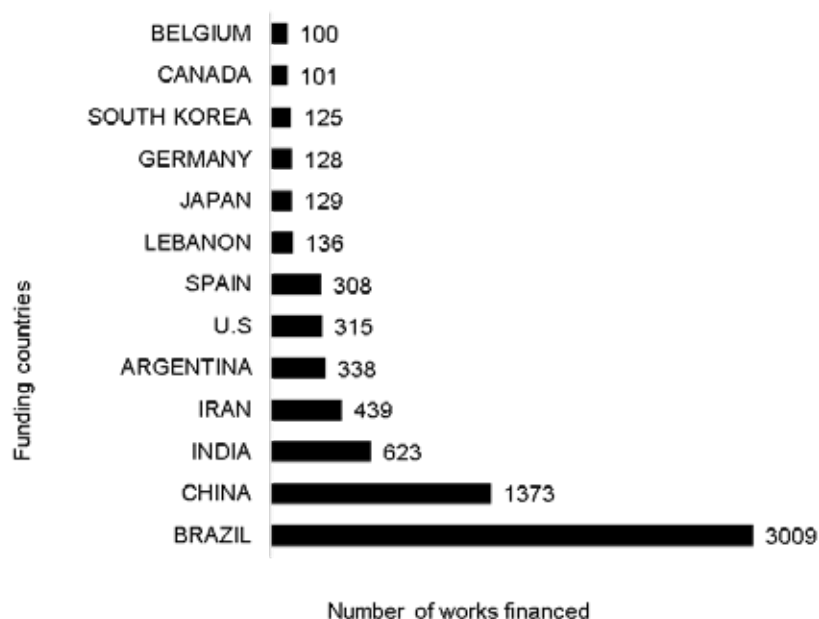


Figure 1 - Number of scientific papers funded by country (Greater than 100). Source: Scopus database
As for the countries that most published scientific documents in the Scopus database regarding essential oils, India, Brazil, Iran and China presented a value of publications above 4,000 documents each, with the United States as the fifth country that published the most (3,894 documents).

3.2 Results found in the technological database

The international classification of patent applications (CIP) in essential oils in dentistry that stood out in quantitative terms in the survey, carried out in the Espacenet database on 06/26/2019, was the A61K (382, in absolute terms), as expected, since it refers to preparations for medical, dental or hygienic purposes. Followed by A61P (69), which corresponds to specific use of cosmetics or similar preparations for personal hygiene, and A61Q (65), being described as specific therapeutic activity of chemical compounds or medicinal preparations. It is noticed that the sum of the classifications A61Q and A61P, give a value less than the value of half of the total of A61K.

Figure 2 shows the number of patents published internationally by countries or organizations, with 91 patents published, in a total list of 16 countries, with publication dates ranging from 1952/11/19 to 2019/04/30. China has a number of published patents related to essential oil in dentistry equivalent to almost the sum of the number of Japan, Republic of Korea, Russia and the United States combined.



Figure 2 - Number of patents published by countries or organizations. Source: Espacenet (WIPO: World Intellectual Property Organization)

3.3 Correlation between variables

Based on the parameters presented in Mukaka (2012), an insignificant correlation was observed for the variables ‘most funded countries for the publication of scientific research’ and ‘countries that have most published patents’. This fact was not expected since financing research requires financial resources, being, in general, public, and its transformation into technology through the registration of patents would be the apparent return of this investment to society.

4. Discussion

It was observed with this research in the Scopus database that Brazil and Iran are the countries that most produce scientific documents by their affiliates with an important participation of 3 Federal Universities in Brazil, and 2 of Iran. As for the profile of scientific production with support from financing entities, Brazil and China have presented over 1000 funded works, with emphasis on 3 Brazilian institutions: CNPq, CAPES and FAPESP. As for the countries that most published scientific documents regarding essential oils, India, Brazil, Iran and China published more than 4,000 documents each. Regarding the Espacenet database, the international classification of patent applications (CIP) in essential oils in dentistry that stood out in terms of quantity in the research was A61K, and finally, China has a larger number of patents published internationally in relation to countries like the United States and Russia, and Brazil does not appear in this list.

Based on the results of the Scopus database, some reflections were possible. One factor that may have contributed to Iran's position with this large number of publications by its affiliates is the formation of the pact of Islamic countries belonging to the Organization of Islamic Cooperation (OIC), in 2016, documented by Bagci et al. (2016), and published by Statistical, Economic and Social Research and Training Center for

Islamic Countries (SESRIC), which presents a 10-year program, aiming at sustainable development and the use of science and technology, through the incentive to research and technological capacities ensuring a conducive policy environment. In addition, the scientific academy The Royal Society (2020) states that there is current evidence of investment in education, science and innovation, with support from governments, companies, agencies. As for Brazil, which stands out in the 3 items researched about science in the Scopus database, Fazzio (2017) notes that the country had the institutionalization of academic activity later in comparison to other countries in Latin America, but it was not always so, because according to Guedes (2011), an increase in scientific production does not mean an increase in financial resources for publication. Although Fazzio (2017) highlights that even in a situation of economic crisis, investment and financing in research is important, Soares (2018) adds that due to the institutional structure of Brazil, the results of the research in it are much more academic, not specifically resulting in social and economic return. Victor (2014) identified that Brazil's position in the world ranking of scientific publications is largely due to the work of CNPq. Zago (2018) also noted that Brazil and India stood out as the largest publishers in research, although Morgantti and Del Pino (2019) note that, in the case of Brazil, the institutionalization of science and technology as a policy to encourage development depends on government priorities. Chinsebu (2016) observed some characteristics of research in the countries, emphasizing that basic research was done mainly in Brazil, Europe and Australia. This fact is corroborated by Ferreira (2014) who observed an increase in interest in essential oils, whose activities were investigated, by researchers such as Prado et al. (2018), Teles et al. (2019), Valor et al. (2018), Helal et al. (2019), who sought new treatment options that were less aggressive and safer to health. However Soares (2018) drew attention to areas such as health, which, although important for society as a quality of life factor, is not considered as important for research. It is worth mentioning the consideration of Negri (2018) for the quantitative assessment of scientific production, that the most used indicator is the number of publications in internationally indexed journals, and in the case of Brazil, an acceleration was noticed as from the 2000s. Guedes (2011) warns of the care with the number of publications that are only to show productivity, as required by graduate programs. Thus, Negri (2018) suggests another indicator of scientific production that would be the number of citations of a scientific article (impact factor), which ends up requiring articles with better qualities. As for the results in the Espacenet database, Moura et al. (2019) in its search for patent filings in Brazil and worldwide registrations for the health area, also found predominance for the A61K area. This author points out that the assignment of the CIP code is carried out by the inventor and the patent examiner, and it must not be forgotten that there may be more than one classification associated with that invention in the same document. Negri (2018) adds that patents are very important for the protection of most innovations, especially in some industries, such as pharmaceuticals. Although Brazil does not appear on the international list of published patents, there was an increase in the number of such intellectual protection in other areas in that country, which according to Soares et al. (2016) and Negri (2018) resulting from deposits made by non-residents, and among deposits made by residents, it is worth mentioning the increase in requests from universities and research institutes. This is perhaps partly due to the creation of technological innovation centers in these institutions, resulting from the Technological Innovation Law of 2004, inspired by the US law (Bayh-Dole Law) (SILVA; VASCONCELLOS, 2018). Also according to Soares et al. (2016), this trend of a greater number of requests made by non-residents in Brazil, is also shared by other Latin American

countries, a fact that suggests that the results obtained in the patent application do not reflect the national effort to promote technological innovation. Moura et al. (2019) also observed a greater predominance of multinational companies among the largest depositors in Brazil, being associated with three areas: health, information technology and electronics. Negri (2018) pointed out that there is more balance between the distribution of patents between residents and non-residents in developed countries. One should consider the aspect related to the reading of patents, there is a more specific audience, as stated by Ouellette (2017) in his work, concluding that researchers in the areas of biotechnology and chemistry observed the reading of patents as a source of technical information more than than researchers from other areas, which demonstrates a need for improvements, including increased accessibility of patents for those who have never used this resource, as well as greater acceleration in the publication of patents, due to the delay of 18 months before publication. In addition to this aspect, it is worth mentioning that from the health research point of view, Negri (2018) also adds the great period for the development of a medication, for example, which can reach up to 10 years, between studies on the molecule, tests preclinical and clinical studies in humans. Assessing the position of the United States, which despite not being among the largest publishers of scientific articles, have published patents, authors such as Arora, Belenzon and Patacconio (2017) observed that after the Bayh-Dole Act, American universities became more engaged in the commercialization of their research, registering patents in an increasing way. This fact in relation to the laws was observed by the authors Mueller and Perucchi (2014) who stated that laws may or may not encourage the technological market. Looking now to understand the prominent position of China in relation to the number of patents published internationally, a parallel was drawn with the area of biotechnology, in which authors such as Streltsova and Linton (2018) observed that there was an increase in patent applications among the BRICS countries (Brazil, Russia, India, China and South Africa), China being the most active of the group, having as a major factor for this aspect the strong initiative that Chinese researchers receive to patent. According to these same authors, Russia experiences a lower growth, as it works with predominantly domestic patents in this area. Negri (2018) stressed that more important than patenting their technologies, is the importance of transferring and appropriating the knowledge produced by universities for society and for companies, in order to avoid the amount of patent filings that will never be technically developed. For Póvoa (2010) from the point of view of social well-being, universities should try to license their patents so as not to place an initial exclusivity, except if there are no interested parties, but the possibility of a “license for research”, in which it can allow researchers who intend to use the knowledge protected by patents to aim to promote the advancement of scientific research. Still in this regard, the authors Mueller and Perucchi (2014), reinforced the need for the university to be an active producer of knowledge that can be patentable, although there are still challenges to be reached once the tradition is focused on scientific information. One must consider a very important factor for the health area, which would be the cost to set up a research center, because according to Negri (2018) infrastructure is an essential aspect for the development of science and technology in a country. In addition, he adds, that in the case of Brazil, this infrastructure is very concentrated in the Southeast and South regions. This fact brings an interesting aspect regarding the results of this study, because despite the inequality between the Brazilian regions, there is the Federal University of Sergipe, from the Northeast, among the 8 institutions that most presented scientific publications on the subject in question, thus recognizing its great challenge.

Finally, there is the result of the insignificant correlation between the variables science and technology, a fact corroborated by the authors Han and Magee (2018) in which they reported that although there is an increase in citations of scientific articles by patents, there is no obvious relationship between science and technology, since it is a very complex and multivariable interaction. Roczanski (2016) also highlighted that innovation results from a complex process and that it depends on other factors related to knowledge within an environment that involves science, technology, learning, production, politics and demand. Soares and collaborators (2016) sought to characterize the Brazilian innovative system in order to understand the evolution of innovation in the country, and realized the need to create mechanisms that could increase investments in research and development in the country. Silva and Vasconcellos (2018) suggest that Brazil, in addition to presenting regional disparities, of having universities considered young, in different stages of maturity, autonomy and financial resources compared to institutions in Europe and the United States, presents latent research gaps in the interaction university-industry. Negri (2018) adds that the country is in an intermediate position, both in the production or use of knowledge and new technologies, but with a minority performance in filing patents, either in the country itself or abroad. The authors Silva, Pereira and Araújo (2019) add regarding the importance of the internationalization of higher education, as a strategy used by universities in order to meet the demands of society in the current century, aiming at institutional development, as well as global projection. Authors such as Rosa and Frega (2017), through a research at a Brazilian university, found answers where most of the interviewees said that there was no appreciation of patents in the university sphere, as there are with scientific publications, and identified possible actors that could interfere in the process of technology transfer under the aspect of the Technology Transfer Offices (ETT), researchers and university, visible in table 1.

Table 1: possible stakeholders who may interfere in the process of technology transfer from the aspect of Technology Transfer Offices (TTO), researchers and University.

	Barriers	Facilitators	Motivators
ETT	· Ignorance in the drafting of patents; · Turnover of human capital; · * Lack of University-Company interaction mechanisms; · * Obstacles to international patenting.	· Competence of managers; · Search for the dissemination of the culture of intellectual property; · Outsourcing of the patent writing process.	
Researchers	· Overload of activities; · Ignorance and lack of interest in the process.	· Academic experience	· Protective awareness; · The transfer of resources for research and economic gains; · Academic prestige.

Universities	· University bureaucracy; · Lack of support and encouragement.		

Source: Adapted from Rosa and Frega (2017).

As a suggestion for improvements in some sectors, Negri (2018) adds reformulations in some areas, such as: Education, Infrastructure, Environment, Innovation in health. Silva and Vasconcellos (2018) observed that although universities are not at the center of the National Innovation Systems model, it is possible to see their greater involvement in this process. For Klofsten et al. (2019) knowledge exchange and collaboration is needed to support organizational innovation, teaching and research and local development, since universities are research-based organizations that create links that link knowledge production to its dissemination, that is, being entitled to the university's 3rd mission, which according to Castro (2011) is based on knowledge transfer. Diaconu and Dutu (2014) complement that to fulfill the third mission, it is necessary to involve in the identification and use of designed tools that can highlight the results of scientific research, as long as there is due financial support to them, in addition to employee motivation, with the intention of increasing the university's prestige in the community. Finally, Ranga and Etzkowitz (2013) pointed out that in the case of adopting an approach of the Triple Helix system (university-industry-society) to innovation, it should focus mainly on measures that can support the formation and consolidation of three areas: Knowledge, Innovation and Consensus.

5 Conclusion

As final considerations of this research, there is the scientific aspect that Brazil presents a significant number of documents published by authors linked to Brazilian institutions in the Scopus database, related to essential oils in general. The numbers are higher than those of Iran, the country that came closest to the number of scientific publications, as well as presenting a larger number of funded works, followed this time by two countries that make up the BRICS, China and India. As for the number of published scientific documents, there is a greater record for the countries: India, Brazil, Iran and China. As for the technological aspect evaluated in the Espacenet database, there was greater emphasis on patents in the A61k category. This is a result considered logical, as patents were selected that involve essential oils in dentistry. In the criterion number of patents granted, China has a higher number, a fact that can be understood by the incentive given to that country for patent registrations. It is noticed that China, in addition to producing scientific content, also does so in technology, maintaining a coherence between science and technology with a return to society. Finally, the insignificant correlation between research and technology, even considering the period studied and the limitation of research in two databases, suggests a disparity between financing scientific production and technological production. In this way, new studies with other variables and other fields of research are suggested, in order to verify the reproduction of this scenario.

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Sample size for estimation of averages of agronomic traits in cassava seedlings

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ABSTRACT

The rapid multiplication method improves the use of propagating material. However, improving management and experimental techniques is crucial for assessing plant production and quality. This study calculated the sample size for estimating averages of agronomic characters in cassava seedlings originating from stem cuttings with a different number of leaves and different diameters. A total of 600 cuttings (each with two buds) with a diameter of 15.00–19.99 mm (N = 300) or 20.00–25.00 mm (N = 300) of the cultivar Apronta Mesa were planted in different growing seasons (July, August, September, and October). On each planting season (September 22, October 7, October 19, and November 25), 300 cuttings, with three to five or even more than five visible leaves, were collected. The following statistics were analyzed: minimum, maximum, range, mean, median, variance, standard deviation, and coefficient of variation. The sample size was determined by resampling using 2,000 resamples, with replacement, and was defined by the number of plants from which the range of 95% confidence interval was 10%, 15%, and 20% of the average estimate. The use of stem cuttings larger than 20 mm in diameter and with more than five leaves was suitable for producing cassava seedlings. Irrespective of the range in cutting diameter and leaf number, 87 plants were enough to estimate trait averages when the range of the confidence interval was 20% of the average estimate.

Keywords: *Manihot esculenta* Crantz, rapid multiplication method, sampling, experimental design.

1. INTRODUCTION

Cassava plants are native to the Amazon and produce starch-rich roots that are used primarily as human and animal food and as an alternative source for producing bioethanol (Bennett 2015). Cassava plants have high rusticity and adaptability to different cultivation conditions (Delaquis et al. 2018) and constitute the third most important food source in the tropics (Hasibuan & Nazir 2017). In addition, cassava is a significant source of income for family farms (Egesi et al. 2007) because of its flexible harvest period and adequate yield under drought and in soils with poor nutritional and physical conditions (Adeniji et al. 2011). Cassava is grown using a traditional planting method with stem cuttings. This method is widely used but limits producing propagating materials with high sanitary quality (Ogero et al. 2012). The average yield is 5,770 kg ha⁻¹ in family properties where this method is used (Brazil 2009) and the adoption of management techniques is limited (Khanthavong et al. 2016). Albuquerque et al. (2014) have shown that low crop yield

can be attributed to the restricted use of management techniques at the right time, including the control of weeds, pests, and diseases.

Despite its social importance and contribution to national food security, few studies have evaluated strategies to increase cassava yield (Silveira et al. 2012). In this context, the rapid multiplication method developed by the International Center for Tropical Agriculture (Centro Internacional de Agricultura Tropical–CIAT) aims to increase the utilization of high-quality physiological and sanitary propagating materials. The method consists of planting cuttings with two to three buds in propagation beds and, after reaching the harvesting height, collect the cuttings and place them in containers with water to promote rooting. After that, the cuttings are cultivated in pots containing a soil substrate to produce seedlings. Although the method has the adaptation proposed by Koefender et al. (2015) for use in southern Brazil, there are few studies on experimental designing and sample size determination for research using adaptations of fast-multiplication methods for cassava seedlings.

The production of cassava seedlings requires selecting the propagating material to obtain vigorous cuttings with good rooting capacity. For this purpose, cuttings with different diameters should be evaluated because this parameter affects the physiological quality of stems (Bezerra 2012). The criterion used for selecting stems for implementing the rapid multiplication method is height, which usually ranges from 10 to 12 cm. However, the number of leaves is the character that best represents the physiological age of the plants (Streck et al. 2003) and may be a good criterion for collecting stems and obtaining high-quality seedlings. For this reason, it is critical to measure biological parameters to determine stem growth and development during plant production with an adequate degree of accuracy.

In agricultural experiments, measuring all plants that make up an experimental unit is the most appropriate method for estimating averages. However, given the limited time, financial, and labor resources, a given study population is represented by sampling. In these cases, estimating and using the appropriate sample size is necessary to increase sample representativeness (Storck et al. 2011). Confidence intervals obtained by resampling have been used to calculate the sample size. This technique is independent of the probability distribution of data (Ferreira 2009) and is utilized to calculate the sample size to estimate trait averages in flax crop (Cargnelutti Filho et al. 2018a). The objective of this study is to calculate the sample size (number of plants) to estimate averages of agronomic traits in cassava seedlings obtained from cuttings with different diameters and a different number of leaves.

2. MATERIAL AND METHODS

A total of 600 cuttings (each with two buds) with a diameter of 15.00–19.99 mm ($N = 300$) or 20.00–25.00 mm ($N = 300$) of the Apronta Mesa cultivar were planted in different growing seasons (July, August, September, and October). Planting was carried out in 15-cell black plastic trays with the following dimensions: length, 34 cm; width, 21 cm; height, 7.8 cm. The dimension of each cell was 6.2 cm (top), 5.0 cm (bottom), and 7.8 cm (height), and each cell had five 6-mm holes at the base for water draining. The trays were filled with the commercial substrate Mec Plant®. After planting, the cuttings were kept in a hatchery (model Van der Hoeven) with sprinkler irrigation.

On each planting season (September 22, October 7, October 19, and November 25), 75 cuttings with a different number of visible leaves (3-5 or >5) and different diameters (<20 mm or >20 mm) were planted, totaling 300 cuttings. The leaf was considered visible when the edges of one of the lobes did not touch each other (Schons et al. 2007). After collection, the cuttings were planted in 15-cell plastic trays filled with wet Mec Plant® substrate to prevent tissue dehydration. Cuttings were planted (one per cell) in 1 cm-deep furrows in the morning at a maximum temperature of 25 °C. After planting, the trays were kept in a greenhouse (model Van der Hoeven) with an automatic mist irrigation system, with a total irrigation depth of approximately 6 mm of water day⁻¹, at an average temperature of 25 °C.

At the time of cultivation, plant height at planting (PHP) (from the base to the last visible leaf) and the number of leaves at planting (NLP) were measured. At 7 days after planting (DAP), the number of visible leaves (NL7) was counted again. At 30 DAP, the seedlings were removed from the greenhouse and transferred to a hatchery for acclimation for a minimum of 5 days, except on November 25, when the seedlings were acclimated at 23 DAP. On each planting season, at 48, 47, 44, and 31 DAP, respectively, the number of leaves at transplanting (NLT) and plant height at transplanting (PHT) were measured in centimeters.

The following statistics were analyzed: minimum, maximum, range, mean, median, variance, standard deviation, and coefficient of variation (CV). The averages were compared using a *t*-test for independent samples at a level of significance of 5%. A total of 66, 72, 66, and 61 plants were evaluated on September 22, October 10, October 19, and November 25, respectively, for estimating trait averages in seedlings originating from cuttings smaller than 20 mm in diameter and with either three to five leaves or more than five leaves.

Based on these data, 999 sample sizes were planned, with an initial sample size of two plants, and the other sample sizes were obtained by consecutively adding one plant, up to a maximum size of 1,000 plants. Therefore, the planned sample sizes varied from 2 to 999 plants. After that, for each sample size, iterative resampling was performed using 2,000 resamples with replacement. Therefore, 2,000 average estimates of each parameter were obtained for each sample size (Ferreira 2009). The following statistics were determined based on average data: minimum value, 2.5% percentile, mean, 97.5% percentile, and maximum value. The range of the 95% confidence interval was calculated by the difference between the 97.5% and 2.5% percentiles.

The sample size was determined by the number of plants from which the range of the 95% confidence interval was equal to 10%, 15%, and 20% of the average estimate. Statistical analyses were performed using R software (R Development Core Team 2014).

3. RESULTS AND DISCUSSION

Standard deviations were higher for PHT in the cultivations carried out on September 22, October 10, and November 25. On October 19, the standard deviations were higher for both PHT and NLT (Tables 1 and 2). Moreover, ranges were higher for PHT and NLT, indicating higher variability in these parameters on the evaluated transplanting dates and the need to calculate adequate sample sizes to estimate average values.

Table 1: Minimum (min), maximum (max), range (ran), mean (m), median (med), standard deviation (SD), and coefficient of variation (CV) of the number of leaves at planting (NLP), number leaves at 7 days after planting (NL7), plant height at planting (PHP), plant height at transplanting (PHT), and number of leaves at transplanting (NLT) of cassava seedlings originating from cuttings with either three to five visible leaves or more than five leaves and a diameter of < 20 mm or > 20 mm planted on September 22 and October 7.

Planting season										
September 22						October 7				
3 - 5 leaves / < 20 mm diameter						3 - 5 leaves / < 20 mm diameter				
Estat	NLP	NL7	PHP	PHT	NLT	NLP	NL7	PHP	PHT	NLT
Min	3.00	1.00	0.40	3.30	3.00	3.00	1.00	0.40	2.80	3.00
Max	5.00	6.00	4.00	17.50	11.00	5.00	6.00	5.40	11.90	10.00
Ran	2.00	5.00	3.60	14.20	8.00	2.00	5.00	5.00	9.10	7.00
M	4.14 b	3.92 c	2.01 d	9.52 b	8.06 c	3.50 b	3.03 b	1.61 d	6.30 d	7.11 c
Med	4.00	4.00	2.00	7.65	8.00	3.00	3.00	1.50	6.10	7.00
SD	0.70	1.04	0.79	4.57	1.42	0.63	0.95	0.72	1.62	1.53
CV	16.90	26.56	39.21	48.00	17.66	17.94	31.34	44.86	25.65	21.57
> 5 leaves / < 20 mm diameter						> 5 leaves / < 20 mm diameter				
Estat	NLP	NL7	PHP	PHT	NLT	NLP	NL7	PHP	PHT	NLT
Min	6.00	2.00	1.10	3.40	5.00	6.00	2.00	1.00	4.20	5.00
Max	9.00	9.00	6.40	18.40	12.00	8.00	6.00	4.50	15.80	12.00
Ran	3.00	7.00	5.30	15.00	7.00	2.00	4.00	3.50	11.60	7.00
M	6.39 a	4.67 b	2.97 b	9.88 b	8.64 b	6.13 a	4.72 a	2.42 b	8.62 b	8.72 a
Med	6.00	5.00	2.90	9.40	9.00	6.00	5.00	2.50	7.50	9.00
SD	0.70	1.71	1.02	3.46	1.58	0.37	1.12	0.64	3.02	1.32
CV	10.93	36.70	34.35	35.03	18.24	6.09	23.64	26.43	35.06	15.18
3 - 5 leaves / > 20 mm diameter						3 - 5 leaves / > 20 mm diameter				
Estat	NLP	NL7	PHP	PHT	NLT	NLP	NL7	PHP	PHT	NLT
Min	3.00	1.00	0.80	5.60	6.00	3.00	1.00	1.00	3.10	4.00
Max	5.00	6.00	3.60	13.80	11.00	5.00	5.00	3.80	16.50	11.00
Ran	2.00	5.00	2.80	8.20	5.00	2.00	4.00	2.80	13.40	7.00
M	4.24 b	4.05 c	2.28 c	8.76 c	8.42 b	3.78 b	3.25 b	2.17 c	7.44 c	7.72 b
Med	4.00	4.00	2.40	8.30	8.00	4.00	3.00	2.05	7.00	8.00
SD	0.63	1.06	0.64	2.22	1.23	0.79	0.96	0.65	3.41	1.52
CV	14.94	26.17	28.13	25.38	14.58	20.94	29.55	30.00	45.79	19.71
> 5 leaves / > 20 mm diameter						> 5 leaves / > 20 mm diameter				
Estat	NLP	NL7	PHP	PHT	NLT	NLP	NL7	PHP	PHT	NLT
Min	6.00	3.00	1.80	6.40	7.00	6.00	2.00	1.60	4.50	7.00
Max	9.00	9.00	5.50	19.60	13.00	8.00	7.00	5.50	16.30	11.00
Ran	3.00	6.00	3.70	13.20	6.00	2.00	5.00	3.90	11.80	4.00

M	6.53 a	5.35 a	3.45 a	12.39 a	9.83 a	6.28 a	4.64 a	2.99 a	10.22 a	9.07 a
Med	6.00	5.00	3.45	12.35	10.00	6.00	5.00	3.00	10.35	9.00
SD	0.77	1.44	0.83	3.43	1.53	0.54	1.21	0.79	2.41	0.98
CV	11.78	26.94	23.98	27.71	15.51	8.55	26.17	26.45	23.56	10.84

*The averages not followed by the same letter in each column were not significantly different from each other using the *t*-test for independent samples at a level of significance of 5%.

Table 2: Minimum (min), maximum (max), range (ran), mean (m), median (med), standard deviation (SD), and coefficient of variation (CV) of the number of leaves at planting (NLP), number leaves at 7 days after planting (NL7), plant height at planting (PHP), plant height at transplanting (PHT), and number of leaves at transplanting (NLT) of cassava seedlings originating from cuttings with either three to five visible leaves or more than five leaves and a diameter of < 20 mm or > 20 mm planted on October 19 and November 25.

Planting season										
October 19						November 25				
3 - 5 leaves / < 20 mm diameter						3 - 5 leaves / < 20 mm diameter				
Estat	NLP	NL7	PHP	PHT	NLT	NLP	NL7	PHP	PHT	NLT
Min	3.00	2.00	0.60	2.40	4.00	3.00	2.00	0.90	3.10	5.00
Max	5.00	6.00	2.70	6.20	9.00	5.00	7.00	2.10	9.00	11.00
Ran	2.00	4.00	2.10	3.80	5.00	2.00	5.00	1.20	5.90	6.00
M	3.67 d	3.94 d	1.17 d	4.33 d	6.98 c	3.93 d	4.51 c	1.38 d	5.39 b	8.74 c
Med	4.00	4.00	1.10	4.30	7.00	4.00	4.00	1.40	5.00	9.00
SD	0.67	1.02	0.37	0.90	1.22	0.77	0.94	0.31	1.55	1.30
CV	18.35	25.79	31.33	20.81	17.49	19.62	20.90	22.52	28.78	14.91
> 5 leaves / < 20 mm diameter						> 5 leaves / < 20 mm diameter				
Estat	NLP	NL7	PHP	PHT	NLT	NLP	NL7	PHP	PHT	NLT
Min	6.00	2.00	1.00	3.30	5.00	6.00	4.00	1.30	4.50	7.00
Max	7.00	7.00	2.90	8.80	10.00	7.00	7.00	4.30	12.60	13.00
Ran	1.00	5.00	1.90	5.50	5.00	1.00	3.00	3.00	8.10	6.00
M	6.17 b	5.36 b	1.72 c	5.62 b	8.26 b	6.11 b	5.92 b	2.25 b	7.19 a	9.21 b
Med	6.00	6.00	1.70	5.30	8.00	6.00	6.00	2.10	6.70	9.00
SD	0.38	0.95	0.40	1.38	1.18	0.32	0.49	0.61	1.60	1.25
CV	6.09	17.80	23.36	24.61	14.30	5.26	8.33	27.12	22.30	13.60
3 - 5 leaves / > 20 mm diameter						3 - 5 leaves / > 20 mm diameter				
Estat	NLP	NL7	PHP	PHT	NLT	NLP	NL7	PHP	PHT	NLT
Min	3.00	2.00	1.20	3.00	5.00	3.00	3.00	0.90	3.50	5.00
Max	5.00	6.00	3.70	8.30	10.00	5.00	6.00	2.60	8.90	11.00
Ran	2.00	4.00	2.50	5.30	5.00	2.00	3.00	1.70	5.40	6.00
M	4.23 c	4.27 c	1.98 b	5.23 c	7.95 b	4.21 c	4.77 c	1.75 c	5.67 b	8.82 c
Med	4.00	4.00	1.90	5.10	8.00	4.00	5.00	1.70	5.60	9.00
SD	0.72	0.89	0.50	1.22	1.33	0.69	0.84	0.39	1.16	1.22

CV	17.01	20.75	25.34	23.39	16.71	16.28	17.70	22.16	20.40	13.81
	> 5 leaves / > 20 mm diameter					> 5 leaves / > 20 mm diameter				
Estat	NLP	NL7	PHP	PHT	NLT	NLP	NL7	PHP	PHT	NLT
Min	6.00	3.00	1.40	3.80	6.00	6.00	4.00	1.40	5.20	6.00
Max	8.00	7.00	4.30	11.50	11.00	8.00	8.00	5.50	11.30	11.00
Ran	2.00	4.00	2.90	7.70	5.00	2.00	4.00	4.10	6.10	5.00
M	6.35 a	5.80 a	2.85 a	7.69 a	9.20 a	6.38 a	6.13 a	2.72 a	7.25 a	9.56 a
Med	6.00	6.00	2.85	7.40	9.00	6.00	6.00	2.60	7.10	10.00
SD	0.59	0.83	0.64	1.51	1.13	0.61	0.67	0.72	1.40	1.01
CV	9.37	14.25	22.32	19.62	12.25	9.57	10.93	26.49	19.29	10.55

*The averages not followed by the same letter in each column were not significantly different from each other using the *t*-test for independent samples at a level of significance of 5%.

The CV was lower for NLP, ranging from 5.26% to 20.94% in seedlings originating from cuttings with three to five leaves or more than five leaves and a diameter of <20 mm or >20 mm on the four planting season. In contrast, the CV was higher for PHP (22.16–44.86%) and PHT (19.29–48.00%). Furthermore, the CV was higher for parameters obtained by measurements compared to those obtained by counting, suggesting that at a given degree of accuracy, a larger sample size is required for characters obtained by measurement compared to those obtained by counting. In contrast, in jack beans (*Canavalia ensiformis*), the average CV in morphological characters was 21.70%, except for the number of leaves (95.65%) (Cargnelutti Filho et al. 2018b).

For the five measured traits, there were significant differences among the averages for combinations between observed trait for cutting collection (number of leaves) and stem cutting diameters in the four planting seasons. Seedlings produced from cuttings with three to five leaves and with a diameter of <20 mm had lower averages for all parameters, regardless of the planting season. In turn, seedlings from cuttings with more than five leaves and with a diameter of >20 mm had higher averages for all parameters on the four planting seasons. This result indicated that seedlings from cuttings with a diameter of >20 mm and with more than five leaves showed better growth and development. The success of vegetative propagation is conditioned by the level of nutrient storage in plant tissues for plant growth and development (Neves et al. 2018).

The sample size necessary to estimate trait averages on different cultivation dates was highly variable among the four types of seedlings produced (Table 3). When the range of the confidence interval was 10% of the average estimate, in seedlings originating from cuttings with either three to five leaves or more than five leaves and with a diameter of <20 mm on the four planting seasons, the sample size ranged from 35 to 361 plants and from 2 to 215 plants, respectively. In seedlings from cuttings with either three to five leaves or more than five leaves and with a diameter of >20 mm, the sample size ranged from 29 to 354 plants and 12 to 124 plants, respectively. Sample size variability was also observed in parameters from pecan (Cargnelutti Filho et al. 2014), black oats (Cargnelutti Filho et al. 2015), and crotalaria (Toebe et al. 2018).

Table 3: Sample size (number of plants) for the confidence interval ranges of 10%, 15%, and 20% of the average estimate of plant height at planting (PHP), number of leaves at planting (NLP), number of leaves at 7 days after planting (NL7), plant height at transplanting (PHT), and number of leaves at transplanting (NLT) of cassava seedlings originating from cuttings with either three to five leaves or more than five leaves and with a diameter of either <20 mm or >20 mm on four planting seasons.

3 - 5 leaves / < 20 mm diameter															
Season	PHP			NLP			NL7			PHT			NLT		
	10%	15%	20%	10%	15%	20%	10%	15%	20%	10%	15%	20%	10%	15%	20%
Sep 22	250	105	60	44	21	11	114	46	29	361	163	87	49	21	12
Oct 7	329	135	80	58	23	12	155	69	40	103	44	26	76	30	19
Oct 19	160	67	40	55	24	14	110	47	25	68	31	16	49	22	13
Nov 25	77	33	18	60	27	16	69	35	17	127	55	31	35	14	9
> 5 leaves / < 20 mm diameter															
Season	PHP			NLP			NL7			PHT			NLT		
	10%	15%	20%	10%	15%	20%	10%	15%	20%	10%	15%	20%	10%	15%	20%
Sep 22	187	85	45	18	8	4	215	93	52	196	88	47	50	22	13
Oct 7	107	46	26	4	3	2	85	39	23	190	86	46	36	17	9
Oct 19	84	38	20	2	2	2	51	22	13	93	41	23	31	15	7
Nov 25	113	52	29	2	2	2	11	6	3	75	35	18	28	13	8
3 - 5 leaves / > 20 mm diameter															
Season	PHP			NLP			NL7			PHT			NLT		
	10%	15%	20%	10%	15%	20%	10%	15%	20%	10%	15%	20%	10%	15%	20%
Sep 22	123	55	30	38	15	10	111	46	28	102	45	25	32	16	9
Oct 7	144	64	35	78	31	19	139	60	32	354	141	84	60	27	15
Oct 19	105	44	24	45	21	10	71	30	17	88	39	21	41	19	11
Nov 25	76	32	19	41	18	10	49	21	12	67	28	16	29	13	8
> 5 leaves / > 20 mm diameter															
Season	PHP			NLP			NL7			PHT			NLT		
	10%	15%	20%	10%	15%	20%	10%	15%	20%	10%	15%	20%	10%	15%	20%
Sep 22	93	38	24	23	10	4	115	53	28	124	53	31	37	16	10
Oct 7	108	48	27	12	5	2	108	45	25	91	38	21	18	9	5
Oct 19	78	35	19	15	6	3	32	14	8	60	28	14	20	11	5
Nov 25	107	47	27	15	7	3	22	9	5	56	24	15	17	8	5

Larger sample sizes were required to estimate parameter averages at the highest accuracy, that is, when the range of the confidence interval was 10% of the average estimate. Smaller sample sizes were necessary for estimating characters measured in later cultivation times, whereas larger sample sizes were required in cultivations performed on September 22 and October 7. Accordingly, a sample size of 28, 25, 8, and 5 plants was used to estimate NF7DAP on September 22, October 7, October 19, and November 25, respectively, in seedlings originating from cuttings with more than five leaves and with a diameter of >20

mm when the range of the confidence interval was 20% of the average estimate. This difference in sample size can be explained by the lower variability in this trait in seedlings cultivated on October 19 and November 25 (Table 2).

Smaller sample sizes were required to evaluate parameters obtained by counting compared to those obtained by measurements. A total of 37, 18, 20, and 17 plants were measured to estimate NLT on September 22, October 7, October 19, and November 25, respectively, in seedlings derived from cuttings with more than five leaves and with a diameter of >20 mm when the range of the confidence interval was 20% of the average estimate. In contrast, 124, 91, 60, and 56 plants were measured to estimate PHT under the same conditions as NLT. Given that there was variability in sample size between characters, seedling origin, and time of planting, sample sizes should be chosen considering these factors and the degree of accuracy set by the researcher. Variability in sample size for estimating morphological characters was also reported by Kleinpaul et al. (2017) in millet crops (*Pennisetum glaucum* (L.) R. Brown) and by Schabarum et al. (2018) in crotalaria (*Crotalaria juncea*).

There was a significant and positive correlation between the CV and sample size. The CV for PHT ranged from 19.29% to 48.00%, and the sample sizes for this trait at these two limits of variation for the confidence interval ranges of 10%, 15%, and 20% were 56, 24, and 15 plants and 361, 163, and 87 plants, respectively. Toebe et al. (2014) found that morphological traits with higher CVs required larger sample sizes to estimate averages. Bandeira et al. (2016) observed that the increase in variability increased the sample size for measuring traits in passion fruit culture (*Passiflora caerulea*).

These results allow researchers to choose the sample size and degree of accuracy according to the financial and technical resources for data collection and the available experimental area. Measurements with higher accuracy produce more reliable estimates but require the analysis of a larger number of plants. Moreover, estimating sample size at different levels of accuracy allows researchers to choose the level that best fits the research conditions. It is known that, in models with low accuracy, the number of sampled plants is decreased, but the reliability of average estimates is also decreased.

4. CONCLUSIONS

Regardless of the range in stem cutting diameter and leaf number when selecting cuttings, 87 plants are enough to estimate average values of morphological characters in cassava when the range of the confidence interval was 20% of the average estimate.

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Self-Perception of Body Image in College Students of a Nutrition Course

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ABSTRACT

Objective: To evaluate the body image of university students in the course of nutrition. **Materials and methods:** A cross-sectional study was carried out with 181 students of both genders from the Nutrition Undergraduate of Maranhão, Brazil. The presence and degree of dissatisfaction with body shape were evaluated by the Body Shape Questionnaire (BSQ 34), another instrument used in this study was Body Figure Silhouettes (BFS). **Results:** The participants presented the mean age of 23.1 (± 5.2) years, the majority of women (89.5%). Most of the subjects were eutrophic (66.9%) according to BMI, and no image perception disorder according to BSQ34. According to the BSF, 56 students had the silhouette represented by figure 4, however, the figure most desired by 111 students was demonstrated by silhouette 3, (p -value 0.000). Demonstrating the desire for weight loss of the majority, despite being represented by a silhouette eutrophic. **Conclusion:** Most (66.9%) eutrophic, according to BMI and without image disturbances (54.7%) according to BSQ 34. However, there is a trend of overweight and obese individuals presenting with image disorders.

Keywords: body image, anthropometry, undergraduate students.

BACKGROUND

Body image (BI) is defined as the "image that the individual has in their mind about the size, structure, shape, and contour of their own body, as well as the feelings about those characteristics and the parts that the body constitute"^{1,2}.

Body dissatisfaction is a disturbance of the attitudinal component and includes the evaluative spheres, characterized by the difference between the current and the considered ideal body; and affective, that is, how much the individual suffers due to this difference ². Body dissatisfaction is multidimensional and may be isolated or jointly related to weight, body shape, and appearance ³.

Studies carried out with college students showed that this group is subject to nutritional or perception disorders ⁴. It is essential to consider that this group of students will be, in their future professional life, responsible in guide people about food, in obtaining results that are expressed in their body and so, they will feel subject to social expectations and exposed to criticism about their weight and their physical form. Thus, they must have a good personal relationship with food and their own body to aim to give effective guidance to the third parties ^{5,6}; but this is not synonymous with a perfect body.

Body image studies attempt to understand which factors play a role in the development and maintenance of body image disorders. In general, women present greater body dissatisfaction than men, as well as a higher prevalence of eating disorders. It is pointed out that body dissatisfaction is associated with depressive symptoms, stress, low self-esteem, greater food restriction, and lack of physical activity, indicating the importance of evaluating this parameter⁷ in the evaluation of the perception of body image in students of the Nutrition course.

METHODS

Cross-sectional research design study with 181 students of the Nutrition Undergraduate Course of the Bacabal School of Education (FEBAC), Maranhão, Brazil. It was adopted a 95% confidence interval.

Inclusion Criteria: The population of this study was intentionally chosen and formed of scholars of the Bachelor of Nutrition Course of FEBAC, duly enrolled and normally attending classes in the academic semester of data collection. This sample included students of both genders, aged 18 years or above, without distinction of ethnicity or social class. Data collection occurred in May 2018.

Data Collection Instruments: The presence and degree of dissatisfaction with body shape were evaluated by the Body Shape Questionnaire (BSQ 34) developed by Cooper et al. (1987) and adapted to Brazil by Cordás and Castilho (1994). This questionnaire presents 34 questions, each with six possible answers, varying from "always" to "never", with scores between 1 and 6. The result is obtained from the sum of the scores assigned to each question, classified into four categories which define the level of concern with body image: (a) normality (less than 70 points) or absence of distortion of body image; (b) slight distortion (between 70 and 90 points); (c) moderate distortion (between 91 and 110 points); and (d) severe distortion (over 110 points)

The Body Figure Silhouettes (BFS) was another instrument used, created by Stunkard in 1983. Such a scale has shown good reproducibility ⁸ and has been used in many studies with adolescents and adults of both genders. This is an instrument commonly used to evaluate distortions in the body image of individuals, allowing to verify the differences between the present and the idealized body, besides the body image at the moment of the application of the study.⁸

For this study, the BFS used contained a scale with nine figures of body silhouettes. The silhouettes were arranged in ascending order, from left to right, numbered from one to nine respectively; the first figure illustrated an extremely thin body (number 1) and the last figure an extremely fat body.⁹

For the acquisition of socio-demographic data of the participants, a questionnaire containing information on age, gender, skin color (self-declared), marital status, student's semester, tobacco use, alcoholic drinks and medication, physical activity practice, among others.

The ethical aspect of this study was approved by the Research Ethics Committee of the University Hospital of the Federal University of Maranhão, under the opinion number 2.509.353. Also, it followed the principles of non-maleficence, beneficence, justice, and autonomy contained in Resolution n. 466/2012 of the National Health Council, assuring the anonymous character of the participants and the freedom of choice in accepting or refusing to participate, or consent in the course of the research.

Data Analysis: The data were tabulated in Microsoft Excel 2013® and the statistical analysis of the results was performed in the statistical program SPSS (Version 22). Data were presented in relative, absolute, and mean frequency and standard deviation. To verify the relationship between disturbance in body perception and categorical variables, the Qui-Quadrado test was applied. To verify the relationship between disturbance in body perception and continuous variables, Analysis of Variance (ANOVA) was applied. To verify the difference between the current and desired silhouette, the Wilcoxon test was applied. The normality test was performed from the Shapiro-Wilk. All associations and comparisons were considered statistically significant when alpha was less than 5%.

RESULTS

A total of 181 students, with a mean age of 23.1 (± 5.2) years and majority women (89.5%). Regarding lifestyle, most reported not smoking (99.4%), not drinking (87.3%), and did not perform any physical activity regularly (70.7%) (Table 1).

Table 1. Sociodemographic and lifestyle characterization of undergraduate nutrition students. Maranhão, Brazil, 2018.

Variables	n	%
age (years)		
18 a 28	161	89,0
29 or more	20	11,0
Md±Dp	23,1±5,2	
Gender		
Male	19	10,5
Female	162	89,5
Year of study		
1° (1° e 2° sem.)	52	28,7
2° (3° e 4° sem.)	43	23,8
3° (5° e 6° sem.)	46	25,4
4° (7° e 8° sem.)	40	22,1
Color		
White	52	28,7
Not White	129	71,3
Marital status		
With mate	22	12,2
Without mate	159	87,8
Smoking		
No	180	99,4
Yes	1	0,6
Alcoholism		
No	158	87,3
Yes	23	12,7
Physical activity		
No	128	70,7
Yes	53	29,3
TOTAL	181	100,0

When applying the Body Shape Questionnaire (BSQ 34), it was verified that more than half of the students did not have an image disorder, followed by slight distortion with 27.1% of students (Table 2). Table 2. Anthropometric characterization and body dissatisfaction (Body Shape Questionnaire - BSQ 34) of undergraduate nutrition students. Maranhão, Brazil, 2018.

Variables	n	%
Disturb		
Absence	99	54,7
Mild	49	27,1
Moderate	21	11,6
Severe	12	6,6
Body mass index		
Malnutrition	13	7,2
Eutrophy	121	66,9
Overweight/obesity	47	26,0
Arm Circumference		
Depletion	44	24,3
Eutrophy	112	61,9
Overweight/obesity	25	13,8
Waist Circumference		
Without risk	154	85,1
High risk	23	12,7
Very high risk	4	2,2
Waist/Hip Ratio		
Without risk	177	97,8
Risk	4	2,2
Waist/Height Ratio		
Without risk	146	80,7 %
Risk	35	19,3%
TOTAL	181	100,0

In the analysis, the current and desired silhouettes (Body Figure Silhouettes -BFS) comparisons 71.2% of the malnourished marked eutrophy as desired; 69.6% of eutrophic patients scored the same option and 85.7% of overweight/obese patients scored eutrophy as desired. Considering that silhouettes 1 and 2 represent malnutrition, 3 to 5 eutrophy, and 6 to 9 overweight/obesity (Table 3).

Table 3. Comparison between body perception of current silhouette and desired silhouette (BFS - Body Figure Silhouettes) of undergraduate nutrition students. Maranhão, Brazil, 2018.

Silhouette	Current		Desired		p-value
	n	%	n	%	
1	20	11,0	5	2,8	<0,001
2	39	21,5	48	26,5	
3	37	20,4	111	61,3	
4	56	30,9	11	6,1	
5	22	12,2	6	3,3	
6	7	3,9			
TOTAL	181	100,0	181	100,0	

According to the BSF, 56 students had the silhouette represented by figure 4, however, the figure most desired by 111 students was demonstrated by silhouette 3, (p-value < 0.001) as shown in Table 3. Demonstrating the desire for weight loss of the majority, despite represented by a eutrophic silhouette.

Table 4 correlates the sociodemographic parameters with the body dissatisfaction. By showing that of the 12 people who had severe body image distortion, according to BSQ 34 questionnaire, all were women and 11 of them were between 18 and 28 years old and 58.3% were in the first year. However, the majority (91.8%) of the participants of this age group presented slight distortion followed by 90.5% with moderate distortion, and, lastly, 86.9% presented no degree of distortion.

Table 4. Relationship between and body dissatisfaction (Body Shape Questionnaire - BSQ 34) and sociodemographic perception of undergraduate nutrition students. Maranhão, Brazil, 2018.

Variables	Absence		Mild		Moderate		Severe		p-value ¥
	n	%	N	%	n	%	n	%	
Age (years)									
18 a 28	86	86,9	45	91,8	19	90,5	11	91,7	0,803
29 or more	13	13,1	4	8,2	2	9,5	1	8,3	
Md±Dp	23,0±5,4		22,9±5,5		24,0±4,4		22,7±5,2		0,837*
Gender									
Male	14	14,1	5	10,2	1	4,8	0	0,0	0,411
Female	85	85,9	44	89,8	20	95,2	12	100,0	
Year of study									
1° (1° e 2° sem.)	24	24,2	19	38,8	2	9,5	7	58,3	0,059
2° (3° e 4° sem.)	24	24,2	11	22,4	5	23,8	3	25,0	
3° (5° e 6° sem.)	24	24,2	12	24,5	9	42,9	1	8,3	
4° (7° e 8° sem.)	27	27,3	7	14,3	5	23,8	1	8,3	
Color									
White	29	29,3	14	28,6	5	23,8	4	33,3	0,943
Not White	70	70,7	35	71,4	16	76,2	8	66,7	
Marital Status									
With mate	7	7,1	8	16,3	4	19,0	3	25,0	0,112
Without mate	92	92,9	41	83,7	17	81,0	9	75,0	
Smoking									
No	98	99,0	49	100,0	21	100,0	12	100,0	0,842
Yes	1	1,0	0	0,0	0	0,0	0	0,0	
Alcoholism									
No	85	85,9	44	89,8	16	76,2	11	91,7	0,456
Yes	14	14,1	5	10,2	5	23,8	1	8,3	
Physical activity									
No	72	72,7	36	73,5	14	66,7	7	58,3	0,899
Yes	27	27,3	13	26,5	7	33,3	5	41,7	
TOTAL	99	100,0	49	100,0	21	100,0	12	100,0	

¥ Square-chi; *ANOVA.

Students who were overweight and obese according to BMI, showed moderate and severe disturbance, 52.4% and 75%, respectively (p-value < 0,001). The majority (73.7%) of the eutrophic did not have an image disorder. Of the 13 that were considered malnourished, 12 of them were absent from disturbance and 1 with mild disturbance (Table 5).

Table 4. Relationship between and body dissatisfaction (Body Shape Questionnaire - BSQ 34) and sociodemographic perception of undergraduate nutrition students. Maranhão, Brazil, 2018.

Variables	Absence		Mild		Moderate		Severe		p-value ¥
	n	%	N	%	n	%	n	%	
Age (years)									
18 a 28	86	86,9	45	91,8	19	90,5	11	91,7	0,803
29 or more	13	13,1	4	8,2	2	9,5	1	8,3	
Md±Dp	23,0±5,4		22,9±5,5		24,0±4,4		22,7±5,2		0,837*
Gender									
Male	14	14,1	5	10,2	1	4,8	0	0,0	0,411
Female	85	85,9	44	89,8	20	95,2	12	100,0	
Year of study									
1° (1° e 2° sem.)	24	24,2	19	38,8	2	9,5	7	58,3	0,059
2° (3° e 4° sem.)	24	24,2	11	22,4	5	23,8	3	25,0	
3° (5° e 6° sem.)	24	24,2	12	24,5	9	42,9	1	8,3	
4° (7° e 8° sem.)	27	27,3	7	14,3	5	23,8	1	8,3	
Color									
White	29	29,3	14	28,6	5	23,8	4	33,3	0,943
Not White	70	70,7	35	71,4	16	76,2	8	66,7	
Marital Status									
With mate	7	7,1	8	16,3	4	19,0	3	25,0	0,112
Without mate	92	92,9	41	83,7	17	81,0	9	75,0	
Smoking									
No	98	99,0	49	100,0	21	100,0	12	100,0	0,842
Yes	1	1,0	0	0,0	0	0,0	0	0,0	
Alcoholism									
No	85	85,9	44	89,8	16	76,2	11	91,7	0,456
Yes	14	14,1	5	10,2	5	23,8	1	8,3	
Physical activity									
No	72	72,7	36	73,5	14	66,7	7	58,3	0,899
Yes	27	27,3	13	26,5	7	33,3	5	41,7	
TOTAL	99	100,0	49	100,0	21	100,0	12	100,0	

¥ Square-chi; *ANOVA.

The medians found in Table 6 show that most individuals do not have image disorders, regardless of their BMI, but the higher the BMI was, the greater was the incidence of disturbances. This information is significantly relevant (p-value 0.001).

Table 6. Association between body dissatisfaction and anthropometry of undergraduate nutrition students. Maranhão, Brazil, 2018.

Variables	Absence	Mild	Moderate	Severe	p-value
	Mean (Min-Max)	Mean (Mín-Máx)	Mean (Mín-Máx)	Mean (Mín-Máx)	
BMI ¹	22 (15-32)	23 (17-30)	25 (21-33)	26,5 (20-32)	<0,001
AC ²	70 (52-98)	74 (60-90)	74 (66-92)	80 (61-82)	<0,001
WC ³	93 (77-119)	97 (80-110)	98 (91-118)	105,5 (91-117)	0,003
WHR ⁴	0,75 (0,61-0,9)	0,76 (0,67-0,98)	0,77 (0,7-0,84)	0,75 (0,67-0,8)	0,054
WHeightR ⁵	0,44±0,04	0,46±0,04	0,46±0,05	0,48±0,05	0,001*

¹ Body mass index; ²Arm circumference; ³Waist circumference; ⁴Waist/Hip ratio; ⁵Waist/height ratio.

*ANOVA.

DISCUSSION

This study has evaluated the body image perception in Nutrition students since these are part of a group of people inserted in a context in which there is social pressure to maintain healthy lifestyle habits and body appearance within the standards required by society. Thus, students in this area can be considered a risk group for the development of eating disorders.

A predominance of women was found in the research, corroborating with the data collected in the study conducted at the Federal University of Rio Grande in 2017, with 111 students from the Physical Education, Nursing, Medicine and Psychology courses, of which 62% were women. In 2007, 335 students participated in a study, with nutrition students from public and private universities in São Paulo in Brazil, with most of them being women (93.7%), mean age 23.5 years (SD = 4.9), white color (65.1%), single (86.6%). Similar data was found in the current research, with the participants differing only in color, where the majority (71.3%) was of self-declared other ethnicities.

Data from the Census of Higher Education in Brazil (2017), showed that the nutrition course is among the five most sought after courses by the female population, thus corroborating the findings presented here. In this study, tobacco rates were low, corroborating data from Palheta et al., (2015) and Brazil, where, from 2006 to 2014, smoking fell by 30.7%⁹. This drop in the rate of tobacco use is linked to the actions developed by the country's National Tobacco Control Politics (National Tobacco Control Policy of Brazil). This pattern is confirmed in this research and collaborates to promote the population's health.

Regarding lifestyle data, 70.7% (128/181) did not perform any type of physical activity, in contrast to what the philosophy of nutrition science propagates in relations to physical inactivity. It is important for the lifestyle to be in accordance with what is taught by the professional. A study conducted by Souza et al. (2015) had the objective of verifying the level of physical activity and stages of behavior change in university students in the health area¹⁰. The sample consisted of 416 individuals, from Physical Education (n = 67), Nursing (n = 87), Pharmacy (n = 79), Physical Therapy (99) and Nutrition (n = 84). The results

found in the study indicated that almost 30% of health academics were considered physically inactive or insufficiently active, 6% in Physical Education, 34.5% in Nursing, 35.5% in Pharmacy, 28,3% in Physical Therapy, and 40.5% in Nutrition.

A physically inactive lifestyle is related to the substantial increase in the development of chronic degenerative diseases like heart disease, hypertension, diabetes, obesity, and some types of cancers. It is estimated that around 31% of the global population is insufficiently active. In Brazil, data collected in the capitals showed that 49.4% of adults are insufficiently active and 16.2% are considered physically inactive^{9,11,12}. The encouragement of physical exercise and healthy eating should be applied in university students, as well as the promotion of strategies for proper body perception¹³.

The BSQ 34 questionnaire revealed that more than half of the students did not have an image disorder, followed by 27.1% with mild disturbance, 11.6% with moderate, and 6.6% with severe image disorder. Of the physical education students evaluated in Souza (2012), 81.5% of the students had no body image distortion, 12% presented slight distortion, and 6% presented moderate distortion.¹⁰ Lopes, et al., (2017) observed nutrition students and noticed that, in total, 81.5% of the students did not a present distortion of body image, 12% presented slight distortion, and 6,5% presented moderate distortion.

In a study on body perception, conducted at the School of Physical Education of the Federal University of Pelotas in Brazil, 65% of men and 20% of women said they would like to change their silhouette, for a more defined one. Nutrition scholars are in constant contact with knowledge about food and nutrition and are supposed to have acquired information that directs their practices towards attaining health, well-being, and quality of life. Therefore, it is suggested that students of nutrition are in an environment that favors the preoccupation with the body image, generating, in some cases, distortions and dissatisfactions with self-image.¹³

The results available here have higher proportions than other gender studies, as examples above, and cause concern regarding the physical and mental health of these students. It is known that the perception of the "ideal" body image is developed over time and is subject to several elements that involve the family, cultural, historical, biological, social, and individual context. In this context, it is necessary to identify and explore these influences to assist in the formation of corporate images, thus showing self-esteem and seeking to reduce the development of eating disorders caused by body image dissatisfaction.¹⁴

In regard to the body mass index, 66.9% presented themselves as eutrophic, followed by overweight in 26% (47/181) and obesity in 7,1%. Regarding the relationship between disorder, evaluated by the BSQ 34 questionnaire and results from anthropometry, some showed a significant positive correlation. The indexes: BMI, AC and WC presented per value <0.05 (p-value <0.001, <0.001 and 0.003, respectively). This is translated by stating that most individuals do not have a disorder, but the closer they are to the risk indexes, the higher the rates of the presence of some degree of image perception disorder. Thus, it is shown that these students want to be thinner than they really are, despite the average BMI is within the normal range.

In Pelotas, similar data were found. Evaluating nutrition students, thirty-two students were newcomers and 33 trainees. Moreira et al. (2017) also found profiles of similar nutrition students when the parameter used is BMI, finding 65.6% of eutrophics, followed by 19.8% of overweight.¹⁵ As in the study

by Laus et al., (2009) the significant positivity found in the correlation analysis between the two instruments and between them and the BMI demonstrates that both act in the detection of the studied constructo.¹⁴

The data presented here show that, despite being eutrophic, students aim for a lower IMC than the real one, corroborating with the study by Bosi et al¹⁶, in which students of the Nutrition course in the state of Rio de Janeiro who had a reported average BMI of 20.8 kg / m² (according to the weight and height reported by the students) wished to have an IMC equal to 20.1 kg / m². This could be attributed to societal pressure and shows that the ideal body image among university students reflects the same slim and muscled patterns (for females and males, respectively) currently praised in sociocultural contexts, where fat or higher body weight are seen as a stigma of ugliness, causing individuals with a higher BMI to feel uncomfortable and concerned with their body image.

The cross-sectional design stands out as a limitation of this study, which does not allow observing the cause-effect relationship, as well as generalizing the results obtained here. However, even with this limitation, the study is relevant, since it aims to contribute to the identification of possible body image disorders in a sample of the population that is responsible for taking care of the individuals' nutritional health and dietetics. Body dissatisfaction is a precursor for negative self-perception or self-worth and can lead to the development of eating disorders.

CONCLUSION

This study verified that eutrophy prevailed in the study population, with no disturbance of image perception, according to BSQ 34 questionnaire and with body image dissatisfaction in both genders, according to BSF. However, it can be seen whether a tendency of overweight and obese individuals to present a body image disorder. It is essential to consider that future nutritionists will be, in their professional life, guiding about food to obtain results that are expressed in the body and, in this way, they will feel subject to social expectations and exposed to criticism about their weight and their physical form. They must have a good personal relationship with food and the body to achieve effective guidance in professional practice.

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Public Research Institutions and Their Connections with Patents of Companies in Technological and Regional Development

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Abstract

The interaction between companies and universities is a central theme in discussions on technology transfer. In Brazil, there is an urgent need to raise awareness of the importance of this cooperative relationship for local and regional development. In this sense, it is observed that the innovation process is strategic so that an institution is strengthened and can fulfill its social mission in economic and regional development. Piauí, according to the IBGE census, has a population estimate of 3,273,227 in 2019. Piauí's per capita income is R\$ 817.00 and ranks 24th in Brazil in this regard. With these data, the need arises to intervene scientifically in this reality. The objective of this study is to investigate the partnership relationships between companies and public research institutions in Piauí, in the development and transfer of technologies. Research Institutions are the main promoters of technological development in the state, however, for these technologies to reach productive arrangements, strategic alignment in the management of these technologies is necessary. Documentary research was used, with a quantitative approach. In the exploratory search, INPI's databases (National Institute of Industrial Property) and of Espacenet (European Patent Office) was used. We sought to select the companies with relevant economic representativeness in the state scenario and investigated the patent information. In the analysis of the data obtained, the Competitiveness Ranking of the CLP States (Public Leadership) was used to compare Piauí with well positioned states. According to the results found, it is observed that the transfer of technology between research institutions and companies is not evident. However, we can see that there are partnership initiatives with small companies in conducting research that can project a change in this scenario. The low number of patents and public/private partnerships in driving innovation in the state of Piauí, may be related to the low index evidenced by the Competitiveness Ranking of States - CLP.

Keywords: Patents; Regional development; Public Research Institutions; Companies; Innovation;

1. Introduction

The interaction between companies and universities is incipient in the Brazilian's scenario, and there is an

urgent need to raise awareness of the importance of this cooperative relationship for local and regional development (MÜLLER; STRAUHS, 2019). In this sense, it is observed that the innovation process is strategic for an institution to be strengthened. Segatto-Mendes and Sbragia (2002) state that there are advantages for universities, government and business, with especially regard to universities, to the extent that new products or techniques are created or improved, public institutions should pay attention to methods of raising funds from with these technology. Thereby, the institutions can invest resources internally in new discoveries and in financing new research.

Conversely, the more companies innovating in a state, the better their economic indicators and the better their processes, services, jobs and products offered to society. This statement is based on the development of some regions of the United States of America such as: Silicon Valley and Route 128, in which, it is mainly due to the cooperation between university and technological companies (VARGA, 1997). In this study, the state of Piauí, in Brazil, is investigated, as it is a state with low levels of development, it needs new perspectives.

Piauí, according to the IBGE census, has a population estimate of 3,273,227 in 2019. Piauí's per capita income is R \$ 817.00 and ranks 24th in Brazil in this regard. The proportion of people aged 16 and over in formal work is 31.4%, which makes Piauí the 26th state in this ranking. In this sense, the processes of strengthening companies, through new technological methods and processes, can make Piauí a state with greater competition power and boost the state's economy. Furthermore, strengthening research and transferring it to institutions is crucial.

Varga (1997) mentions that economic development is determined by technological innovation resulting from investments in Industrial Research and Development (R&D) planned and motivated by the market. Varga attributes local development to the relationship with knowledge produced in technological centers. These institutions can transfer technology to other institutions as long as those technologies are protected. In this sense, one must observe the question of the valuation of these technologies, in order to obtain quantitatively the monetary value of something specific and, thus, to be able to potentiate the development of the institution and the region in which it is inserted.

The aim of this study is investigate relations of partnerships between companies and research public institutions of Piauí (state of Brazil), in the development and transfer of technology. Research Institutions are the main promoters of technological development in the state, however, for these technologies to reach productive arrangements, a strategic alignment in the management of the portfolio of these technologies is necessary. If the technology does not have a market potential, it is likely that this patent will become a high-cost liability.

On the other side, it is noted that when there is partnerships between companies and public institutions, patents derived from theses researchs have greater chances of achieving the company as a product , as outlined per Cario, Da Cunha Lemos and Simonini (2011). If the technology does not have a market bias, the technology transfer between the interested parties may not occur. Winter, et al (2019) reports the need for mechanisms for managing the technological portfolio by the Public Research Centers. In this sense, with evidence of a low level of technology transfer, it is possible to progress in further studies to diagnose possible reasons and, thus, seek methods to assist n the process.

Piauí occupies the last positions in the national rankings of competitiveness and economics (CEPRO, 2016;

CENTRO DE LIDERANÇA PÚBLICA-CLP, 2019), with this, it seeks relationships between companies and institutions that promote new technologies, with the purpose of obtaining data that prove or disprove that this position in the ranking have relation with these connections. With Law No. 10,973 of 2004, which regulates the incentive to innovation (BRASIL, 2004), Universities would, in theory, facilitate to innovate and transfer these technologies to productive arrangements. It is theorized that if this were to happen, Piauí's degree of competitiveness would be leveraged, or if the management of these technologies was better articulated, we could obtain better results. The local government must promote ways to spread the technologies, whether with incubators, licenses and joint development (WINTER, et al., 2019).

2. Theoretical foundation

The innovation law, Law No. 10,973 of 2004, made it possible to regulate ICT (Scientific and Technological Institutions) and the creation of Technological Innovation Centers (NIT) in order to reduce the distance between research institutes, companies and universities (Kruglianskas & Matias -Pereira, 2005; Law No. 10,973, 2004). Livesey (2014), evidenced, in a survey of 33 NITs (Technological Innovation Centers) from different regions, that technology transfer is not a strategy commonly used in universities, in addition to showing that project financing is not adequate for development of the same.

In academic environments, the stimulation of innovation and creation of patents for inventions has been a way of stimulating public policies to raise awareness of this type of situation (HAASE; ARAÚJO; DIAS, 2005). As a result, stimulating the production and dissemination of these materials becomes an essential point in academic environments, including the entrepreneurial view of the market. This can be attractive to students, as it brings them closer to the job market.

Technology transfer is an essential topic to be discussed in research and innovation environments. Blakeney (1989), reports that technology transfer is the process of commercial distribution of a technology. In this sense, it is considered that the transfer of technology should be a way that research institutes have to boost their research and obtain returns for both society and researchers. It is worth mentioning that, with the partnerships mentioned in the study, the researcher can obtain gains on the commercial exploitation of his research, together with the institution (SOARES, 2018).

When it comes to regional development, the Piauí, in 2016, occupied the 21st position in the ranking of the largest economies of Brazil, with only 0.7% share in the wealth of the country (CEPRO, 2016). These economic results reflect the technological production and development of the state, which in 2018, occupied the 21st position in the competitiveness ranking, with a score of 37.9 out of a maximum score of 100 points, according to the Organization Competitiveness Ranking of States - CLP (2018). In 2019, according to data from the same ranking, Piauí ranks 23rd among the 27 Brazilian states (including the Federal District), with 35 points (Figure 1).

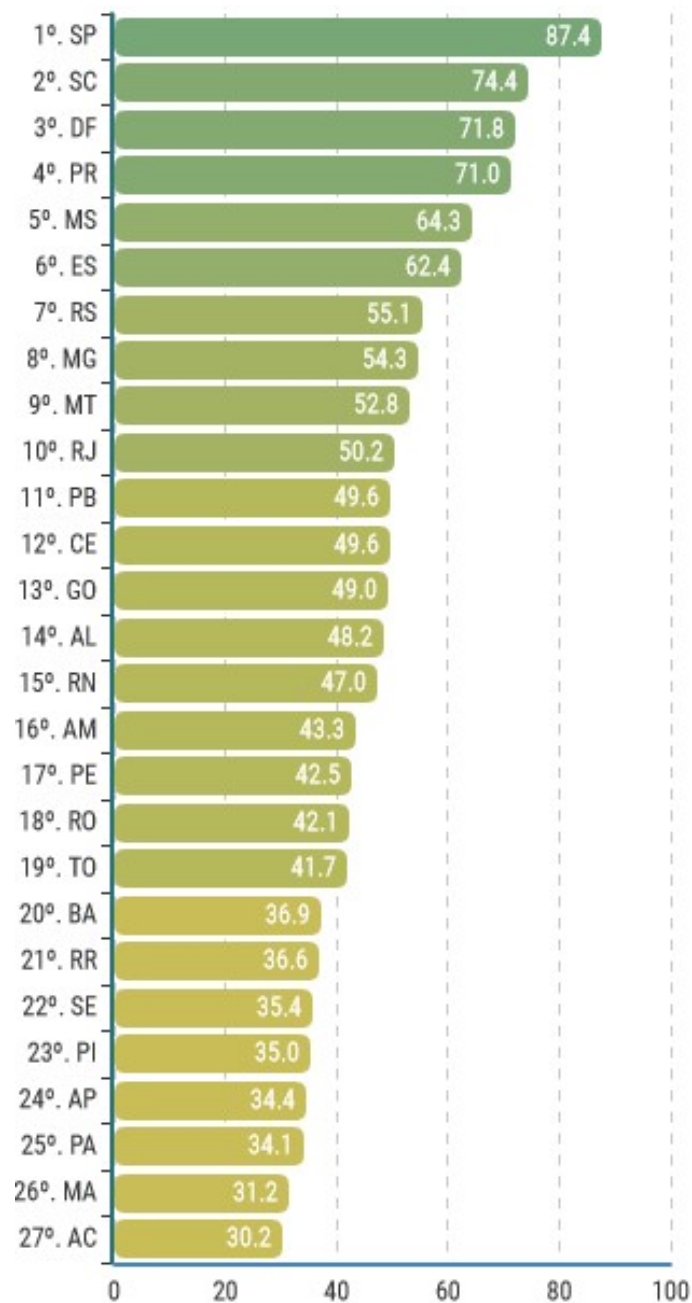


Figure 1. CLP General ranking – States. Source: Competitiveness Ranking of States - CLP (2019). This ranking is consisting of 10 pillars. Figure 2 shows the pillars and the relationship between Piauí and the Brazil average.

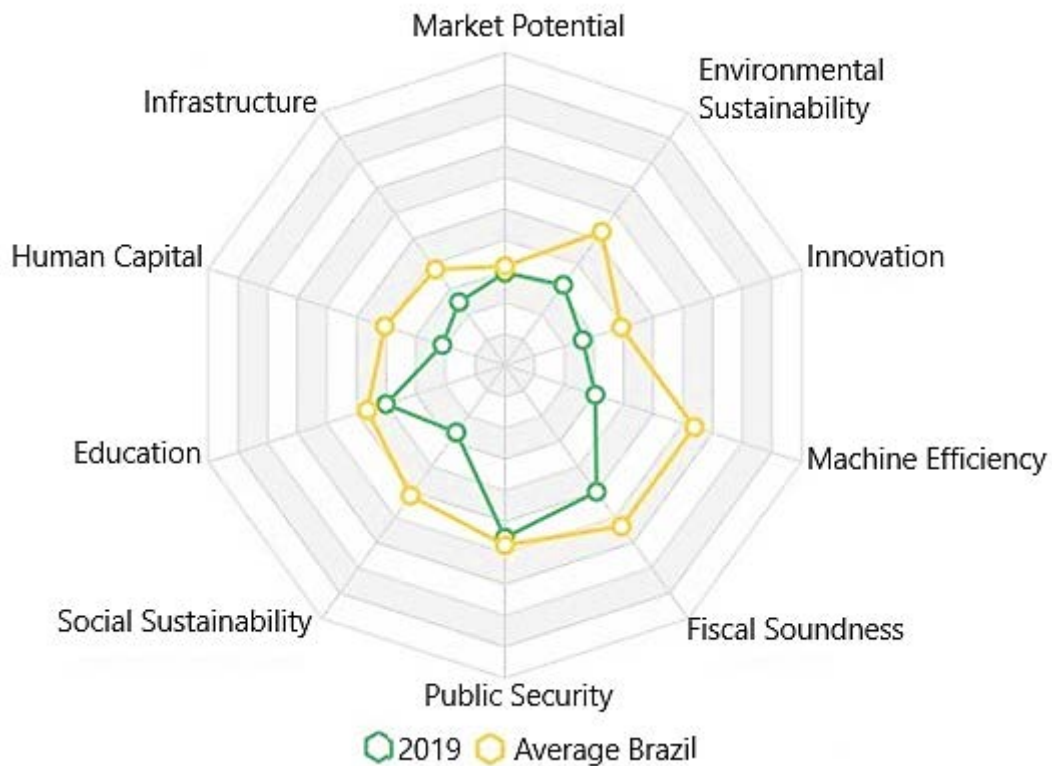


Figure 2. Pillars of Piauí in the Ranking of States and Average Brazil – CLP. Source: Competitiveness Ranking of States - CLP (2019).

Despite the fall, the state shows a stagnation, as shown in figure 3. Piauí's score does not show a big difference in the range from 2016 to 2019.



Figure 3. Piauí in the Ranking of the States from 2016 to 2019 and the overall average of Brazil. Source: Competitiveness Ranking of States - CLP (2019).

The data reinforce the need for efforts to improve the reality of the state. The ranking explores 10 pillars, which are composed of indicators. With a focus on the Innovation pillar, Piauí occupies the 17th position in 2019. The Innovation pillar explores four indicators, which are: Master's and doctorate scholarships, Innovative Enterprises, Investments in R&D and Patents. It is worth mentioning that in 2019, Piauí occupies the 7th position in R&D investments, as shown in table 1.

Table 1. Indicators of the Innovation pillar of the Ranking of States - CLP

Indicator	2019 (value and position)		2018 (value and position)	
1. Master's and Doctorate Scholarship	25.5	22nd	0 ¹	0 ¹
2. Innovative Enterprises	60.6	10th	0 ¹	0 ¹
3. Investments in R&D	21.4	7th	12.0	15th
4. Patents	0.0	22nd	7.7	15th

Source: Ranking of States – CLP (2019). ¹ Value 0 indicates either a low score for the indicator, or the lack of data.

3. Methodology

In the methodological procedures of this work, we have used the documentary research in the data collection, with a quantitative approach. In the exploratory search, INPI's databases (National Institute of Industrial Property) and the Espacenet (European Patent Office) were used for relationship the patents of companies and research institutes the state of Piauí. We sought to select the companies with relevant economic representativeness in the state scenario listed on the Econodata platform (econodata.com.br) and on news sites (180graus.com, oitomeia.com.br). In short, the companies are in the pharmaceutical and industrial sector (production of bicycles, material for the gym, mattresses, steel, security and distributors). After this selection, used the company name and the National Register of Legal Entities - CNPJ to perform consultations.

In possession of the data, information on depositors, ownership and co-ownership of companies' patents was investigated and, then, the search for names of institutions and inventors. The inventors' links with universities or research institutions were investigated on the federal government's transparency portal.

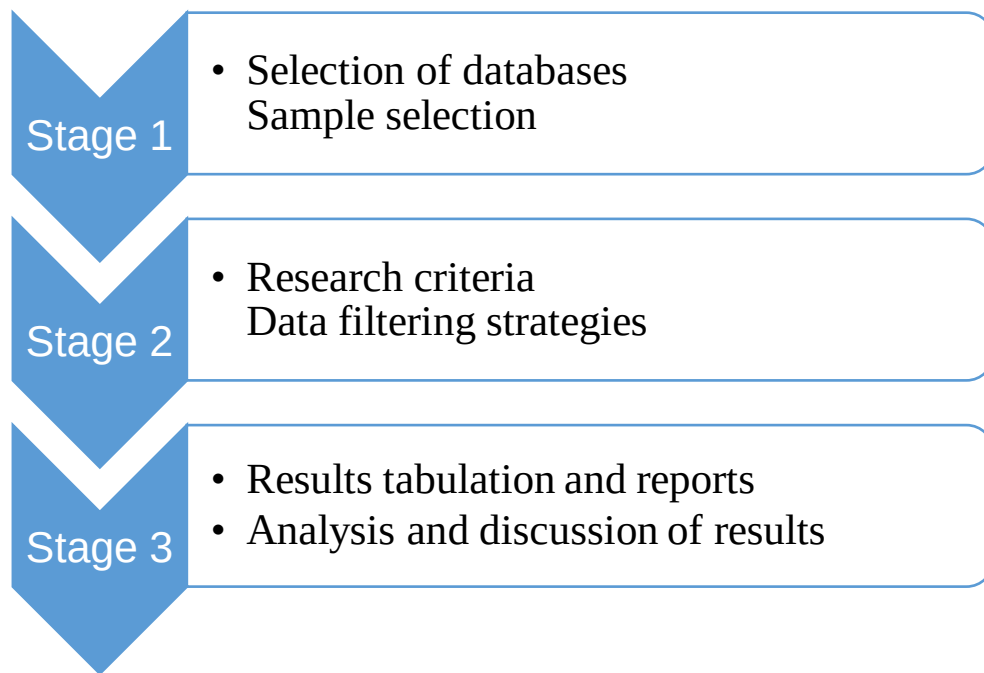


Figure 4. Methodological design. Source: Prepared by the authors (2020).

Searching for the name of the depositor, in some cases, did not return reliable results. This is because the company name is not listed in patent documents in many cases. With this, the CNPJ was a viable option to return more reliable and specific results for companies in Piauí. The CNPJ name was collected by consulting the companies' websites and confirmed by consulting the website: www.cnpj.info.

A sample of 8 (eight) companies from Piauí was selected, they are: Houston Bike, Só Aço Industrial, Laboratório Sobral, Jorge Batista & Cia LTDA, Socimol Industria de Colchões, Onix S/A Industria de Colchões e Espuma, PVP Sociedade Anônima e Servi-san Vigilância e Transporte de Valores. The table below shows the companies and their CNPJ. After surveying the technologies, the name and data of the inventors were sought in the transparency portals to ascertain links with the federal government and state government.

Table 2. Companies surveyed and their CNPJ

COMPANY NAME	CNPJ
BIKE DO NORDESTE S/A HOUSTON BIKE	02.220.262 / 0002-78
SO ACO INDUSTRIAL LTDA	04.041.754 / 0001-40
LABORATORIO INDUSTRIAL FARMACEUTICO SOBRAL	06.597.801 / 0001-62
JORGE BATISTA & CIA LTDA	07.222.185 / 0001-28
SOCIMOL INDUSTRIA DE COLCHOES E MOVEIS LTDA	06.751.564 / 0001-42
ONIX S/A INDUSTRIA DE COLCHOES E ESPUMA	03.604.761 / 0001-40
PVP SOCIEDADE ANÔNIMA	06.700.769 / 0001-07
SERVI-SAN VIGILÂNCIA E TRANSPORTE DE VALORES	06.855.175 / 0001-67

Source: Prepared by the authors with research data (2020).

As a reverse path, we conducted searches in the Espacenet databases, in INPI, respectively, in patents and in the consultation section on technology transfer. INPI the search been performed entering the ID number and the names of the research institutions of Piauí as input, in order to investigate the existence of technology transfer with universities/institutions in the role of depositors. More specifically, State University of Piauí (UESPI), Federal Institute of Piauí (IFPI) and Federal University of Piauí (UFPI). For a better detail, we sought patents registered by the institutions in the selected databases.

The Microsoft Excel application was used to tabulate the data and generate the tables for analysis. For better understanding, in the analysis of the data obtained, the Competitiveness Ranking of the CLP States (Public Leadership) was used to compare Piauí with states well positioned in the Innovation pillar, since the pillar has indicators of interest for research. Piauí was compared with São Paulo, 1st place in the general ranking, and Paraíba, 1st place in the Northeast, region of Brazil, in the Innovation pillar and in the general ranking (all pillars) it was in 11th.

3. Results and analysis

In searches for companies in the state of Piauí, we found 4 companies that have patents and/or patent applications registered with the INPI. They are: SOCIMOL INDUSTRIA DE COLCHOES E MOVEIS LTDA, ONIX S/A INDUSTRIA DE COLCHOES E ESPUMA, PVP SOCIEDADE ANÔNIMA E SERVI-SAN VIGILÂNCIA E TRANSPORTE DE VALORES. The other companies surveyed did not have patents and/or orders registered in the INPI/ESPACENET databases. According to table 3.

Table 3. Companies and Patents

COMPANY NAME				NUMBER OF PATENTS
BIKE DO NORDESTE S/A	HOUSTON BIKE			0
SO ACO INDUSTRIAL LTDA				0
LABORATORIO INDUSTRIAL	FARMACEUTICO SOBRAL			0
JORGE BATISTA & CIA LTDA				0
SOCIMOL INDUSTRIA DE	COLCHOES E MOVEIS LTDA			2
ONIX S/A INDUSTRIA DE	COLCHOES E ESPUMA			1
PVP SOCIEDADE ANÔNIMA				3
SERVI-SAN VIGILÂNCIA E	TRANSPORTE DE VALORES			51

Source: Prepared by the authors with research data (2020).

The company SOCIMOL INDUSTRIA DE COLCHOES E MOVEIS LTDA holds a patent with a rejected application and an extinct patent. According to table 4.

Table 4. Patents of Socimol LTDA

Request number	Deposit Date	Title	IPC classification	Situation
PI 0705793-8	07/27/2007	BED SET	A47C 17/32	UNDEFERRED
MU 7600396-5	02/15/1996	MATTRESS EXHIBITOR	A47F 7/30	EXTINCT

Source: Prepared by the authors with research data (2020).

The invention with application number PI 0705793-8, presents the description in the IPC classification: Couch; Beds/ Transformation of a single bed into a double bed by extension, rotation or inclination of a second mattress or other previously hidden piece. This patent application was published on 06/01/2009 and its rejection on 12/14/2010 for not having the inventive concept, as exposed in the process.

The second invention, number MU 7600396-5, has the description in the IPC classification: Showcases, suspension systems or shelves, adapted to certain articles or materials/for furniture, p. ex. beds, mattresses. This patent was granted on 09/30/2003, with the title “mattress exhibitor”. The patent's extinction was published on 12/20/2011. The inventors have no connection with Public Research Institutions, according to the consultation made on the Transparency Portal.

The company Onix S/A Industria De Colchões e Espuma has a patent with application published on 08/15/2006, as described below (table 5).

Table 5. Patents of Onix S / A

Order No.	Deposit Date	Title	IPC	Situation
PI 0600662-0	02/17/2006	FORMULATION OF FLEXIBLE FOAMS MADE IN FREE EXPANSION FOR DISCONTINUOUS PROCESSES FOR CASH AND / OR CONTINUOUS PROCESS WITHOUT USE OF TDI (TOLUENE DIISOCIANATE)	C08G 08/18	FILED ORDER

Source: Prepared by the authors with research data (2020).

The invention features the description in the IPC classification: Polymeric isocyanate or isothiocyanate processes/products. The title of the invention is: “formulation of flexible foams made in free expansion for batch processes and/or continuous process without using tdi (toluene diisocyanate)”. Inventor has no connection with Public Research Institutions and the order was filed for non-payment of annual fees.

The company PVP limited company has three (3) patent are deposited, according to the table 6.

Table 6. Patents of PVP S / A

Request number	Deposit Date	Title	IPC classification	Situation
PI 9503286-0	7/12/1995	PROCESS FOR THE RECOVERY OR REUSE OF BLINDING CLAYS, ACTIVE OR ACTIVATED, INDUSTRIALLY APPLIED FOR PURIFICATION AND / OR PURIFICATION OF ORGANIC FAT, WAX, OR RESIN, NATURAL OR SYNTHETIC MATERIALS	B03B 7/00	UNDEFERRED
PI 9303355-9	08/11/1993	IMPROVEMENT IN PROCESS FOR OBTAINING COSMETIC COMPOSITIONS, INTENDED FOR CARE, CONSERVATION AND REGENERATION OF THE HAIR AND THEIR COMPOSITIONS	A61K 7/06	EXTINCT
PI 9202165-4	06/05/1992	CARNAÚBA CRAB MANUFACTURING PROCESS	C11B 11/00	EXTINCT

Source: Prepared by the authors with research data (2020).

The invention with application code PI 9503286-0, presents the description in the IPC classification: Combinations of processes or devices that work wet with other processes or devices, e.g. ex. for preparing ores or waste. The deposit patent was published on 10/07/1997, in 31/12/2002 and was rejected.

The second invention, number PI 9303355-9, presents the description in the IPC classification: Preparations for medical, dental or hygienic purposes. This patent was granted on 10/19/1999. The patent was extinguished on 08/11/2013.

The third invention, number PI 9202165-4, has the description in the IPC classification: Recovery or refining of other fatty substances, p. ex. lanolin, waxes. This patent was granted on 12/26/2000. The patent's extinction was published on 02/09/2014. The company PVP SOCIEDADE ANÔNIMA holds 3 (three) licensed patents and all of them filed with the same inventor described in the documents. The inventor has no connection with the research institutions studied.

The company SERVI-SAN VIGILÂNCIA E TRANSPORTE DE VALORES was the one that filed the most patents based on the data survey conducted in this research. 51 patents were found in the CNPJ consultation, all with the same inventor. The deposits started in 1998 and extend until 2004. The inventions are varied, but linked to the engineering area. Most of the patents consulted were inactive. In Table 7, some of the patents.

Table 7. Servi-San patents

Request	Deposit	Title	IPC
PI 0404115-1	09/23/2004	AUXILIARY SYSTEM FOR LAUNCHING AIR AND SPACE VEHICLES BY PUSHING FORCE	B64G 5/00
MU 8303170-7	12/15/2003	CONSTRUCTIVE ARRANGEMENT IN THERMAL ENERGY REGENERATOR IN TRANSFORMERS AND POWER SOURCES FOR MICROWAVE WATER HEATERS	H05B 6/72
PI 0303872-6	09/23/2003	PUSHING ROTARY ENGINE	F03B 2/17
PI 0303845-9	9/17/2003	MECHANICAL ENERGY GENERATION SYSTEM BY PUSH	F03G 7/00

Source: Prepared by the authors with research data (2020).

In the patent search of public institutions in Piauí, 87 registered patents were found. With the exception of the State University of Piauí (UESPI), both the Federal Institute of Piauí (IFPI) and the Federal University of Piauí (UFPI) have patents. The Federal Institute of Piauí has 11 patents with only the name of the institution as depositor, and the Federal University of Piauí has 64 only with the name of the institution as depositor.

IFPI has 1 patent in partnership with UFPI deposited. UFPI has another 22 patents deposited in partnership with other institutions. From these partnerships, we highlight the following entities as they appear in the records: PHYTOBIOS PESQUISAS DESENVOLVIMENTO E INOVACAO LTDA, FITO FIT SUPLEMENTOS E PRODUTOS NATURAIS, MARCOR MÁXIMO ATENDIMENTO E

RECUPERAÇÃO CORPORAL LTDA ME e ITAOESTE SERVIÇOS E PARTICIPAÇÕES LTDA. The names of these companies are listed with connections the Public Research Institutions in Piauí in the filing of these patents. Among the inventors are teachers, civil servants and members of companies. There were no records of technology transfer of patents from these companies to other entities.

In terms of technology transfer, no results were found for the institutions surveyed. In other words, no technology transfer records were found with UFPI, IFPI or UESPI in the role of assignor.

3.1 Results analysis

According to the results found, it is observed that the transfer of technology between research institutions and companies is null or was not evident in the methodology applied in this study. However, we can see that there are partnership initiatives with small companies in conducting research that may project a change in this scenario. In this research it was not possible to assess how the relationships were established and whether there is any economic exploitation of these patents. It was identified that the relationships exist, with small companies, and that no transfer records were found by the research institutions. It is observed that no relationship was found between patents of large companies and the institutions surveyed.

The low number of patents and public/private partnerships in driving innovation in the state may be related to the low index evidenced by the Competitiveness Ranking of the States - CLP with regard to Piauí. This argument is reinforced by the lack of technology transfer between the parties studied.

Table 8 compares Piauí with São Paulo, the first in the general ranking, and Table 9, with Paraíba, 11th in the general ranking, however, the state best positioned in Northeast. The pillar shown in the tables is the Innovation pillar. With the analysis of Tables 8 and 9, that Piauí has a good position in the indicators Investment on R&D and Innovative Enterprises, which, it is considered, a positive factor for regional development. In the category of New Enterprises, Piauí is better placed. However, in terms of Master and Doctorate Scholarships, Piauí is poorly placed in the ranking. In terms of patents, Piauí and Paraíba have close numbers, while São Paulo occupies the fourth position.

Table 8. Comparison of results between Piauí and São Paulo in the Ranking of Competitiveness of States - CLP

INDICATOR	PIAÚÍ			SÃO PAULO		
	Current Position	2019	2018	Current position	2019	2018
1. MASTER AND DOCTORATE SCHOLARSHIP	22 nd	25.5	-	6 th	67.9	-
2. INNOVATIVE VENTURES	10 th	60.6	-	18 th	35.4	-
3. INVESTMENTS IN R&D	7 th	21.4	12.0	1 st	100.0	100.0
4. PATENTS	22 nd	0.0	7.7	4 th	68.9	74.1

Source: Competitiveness Ranking of States - CLP (2019).

Table 9. Comparison of results between Piauí and São Paulo in the Competitiveness Ranking of States -

INDICATOR	CLP					
	PIAUÍ			PARAÍBA		
	Current Position	2019	2018	Current position	2019	2018
1. MASTER AND DOCTORATE SCHOLARSHIP	22nd	25.5	-	1st	100.0	-
2. INNOVATIVE VENTURES	10th	60.6	-	23rd	21.3	-
3. INVESTMENTS IN R&D	7th	21.4	12.0	3rd	35.7	36.4
4. PATENTS	22nd	0.0	7.7	18th	3.6	5.1

Source: Competitiveness Ranking of States - CLP (2019).

4. Final considerations

It was observed a lack in the production of innovations and registration of these technologies in the form of a patent in companies in Piauí. Through the study, one cannot conclude the reason, but it is observed that patents in large companies in Piauí are scarce in some cases, and abundant in others, however, the patents were filed some years ago. Some of the companies are the same group and, probably, have an innovation policy that promoted, at least in a given time, innovation.

The low rates of patent applications and patent licensing in Piauí evidence the low economic rates of the state at the national level. Is likely and can be verified in indices related that investment in intellectual property can leverage innovation and economic indices of the Piauí state industry.

There is a low rate of requests for protection of intellectual property in the largest companies in the state. Despite being a limited sample, it can be observed that companies do not deposit, frequently, new inventions and innovations in the processes they perform routinely.

The link between small and medium-sized companies in Piauí and the inventors of public institutions was evident. It is concluded that it is necessary to invest in research and development, and in the provision of master's and doctoral scholarships to enhance the results of the state. Although the sample observed is limited and the number of large companies in Piauí is reduced, it is clear that these companies do not have a notable innovation link with the Public Research Institutions, a link that could generate dividends for public coffers and economic improvement for the state. A more adequate position of patent management, a more active public/private partnership policy, as well as methods for evaluating and valuing technologies can be an option to assist the processes of development, transfer and commercialization of technologies.

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Distance Education: Effects of individual factors on the perceived image of high education institutions

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Abstract

Current changes in the socioeconomic variables in which both public and private universities interact require them to manage their image to attract and satisfy their students. Added to this, new technologies are affecting education, increasing the supply and relevance of distance learning in the university structure. Given that, this research aimed to understand which individual factors cause significant differences in perceived university image. This study is a descriptive field research. We collected the data with a survey and analysed the results using factor analyses, t-tests, and linear regression. We found that gender, age, income, and length of interaction between the students and the organization do not influence the overall image. However, the exact sciences students presented a different perception of the researched institutions. Given the results, we concluded that perceived image can be seen as a momentary picture. The study indicates the image as a multidimensional construct. This construct is most expressively associated with intangible aspects.

Keywords: Organizational Image; Distance Education; Public University; Marketing.

1. Introduction

Currently, higher education institutions (HEI) are taking an increasingly important role in social and economic development (Doña-Toledo, Luque-Martinez, & Del Barrio-García, 2017), being decisive

for the proper positioning of a country in the global economy (Jalaliyoon & Taherdoost, 2012). In global terms, with new technological adventures, higher education has been changing (OECD, 2016). The internet has made it possible increasing supply of distance course (Uppal, Ali & Gulliver, 2017) being a key part of a new university structure (Sneideriene, 2013).

According to Wu (2016), this fact indicates that enrolees students in distance education courses will growth in the future. In Brazil, this movement is confirmed by Anísio Teixeira National Institute of Studies and Educational Research - INEP (2018). The INEP showed that these courses increased by approximately 226% students' enrollees in undergraduate distance courses between 2007 and 2017. It represents an share increasement in the total number of enrolled from 15.4% to 33.3%, considering the classroom and distance courses (INEP, 2018).

In view of this growth, Sneideriene (2013) considers image as important element to manager these courses, helping to highlight positively the institution in relation to other organizations, attracting more students for them. In this manner, the identification of all elements that impact on HEI image is essential (Luque-Martínez, Del Barrio-Garcia, Ibañez-Zapata, & Molina, 2007). The authors indicate that these institutions need to become aware of the own current public image, to project a desired image, and to take actions to establish the market.

Considering these reflections and being the image a phenomenon that involves a perception, this fact allows different groups to identify multiple images of an object, because this perception is a variable of how individuals interact with the object (Dowling, 1986). Therefore, in this research we aimed to answer the question: which individual factors cause significant differences in perceived university image? Given this, we considered distance education's students from public universities to answer this question.

The interest in research is inserted in Doña-Toledo et al. (2017) that emphasize being image of distance courses as important for educational institutions as that of classroom courses. It is observed an insufficient amount of research about image perception in non-profit institutions, such as universities (Aghaz, Hashemi & Sharifi Atashgah, 2015).

Adding this idea, Rodríguez-Ardura and Meseguer-Artola (2016) consider to be a challenge to retain users who enrol in undergraduate distance courses. Furthermore, it is possible to apply marketing knowledge to understand the reality of education institutions (da Costa & Pelissari, 2017; Faé, Teixeira, Lima, & Azzari, 2019). Finally, it is possible to observe changes in the socioeconomic atmosphere in which HEIs operate and this require a manage their image to attract and satisfy their students (Panthong, 2016).

Therefore, we seek to better understand individual elements associated with universities image, from the viewpoint of undergraduate distance students. Also, we seek to encourage the development of corporate image strategies for distance education courses. In this study, we will indicate how high educational institutions, public or private, can benefit itself using marketing strategies, and provide subsidies for other researches.

2. Theoretical Reference

2.1 Organizational Image and Universities

Every organization has a perceived image and a desired image, the first one is how the organization

is observed by its audience, and the second, the image idealized by its managers (Roberts, 2005). Therefore, Casidy (2013) argues that universities should identify constantly the gap between the images desired and perceived by their publics. In this sense, Wilkins and Huisman (2015) made a distinction between the issues involving images of HEIs in relation to other types of organization, because the fact that they are seen as an organization focused on the public interest, there is an interference in their perception process.

Druteikiene (2011) observes image as a main element for the success of a university, requiring the establishment of strategies for this image to be created, developed and sustained. Thus, the author indicates that not only the planning, but also the implementation and control of image process creation are important for universities to create an image perceived significant, irreplaceable and hardly imitated by competitors.

Therefore, perceived image is important in the strategic planning process of the university (Doña-Toledo et al., 2017), especially in current environment where HEIs operate, with constant socioeconomic changes (Panthong, 2016). Because of these changes, universities have been operating in a challenging and dynamic environment, requiring marketing strategies to ensure not only recruitment of students but also their retention (Asaad, Melewar, Cohen & Balmer, 2013). Competition in the educational sector is in increasing evolution, and this competition occurs in search for students, professionals and new sources of funding, and in this reality only institutions that present a strong image will succeed (Azoury, Daou & El Khoury, 2013).

This observation is also appropriate for publics HEIs, their image also impacted by diversified factors, and it is not contradictory to apply the knowledge of this area of marketing in their daily life (da Costa & Pelissari, 2017). Its application is only more complex, because the public services of HEI are based on promise of service and value to be offered to different publics, such as students, government, fomenting agencies and society (Moogan, 2011). Therefore, universities should accept a dual identity for their survival: the normative, which includes traditional and ideological, and other utilitarian image, which attracts resources to the institution (Azoury et al, 2013).

Considering undergraduate distance courses students' perspective, potential clients of the universities, whether public or private, there are several institutions to choose from, and in this perspective, such institutions should offer more services to attract and satisfy their customers (Panthong, 2016). With the arrival of the information age, the technology has impacted on development of undergraduate distance courses. However, include it in the university structure increases the concerns of educational institutions (Mohamadzadeh; Farzaneh & Mousavi, 2012).

To maintain the motivation and commitment of the students in this modality, the institutions must concern of their students' satisfaction (Palmer & Holt, 2009) and considering that image affects their satisfaction (Palacio, Meneses & Pérez, 2002; Aiwi & Kitchen, 2014) add Landry, Griffeth and Hartaman (2006), interactivity involving undergraduate distance courses, makes it important to know what is more or less valued by the students in the planning of this modality.

2.2 Corporate Image

Gardner and Levy (1955) were the researchers that brought the discussion of image into the field of organizations. Alcaide-Pulido, Alves and Gutiérrez-Villar (2017) elucidate that two distinct phases were present in studies on the image of HEIs, the first of which occurred in the 1990s, and a later phase that

initiated in the 2000s and extended to the present days.

Even considering the various image concepts, it is considered an impression (Kuo & Tang, 2013) based by interactions with aspects of their identity (Costa & Pelissari, 2017), combined with beliefs and expectations of the individuals who interact with it (Kennedy, 1977; Balmer, 2001) and having multiple dimensions (Duarte, Alves & Raposo, 2010; Azoury et al, 2013).

In this research, we considered the image concept adopted by Dowling (1986). He describes the image as an effect of interaction individual with an object, considering his/her impressions, beliefs, feelings, and ideas, linking to a set of signs through which the object becomes known. Thus, being the image a phenomenon that involves perception, it can be observed differently by the different audiences that interact with the object (Dowling, 1986).

Waithaka, Kibera and Munyoki (2018) establish the need for a long-term process for the image to be designed, resulting from accumulated stimuli (Doña-Toledo et al, 2017). Tubillejas, Cuadrado and Frassetto (2011) go further, emphasizing to be permanent the process of image formation, involving a constant feedback. The researchers believe that it is not possible to have an original organizational image, because experiences between the public and the organization are endless.

In addition, the institution creates realities that influence the individual and he/she influences the institution, in an interchangeable process (Alcaide-pulido, Alves & Gutiérrez-Villar, 2017). However, another perspective is defended by Ngugyen and LeBlanc (2001) state be possible for the institution to have its image improved or destroyed quickly, according to expectations and needs met or not, in relation to their audiences. However, another perspective is defended by Ngugyen and LeBlanc (2001) state be possible for the institution to have its image improved or destroyed quickly, according to expectations and needs met or not, in relation to their audiences.

However, Balmer and Grayser (2006) have a different idea disregarding image perception as a process. They state that image is what is answered when questioned: 'how is the organization being viewed now?' This perspective is similar to the Dowling (1986) which stress image as the way an institution, a brand or an object are known, being a result of individual perception when contacting it.

H1: The perceived image of HEI is related with length in which students interact with the institution.

Luque-Martínez and Del Barrio-García (2009) state that the formation of the image involves different groups that have perceptions resulting from their experiences. In turn, Wilkins and Huisman (2013) argue that the individual decodes organization through interactions with it. Thus, it is possible to form contradictory images of the same organization, because different aspects are considered as important in this perception by each individual.

Aghaz et al (2015) concluded that different groups observe the institution in a different manner, using their own criteria in determining the image. In agreement with this view, for new image researches in HEI, Duarte et al (2010) propose the inclusion of the variable of 'area of knowledge' as an image influencer.

H2: The area of knowledge is related with the perceived image of HEI.

The image is sensitive to sociocultural variables (Kazoleas, Kim & Moffit, 2001). Thus, Duarte et al (2010) approach people elaborate an image considering different factors. It is important to note that aspects as age, gender, and income might influence the human behaviour. Previous studies suggest that

women and men can have different perceptions of a company and brand (Hasan, 2010; Pasual-Miguel, Augdo-Peregrina, & Chaparro-Peláez, 2015). Additionally, discussions about different behaviours between social classes and generations are also present in literature (Ahmad, Shaheen, Quarshi, Hunjra, & Niazi 2011; An, Kwak, Jung, Salminen, & Jansen, 2018).

Adding to these ideas, more specifically at universities with distance courses, Šneideriene (2013) emphasizes that their structures should be developed considering the socioeconomic aspects of their target audience. Finally, Palacio et al. (2002) suggest continued others researches on the organizational image of HEI, analysing the effects of both socioeconomic and psychographic characteristics on the overall image perceived of these institutions.

H3: Gender is related with the perceived image of HEI.

H4: Age is related with the perceived image of HEI.

H5: Income is related with the perceived image of HEI.

2.3 The CEDERJ Consortium

The Center for Higher Education Distance from the State of Rio de Janeiro (Centro de Educação Superior a Distância do Estado do Rio de Janeiro - CEDERJ) consortium was created by the Government of the State of Rio de Janeiro in 2000 (CEDERJ, 2017). The CEDERJ is a consortium of six public universities (Heitor & Horta, 2014) and a technical education center (CEDERJ, 2017), as a result of which Brazil stands out around the world with regard to undergraduate distance courses (Horta, Heitor & Salmi, 2016).

The municipal governments provide the administrative staff (Souza Neto, Dias, Boas, Brito & Leite, 2010). It is the responsibility of consortium universities coordinate the pedagogical project (Souza Neto et al., 2010) and the disciplines offered by them, adds Claro (2007), in order to maintain a quality similar to the classroom courses.

To support the activities of CEDERJ, the State of Rio de Janeiro Center for Science and Distance Higher Education Foundation (CECIERJ) was created (Heitor & Horta, 2014). Thus, the CECIERJ takes care of the production of teaching materials, management of the teaching and learning process, and of the platform to support distance teaching and tutoring (Horta et al, 2016).

Tutors must be graduates or post-graduates but are not considered part of the teaching staff of the consortium organizations (Claro, 2007), having no employment relationship with any of them (Brust Hackmayer & Bohadana, 2014). They support the student by attending and accompanying as a learning facilitator (Brust Hackmayer & Bohadana, 2014).

3. Methodology

The study is classified as a descriptive field research. We applied a survey to collect data. The research was conducted at CEDERJ institutions. Two aspects motivate us to choose these institutions as unit of analysis. First, the pioneering use of printed material resources, face-to-face and distance tutoring, with a virtual learning environment designed for undergraduate distance courses (Claro, 2007). Second,

the characteristic of innovation, whose project was emphasized by the Brazilian Ministry of Education and Culture (2001).

The observation unit was formed by all students with regular and frequent enrollment in their courses. For incoming students, we considered those who started the studies a semester ago. And for graduating, we considered the students with three years or more of coursework. To guarantee the representativeness of the sample for all groups of the population, the probabilistic and stratified sample was used. This process was done by course, being based on the list of students in alphabetical order. In table 1 we present the sample composition.

Table 1. Sample by course.

Course	Institution	Incoming	%	Graduating	%	Total
Administration	UFRRJ	14	37,84	12	25	26
Biology	UENF	8	21,62	10	20,83	18
Computer Sciences	UFF	2	5,26	1	2,08	3
Mathematics	UFF	2	5,26	2	4,17	4
Education	UNIRIO	10	26,32	18	37,5	28
Chemistry	UENF	1	2,63	5	10,42	6
TOTAL		37	100	48	100	85

Source: Author's own elaboration.

For a factorial analysis is acceptable five times the number of variables of the largest research construct, seeking to reach ten times that value, preferably (Hair, Anderson, Tatham & Black, 2005). However, the same authors highlight the need for a minimum of 50 respondents to use this statistical technique. The observations of the present study reached a number higher than that defined by Hair et al (2005). The survey got 85 observations. The overall image construct presented 3 variables, thus the minimum acceptable for the authors would be a sample composed of 50 participants.

To measurement of the overall image, a structured questionnaire with 3 variables was used. The closed questions were developed by Tubillejas, Cuadrado and Frasset (2011). The Likert scale of the accept/disagree type was used for data collection. To avoid central tendency bias and obliging a position of the respondents as the agreement or not about what is being questioned, the six-point scale was used.

This decision considers the research of Garland (1991) which proved that the results of a study can be distorted with the presence of the central point, because the respondents tend to give neutral answers not displeasing the researcher with negative answers.

The categories related to sex, age, and family income were made considering the categorization of the Brazilian Institute of Geography and Statistics – IBGE (2011), presented in the 2010 Population Census – Population and Household Characteristics. The Table 2 shows the socioeconomic data.

Table 1. Socioeconomic data.

	Classification	Quantity	%
Gender	Female	65	76
	Male	20	24
	Total	85	100
Age	19 years or less	6	7
	Between 20 and 24 years	16	19
	Between 25 and 29 years	17	20
	Between 30 and 34 years	14	16
	Between 35 and 39 years	17	20
	40 years or more	15	18
	Total	85	100
Income	Between R\$ 0.00 and R\$ 724.00	17	20
	Between R\$ 724.01 and R\$ 1,448.00	29	35
	Between R\$ 1,448.01 and R\$ 2,172.00	21	25
	Between R\$ 2,172.01 and R\$ 3,620.00	9	10
	Between R\$ 3,620.01 and R\$ 7,240.00	9	10
	More than R\$ 7,240.00	0	0
	Total	85	100

Source: Author's own elaboration.

The data analysis was performed using different statistical techniques, as linear regression, t-test, and exploratory factor analysis, all of them using SPSS Statistical 20 (Statistical Package for Social Sciences). For questions about overall image, we analyzed correlation between the variables and each one of them with OI.

Hair et al. (2005) indicate evaluate the internal consistency, being 0.30 as a significant minimum value for correlation between items and greater than or equal to 0.50 for correlation of the item with the total of the scale. The reliability of the data was observed using Cronbach's alpha. For this, values equal to or lower than 0.6 are found to be inadequate (Hair, Anderson, Tatham & Black, 2005). An exploratory factor analysis completed the initial part of the data analysis.

3.1. The scale of corporate image

The overall image scale presented Cronbach's alpha of 0.808 and all values above 0.52 and 0.63, for correlations between items and each variable with the total scale, respectively. The excluded of any variable from overall scale would cause a reduction of Cronbach's alpha, it was decided to maintain all variables.

Hair et al. (2005) point out as significant the value equal to or greater than 0.50 for verification the correlation of the variables with the extracted factor the data presented values higher than 0.782.

In addition, values higher than 72% were presented for the overall image variance, and accepted values for the social sciences, considering Hair et al (2005). The variance shows in its value how much the

variables explain the extracted factor (Levine, Stephan, Krehbiel & Berenson, 2008).

In the factorial analysis, the Kaiser-Meyer-Olkin (KMO) values were 0.705 for the overall image. KMO is indicative of how much of the raising factor explains the construct under analysis (Hair et al., 2005), and its values are considered sufficient when between 1 and 0.50 (Aranha & Zambaldi, 2008). Given the results, the factor analysis allowed us to create the variable overall image (OI).

4. Results

4.1 Effects of length in which students interact with the institution

To determine if the OI perceived by incoming and graduating students is significant different statistically, we transformed the variable "interaction time" into a dummy variable. Thus, the value 1 was assumed to all incoming students, and value 0 for all the graduating. The processing of the t-test measured the variance of the means for the OI, and the results obtained are compared between the two groups in question.

Even for a sample with $n < 30$, Levine et al. (2008) observe the possibility to perform the t-test, if the population presents equal variances, a normal distribution and the sample collection was done independently and randomly. Table 3 shows the results.

Table 3. T-test based with on length in which students interact with the institution and perceptions of respondents about the HEI overall image.

Overall Image	Levine's test for equality of variance		T-test for equality of means	
	F	Sig.	t	Sig.
Equality of variance accepted	1.518	0.221	0.645	0.521
Equality of variance not accepted			0.635	0.528

Source: Author's own elaboration.

Before performing the t-test, the SPSS program performs the F-test. It is shown in the fourth column of the table the significance level obtained with the test. The result of the test reveals that there is homogeneity between the variances, since the obtained p-value of 0.221, thus higher than 0.05, which is the significance of F-test.

Faced with this result, considering a 95% confidence level the t-test provided evidence of no significant differences between the incoming and the graduating participants in the OI perceived of the organizations, considering the sample. Thus, the H1 hypothesis is rejected, which indicates that the perceived image of HEI is not related significantly with length in which students interact with the institution.

4.2. Effects of knowledge area

To test hypothesis H2, which asks if the area of knowledge is related significantly with the perceived image of HEI, the "course" variable was transformed into a dummy variable. For every test conducted, the

value 1 was assumed to the area of knowledge analysed, and all others, value 0. The processing of the t-test measured the variance of the means for the OI, and the results obtained by each area in comparison to all others, forming two groups to be analyzed in each test. Table 4 shows the results.

Table 4. T-test result based in areas of knowledge and perceptions of respondents about the HEI overall image.

Area of knowledge	Levine's test for equality of variance		Equality of variance accepted		Equality of variance not accepted	
	F	Sig.	t	Sig.	t	Sig.
Exact Sciences	2.247	0.138	-3.740	0.000	-2.883	0.016
Computer Sciences	0.189	0.665	0.950	0.345	1.080	0.384
Biological Sciences	0.015	0.903	-0.299	0.765	-0.303	0.764
Human Sciences	3.680	0.058	2.217	0.029	2.423	0.018
Social Sciences	0.582	0.448	0.109	0.914	0.116	0.908

Source: Author's own elaboration.

The results of the t-test indicated that the OI perception of the HEI by the respondents of the exact and human sciences showed differences when compared, each one with all the other students. Therefore, the identification or not of a significant correlation between each of them and the OI was made performed a regression analysis, based on the enter method. The results of the regression showed that only the correlation of the students of the exact sciences area was significant, confirming hypothesis H2. Considering the sample, the OI perceived of the HEI is 0.692 lower (p-value: 0.000) when the respondents from exact sciences area are compared to all other areas of knowledge.

4.3. Effects of socioeconomics variables

The procedures to test hypothesis H3, which seeks to determine whether gender significantly influences the OI perceived of public HEI, indicated in the t-test a significant difference to mean of the OI perceived between female respondents compared to male respondents. Table 5 shows the results.

Table 5. T-test result based in gender and perceptions of respondents about the HEI overall image.

Overall Image	Levine's test for equality of variance		T-test for equality of means	
	F	Sig.	t	Sig.
Equality of variance accepted	3.051	0.084	2.174	0.033
Equality of variance not accepted			1.823	0.080

Source: Author's own elaboration.

The fourth column of the table shown the significance level obtained with the test. The result of the test reveals that there is homogeneity between the variances, since the obtained p-value of F-test was 0.084, higher than 0.05, which is the significance of test.

Face on the results infers that, statistically, there are significant differences between male and female participants in the OI perceived of the organizations, considering the sample. The p-value was lower than the level of significance of the test (0.05).

A linear regression analysis was conducted. The results revealed that the correlation between gender and the OI is not significant, indicating that hypothesis H3 should be rejected because although the groups differently perceive the OI of the organizations under study, the presented correlation is not significant. Finally, hypotheses H4, which investigates if age is related significantly with the perceived image of HEI, and H5, which examines if income is related significantly with the perceived image of HEI, were rejected. The t-test showed no significant differences two both cases.

5. DISCUSSION

Studies that address how the audience perceives the public HEI are still few. Part of this behaviour is related to the mistaken view that marketing science is not applicable to such entities. One of the main marketing principles is the segmentation. Given that, we aimed to understand the role of individual factors in high education institutions image, given the distance education courses.

Considering the institutions, we observed among the incoming and graduating students that OI was not perceived differently. Thus, there is evidence that the exposure of an audience to the same environment, influenced at the same time, by equal variables, the perceived image of this institution does not suffer the effects of the interaction time with them. The results do not corroborate Tubillejas et al (2011), Doña-Toledo et al (2017) and Waithaka, Kibera and Munyoki (2018). They establish the need for a long-term process for the image to be designed. In turn, these results confirm Balmer and Grayser (2006) that define image as a response to how the institution is perceived by the public. They also corroborate Dowling (1986) who emphasized being the image resulting from what is perceived by the individual when contacting the institution.

Analyzing the effect of the area of knowledge, we found a significant different opinion of exact and human sciences' students from the others. The results corroborate the view of Aghaz et al (2015), Duarte et al (2010) and Luque-Martínez and Del Barrio-García (2009) who indicate that different groups observe the institution in a different manner, using their own criteria in determining the image.

Moreover, the exact sciences students presented a lower OI perceived. This result is an indication that expectations are not being met and there are gaps or inconsistencies in the interactions with this group. A group with a negative view of the OI can negatively influence other groups, causing damage to organization image.

Analyzing the effect of socioeconomics variables, we find that the differences of age, income, and gender are not related to overall image of the institution. In other words, the socioeconomic factors analysed did not influence the OI perceived considering undergraduate distance students. It contradicts the conclusions of Kazoleas et al. (2001) and Šneideriene (2013).

All these results reinforce the idea that image can be thought as a momentary picture. Therefore, this image can be changed contemplating the emission of aspects in the present of their identity, how the organization relates to the environment, market, competitors, beyond the expectations met or not recently

according your audience.

Given that, this research has achieved its objectives, showing how to use marketing to benefit public HEI, given that their image impacts their activities and relationship with government, funding and regulatory agencies and is thus connected to their future existence. Specifically, for distance education, marketing strategies is more significant because in this teaching modality, there is an interaction between students from different realities and regions.

The research corroborated other studies indicating that this image is a momentary picture created based on individual and external references of both the individual who observes and the observed organization. The image can be understood as the way in which institutions are perceived, through the reception of the stimuli generated by the observed object and its subsequent translation, considering beliefs, personal values, impressions, life experiences, and individual expectations, positives or even negatives, satisfied or not.

5.1. Limitations and suggestions

The sample of this study was composed by students of the same consortium and enrolled in the same center. This is a limitation of the study. Thus, future studies may consider undergraduate distance students from different universities and other centers to understand the influences of students from different institutions on overall image.

Another suggestion to be investigated in future studies is whether the CEDERJ influences the image perception of public institutions surveyed. Considering the features of the public service, it is possible to conduct research in private institutions offering undergraduate distance courses and to verify the results between the institutions.

In addition, other studies may use other approaches, such as qualitative research, allowing further exploratory analysis of the elements that contribute to image perception of distance education institutions. Further studies also can be conducted in institutions offering both classroom and distance courses to determine whether the image perceived differs between them.

Finally, other variables should be considered for the studied factors. Since in the present study there was an explanation of 72% of the variance of the overall image, other variables influencing the perceived image should be researched in the literature and observations of reality, and these should be included in new research models.

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Digital games, cognitive skills, and motivation: children's perception in the school context

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Abstract

In addition to entertainment, games have been recognized as enhancers of cognition and associated with increased motivation in the school learning context. The possibility of immersion and active player participation is considered a distinguished aspects of game design. Therefore, this study proposed the application of Brain School's digital games using tablets during a school year, with weekly interventions of 50 minutes in a class of the second year of elementary school. Twenty-five students were analyzed with an average of eight years old. At the end of the interventions, the evaluation was carried out through individual interviews. The results revealed that most of children felt motivated to participate in the games activities. However, there was no association between level of motivation and cognitive skills investigated (attention and problem solving), nor between preferred games and cognitive skills trained. However, qualitative data showed that children liked using games and acknowledged that the activity contributed with the exercise of their abilities. In general, this research contributed to reinforcing the importance of the diversification of methodological strategies which include the use of digital games in education.

Keywords: learning; school; executive function.

1. Introduction

This paper aims to discuss the role of digital games to improve cognitive skills and their potential motivator for the engagement of children in school. The interactive and playful characteristics that make games enjoyable experiences, as well as the way in which the proposed tasks and actions exercise aspects of cognition, are highlighted.

The interaction with digital games may constitute experiences that enhance cognitive abilities. Studies demonstrate that games can offer contributions to the development of functions directly linked to school learning (Mattar, 2010; Ramos & Melo, 2016), to the exercise of mathematical skills (Neto & Fonseca, 2013) and Executive Functions (Ramos & Segundo, 2018).

The contributions of digital games to cognitive development and learning are clashing with the disparities and resistance to the integration of digital technologies in the educational context (Ramos, 2013). Theoretical clashes, beliefs, demands for teacher training and lack of infrastructure are the main problems related. In general, there is a gap between what children consume and produce in their daily lives and how they experience school (Ramos, 2012).

Regarding the integration of digital games at school, several studies evidence them as motivational resources that stimulate children in their learning processes. Digital games can help in the development of new knowledge, increasing the possibilities of learning in a fun way and helping in the motivation of the children (Neto & Fonseca, 2013).

Considering these aspects, we define digital games, the exercise of cognitive skills and motivation, highlighting an intervention carried out in the school context using digital games integrated into the daily routine of the classroom. The results presented are based on the perception of the participating children about their motivation and the exercise of cognitive abilities such as attention and problem-solving ability.

2. Theory and related work

The context of digital games has motivating and fascinating elements which enable the satisfaction of desires through sensations and immersions (Ramos, 2012), as well as enable the player to be the protagonist in the development process through the participation and interaction of individuals (Murray, 2003). Immersion is characterized as a feeling of involvement in a strange reality that may cause sensations in the player and the gratifying ability to take meaningful actions and see the results of one's own decisions and choices (Murray, 2003).

Digital games share characteristics of analog games, but differ mainly by interactivity, interface, and immersion. In general, a game is "a system in which players engage in artificial, rule-defined conflict that implies a quantifiable outcome" (Salen & Zimmerman, 2012). Digital game is considered as playful activity in a series of actions and decisions limited by the rules and the game world that result in a final situation (Schuytema, 2008).

To summarize, the characteristics of the game Huizinga (1996) consider that it is "a free activity, consciously taken as 'non-serious' and outside the usual life, but at the same time capable of absorbing the player in an intense and total way".

Digital games are characterized by the following structural elements: rules, goals or objectives, results,

feedback, competition, challenge, interaction, and representation or plot (Prensky, 2012). The objectives and goals of a game are highlighted, which have the function of motivating the player and guiding the measurement of their performance, indicating how close you are to achieving the goal (Prensky, 2012).

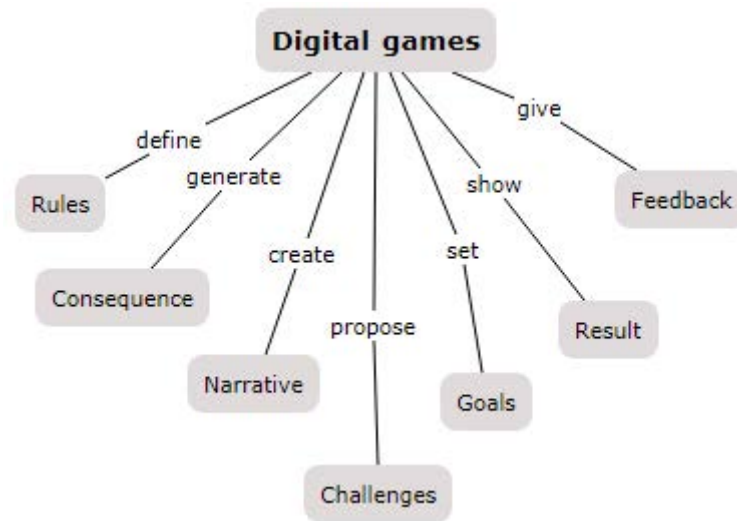


Figure 1. Game Character Scheme created with the Cmap Cloud.

The characteristics of digital games described by various authors (Mattar, 2010; Prensky, 2012; Murray, 2003; Salen & Zimmerman, 2012), as observed in Figure 1, can be related to player actions or player-game interaction, resulting in numerous possibilities which generate rich experiences. These characteristics assume the attention and focus of the player to overcome the challenges. To do so, many cognitive skills are involved in the player's action, based on mental processes such as memory, perception, reasoning, language and problem solving (Ramos & Melo, 2016). Cognitive abilities can be understood as the capabilities that make the subjects competent and allow them to interact symbolically with the environment it is in (Gatti, 1997). This way, games have been proposed for the improvement of cognitive abilities.

Among the diverse game types, we highlight the cognitive games that are used to provide experiences that enhance cognitive skills. These games “may be presented in different formats. They are generally simple games and have increasing levels of difficulty and can also replicate board or challenge games using the digital media” (Ramos, 2012).

Digital games have resources that effectively motivate learning in an intense way, contributing to what is called a “culture of interactivity”, in which it is possible to participate actively in the process of acquiring new knowledge (Mattar, 2010). In addition, games have a high capacity for fun and entertainment, encouraging and motivating different learning through environments that generate curiosity, interaction and fantasy (Hsiao, 2007; Balasubramanian, Wilson, & Cios, 2006). Cognitive games exercise significant aspects related to cognition. Games challenge the player to use elements such as logical reasoning, memory, attention, problem solving, among others, converging aspects of pleasure and joy in digital games (Ramos, 2013).

Among the principles of learning in game designing, there are some aspects to be considered. The “interaction” happens when the player makes decisions and acts, receives feedback and new problems, and the game develops to the player's actions (Gee, 2009). The “production” refers to when the players are producers and participate in the game flow, because each player can follow different trajectories. The game

can be customized according to the player's style of playing and learning, which is called "customization". There are different difficulty levels, different ways to solve a problem, and one can choose different attributes for the characters. In good games, the "order of challenges" is present in such a way that connects one challenge to the other, leading the player to formulate hypotheses to solve problems efficiently; "challenge and consolidation" - the games offer a set of challenging problems and their solution becomes automated. After it, new problems are presented requiring the player to rethink and modify the solution; systematic thinking - games encourage thinking about the relationships that are established between events, facts, abilities and on the consequences of each action (Gee, 2009).

Motivational aspects related to teaching and learning processes have been discussed in different scientific contexts, as well as research that relates motivation using digital games in education (Savi & Ulbricht, 2008; Alves & Battaiola, 2011). In this perspective, motivation is a result of the individual's desires and needs (Spector, 2006). In addition, it can be understood as an "objective-directed action, being self-regulated, biologically or cognitively, persistent over time and activated by a set of needs, emotions, values, goals and expectations" (Salanova, Hontagas, & Pieró, 1996).

Motivation in individuals may involve aspects that guide the achievement of objectives and activate certain behavior (Tapia, 1999). In this sense, we can highlight two types of motivation: intrinsic motivation, which refers to the individual's internal motivations; and extrinsic motivation, which refers to external motivations (Huertas, 2001). Digital games can influence the motivational aspects related to learning, because games have favorable contexts for the understanding of intrinsic and extrinsic motivation, such as scores and feedbacks (Katz *et al.*, 2014).

The success of using digital games for cognitive enhancement can be evidenced in several studies. Researchers in Scotland (Miller & Robertson, 2010) proposed an experiment with 71 children aged 10 to 11 years old attending elementary school for 10 weeks, during which activities were done with the children for 20 minutes daily. To provide a basis for comparison, children were divided into two groups: one that practiced with the digital game "Dr. Kawashima's Brain Training", and another that exercised for mental gymnastics on platforms similar to the game, but physical.

The evaluation was based on the tests used in the "Number Challenge", which verified self-esteem, mathematical skills, linguistic and social abilities, and the "Burnett Self Scale (BSS)", a self-administered method that identified opinions on aspects of students' academic and social lives. Results showed that, although both groups showed improvement in the post-test compared to the pre-test, the experimental group achieved more than twice the progress of the control group.

Another study (Castellar, Looy, & All, 2015) investigated the benefit of the use of digital cognitive games, involving 67 children with a mean age of 7 years, who participated in interventions for a duration of 3 weeks. Participants were divided into two groups in a random manner, half were instructed to regularly play "Monkeys Tales" while the other party performed mathematical exercises. The comparative results between the pre-test and the post-test showed that the use of the digital game has a positive effect on the students' working memory and perception of gratification.

A study in Sweden (Thorell, Lindqvist, Nutley, Bohlin, & Klingberg, 2009) involved 65 children aged 4 and 5 who used specific digital games for 5 weeks to work on oculomotor control and inhibitory control, while some of the children composed the control group and used other games. The comparative evaluation of

children included the application of six tests and the results indicated improvement in working memory and in higher levels of joy in children.

Finally, a research developed in Brazil with the use of “Brain School” (Ramos & Segundo, 2018) reinforces these results. A *quasi-experimental* study was carried out involving 100 children, divided into two groups: experimental and control. The experimental group participated in classroom interventions using cognitive digital games five days a week for six weeks. After the intervention period, both groups were assessed based on the application of psychological tests compared to the pre assessment. The results showed that the experimental group had a significant improvement in attention ($p < 0.05$) and cognitive flexibility ($p < 0.05$) when comparing the performance of both groups in the test, suggesting that the use of games can contribute to the enhancement of executive functions.

3. Material and methods

This study is characterized as a field research of mixed approach and is based on the participant's perception through semi-structured interviews. Interventions and data collection were carried out in a class of the 2nd year of an Elementary public school in Brazil, aiming to understand the perception of the participating children as well as their motivation regarding the proposed intervention and the development of their cognitive abilities.

The activities took place during a school year, with the interventions being carried out weekly and lasting the period of one class (50 minutes). The teachers agreed with the intervention and participated. The interventions used tablets provided by the school's Interdisciplinary Laboratory of Educators Training (LIFE).



Figure 2. Intervention in the classroom.

3.1 Participants

Twenty-five students were included, fifteen females and ten males. Participants were on average 8 years old. Parents received free consent terms allowing the children to take part in the intervention.

3.2 Instruments and procedures

The interventions were based on the use of the Games of the Brain School and took place in the room of the Interdisciplinary Laboratory of Educators Training located in the school. Twenty-five tablets were used, one for each child. During the intervention, two scholars were responsible for guiding the children and mediate any situation.



Figure 3. Screen of access to the games of the Brain School.

Brain School is an application that integrates digital cognitive games such as *Tetris*, *Genius*, *Looktable*, *Ladybug*, *Tangran*, *Connectome* and *Blocks*. It allows periodic assessments of attention, working memory and problem solving. In addition, provides the monitoring of individual performance in each game. For the intervention, games were previously chosen for each week, so that all the games of the application were played until the end of the intervention.

Table 1. Description of the objectives of Brain School games and cognitive skills.

Screen	Objectives	Cognitive Functions
	<i>Ladybug</i> Release the ladybug, moving blocks in only two directions, so that she can exit.	Attention to the initial conditions and arrangement of the parts. Planning and developing strategies (problem-solving) to move parts efficiently. Memorization of actions performed and solution hypothesis already tested.
	<i>Breakout</i> Destroy the blocks by bouncing the two balls and trying to keep at least one to complete the task.	Attention to follow the ball's movement. Analysis of the trajectory of the ball to elaborate strategies to hit the blocks (problem-solving).
	<i>Looktable</i> Find and click the numbers, scrambled in the grid, in ascending order.	Attention to track the numbers that complete the sequence. Problem-solving to justify the decision on how to better act. Operational memory to save the completed sequence.

*Genius*

Play back the growing color sequences that are displayed.

Attention to follow the presentation sequence. Memorizing the sequence for later reproduction. Depending on the amount of stimulus, a strategy must be used to reproduce the sequence (problem-solving).

*Connectome*

Connect two neurons, organizing the links between them, selecting and changing the position of the neurons to create the path.

Attention concerning the conditions and possibilities of solution. Problem-solving by developing strategies and planning actions to find the path in less time and with fewer clicks. Memorization of the strategies already used and the objective to achieve.

*Tangran*

Use all geometric pieces to complete the displayed figure.

Attention to discriminate the pieces and analyze the form. Problem-solving when develop hypotheses about the layout of the pieces to complete the figure. Memorization of the attempts already made.

*Tetris*

Move the pieces to draw lines and gain points, without letting the pieces reach the top.

Attention to analyze and discriminate each new piece. Problem-solving to determine the best movement to draw lines considering the possibilities.

Source: Ramos & Melo (2016).

The research was submitted and approved by the Research Ethics Committee (CAEE 67638216.5.0000.0121). After the weekly interventions based on the use of Brain School games, the children were interviewed individually. A semi structured roadmap was used as a basis to interview participants.

This script aimed to question participants about their perception of the project. They asked how often they played the games during the week besides the time in class. The motivation was checked using a Likert scale. The script then questioned which of the games the child had liked the most. After choosing the favorite game, three open questions were proposed: 1. *What did you like most about tablet activity using Brain School? Why?*; 2. *What did you learn by playing the Brain School games? Why?*; and 3. *What did you like least about tablet activity using Brain School? Why?*

After the open questions, the participant was submitted to filling in a scale of 1 to 3 (being 1 = “yes, much more”, 2 = “yes, a little more”, and 3 = “no, I continue as before”) on eight statements regarding attention, out-of-activity behavior, problem solving, and comprehension skills. The statements were: 1. I think better before doing any activity or solving a problem in school; 2. I got faster at problem solving; 3. I can more easily solve school problems and activities; 4. I try to solve more times something that I cannot solve easily;

5. I can understand better what the teacher asks me to do; 6. I understand better when I read something, such as texts and statements; 7. I can pay more attention in class; and 8. I try different ways to solve something that I cannot get right away.

The interviews were conducted individually with twenty-five children. The roadmap was filled in Google Forms and was applied by the interns after the end of the class. At the end of each interview, it was possible that the child also made some additional comments as wished.

4. Results

Considering the factors proposed and observed, the association between the level of motivation and the scores obtained was verified. From the sum of affirmations corresponding to cognitive abilities in total and in relation to attention and problem solving, it was observed that the average scores were higher in the higher motivation level, but this difference was not statistically significant ($p > 0.05$), as can be seen in table 2.

Table 2. Results of non-parametric tests for the level of motivation associated with scores of cognitive abilities.

	Level Low motivation Mean (SD) (n=4)	Level High Motivation Mean (SD) (n = 17)	p*
Attention score	9,5(3,0)	11,3 (1,57)	p>0,05
Score problem solving	11,0(1,15)	11,41(1,17)	
Total score	20,5(3,41)	22,70(2,44)	

* Mann Whitney Test

Another factor analyzed referred to the game indicated by the child as the one that he/she liked the most and the scores obtained in the cognitive abilities considering previously the importance of affective elements in the involvement of the children with the proposals.

Considering the five games used in the activities, four were cited as favorites, especially the Breakout and Ladybug games. The results showed no influence on this preference in relation to the scores since close results were observed and the Kluskal Wallis test did not indicate a significant difference.

Table 3. Results of non-parametric tests for preferred games associated with cognitive abilities scores.

	Tetris (n=4)	Breakout (n=6)	Ladybug (n=6)	Connectome (n=4)	p*
Attention score	10,5 (3,0)	11,6 (0,8)	10,6 (2,4)	11,6 (0,8)	p>0,05
Score problem solving	11,5 (1,0)	11,0 (1,6)	11,6 (0,8)	11,3 (1,3)	p>0,05
Total score	22,0 (4,0)	22,6 (2,4)	22,33 (3,2)	22,9 (1,6)	p>0,05

Nota.* Mann Whitney Test

Regarding the qualitative data, results show that the children interviewed liked the interaction with the Brain School games, when 47% (n = 10) pointed out that being in touch with digital games was what they liked the most, as illustrated by the lines: “I liked because then we had an electronic game moment in the classroom” (Interviewee 9) or even more generally “Play! Because I like to play.” (Interviewee 12). In addition, 14% (n = 3) of respondents demonstrated a preference for a specific platform game, 4% (n = 1) reported that they liked the presence of the challenge related to games, and 4% (n = 1) importance of the collaboration and to play together with the colleagues, being able to withdraw doubts with them about the games. Some children, about 14% (n = 3), did not know how to answer this question and another 14% (n = 3) did not like the Brain School.

When asked what they liked least about the tablet activities using Brain School games, about 38% (n = 8) of the children said they did not like it at all. In addition, 19% (n = 4) reported on the existence of difficult and boring games and 9.5% (n = 2) of the children commented on the tablet locking while playing. Other children interviewed, about 9.5% (n = 2), reported that they did not know how to answer this question, 9.5% (n = 2) did not like it when they wanted to change games and could not, 4.7% did not like the activities, and 4.7% (n = 1) reported that they did not like it when the activities ended.

Thus, when questioned about what they learned to play, the answers were diverse, as well as the following: mathematical learning, how to perform mathematical operations in the perception of 24% (n = 5) of children, as illustrated in the speeches: “I learned that I can connect things and also make an account that I had never learned” (Interviewee 14) or “I learned numbers. There is a little game that has to find the numbers” (interviewee 6). In addition, attention training was indicated by 19% (n = 4) of the children, the use of time in our favor cited by 4.7% (n = 1); overcoming obstacles and learning new paths that were commented by 4.7% (n = 1) children.

5. Discussion

From the analysis of the data found, the motivation was highlighted as a relevant aspect for the children researched. The children indicated feeling highly motivated in relation to the activity proposed with the use of digital games. Motivation allowed the children to engage with more interest in the proposed activities (Prensky, 2012), enhancing their involvement.

When analyzing the level of motivation self-referenced by the participating children during the interview stage, most of the children indicated to feel highly motivated by the activity proposed using digital games. This perception is in keeping with what authors (Huizinga, 1996) classify as typical of human nature, which is the historical tendency to voluntarily seek to deal with gaming activities. According to this same author, this occurs mainly because games give meanings to actions that transcend the activity performed, being these meanings built with the purpose of satisfying some tendency previously found in the player, along with elements of fun.

The results revealed that in general children had a high level of motivation, which according to Hsiao (2007) and Balasubramanian et al. (2006) can be justified by the understanding that digital games activate curiosity, interaction, and fantasy, encouraging and motivating players through the fun and entertainment that becomes constantly present. In addition to the fact that digital equipment is already part of the

children's daily routine, they are devices that are excluded from everyday life in the classroom.

It is observed that the average scores called attention and problem solving were higher in the higher motivation level, even though this difference was not statistically significant. According to Tappia (1999), motivation in individuals guides the achievement of goals and can activate certain behaviors. In this sense, the motivation provided by the play elements present in digital games affects the intrinsic motivation of the children contributing positively to the development of the proposed skills (Katz *et al.*, 2014).

The mean scores for attention and problem solving were higher in the higher motivation level, but this difference was not statistically significant, indicating that the comparison between the higher and lower level of motivation did not influence the way the children assessed their cognitive abilities. This result may be in line with the studies of Katz *et al.* (2014), which, when affirming that games are effective resources for cognitive teaching and development, indicate the need to give greater attention to the selection of games and their elements, since they can induce distraction and therefore impair or reduce the performance of children in certain goals.

Regarding the preference for the use of games as a method of intervention, support is given to such a decision both in the gains pointed out in other articles by the choice of such path and by the motivational aspect offered by these devices - aspects that will be dealt with below.

Among its advantages, one that makes cognitive games especially viable in the school pedagogical environment is the way in which they measure the development of cognitive abilities in a playful way (Ramos, 2013). Thus, the child actively engages in the process of knowledge, making it more fruitful. The game, in turn, is a shortcut to "social, affective and cognitive benefits for the child and allows to work aspects such as imagination, imitation and rule", each game having a specific function and focusing on specific skills (Ramos, 2013). Through these activities, there is the provocation of a greater sense of cultural pertinence, motivation, information processing, data selection ability, involvement, interest, speed of data computation, self-esteem, mental arithmetic performance, cognitive processing (Miller & Robertson, 2010), memory visuospatial and verbal work (Thorell *et al.*, 2009).

On the motivational criterion, the use of games in the improvement of executive functions is strengthened by the characteristics that allow the players to stay entertained and engaged. In his studies, Prins, DAVIS, Ponsioen and Van der Oord (2011) suggest the use of strategic ludic elements such as thematic, feedback and animations instigate motivation and good performance in children players. In addition, the same study still infers that the formulation of games of simple adjustment profile allow small modifications to become possible in order to adapt the platform to the subjectivities of the target audience. Such an alternative is commonly used in programs with cognitive games, and, in turn, configures the structure of each game in the form of "problem games", to which Gee (2009) assigns repetitive and objective mechanisms.

Although the games used are classified by cognitive abilities and indicate that they work more strongly in relation to each other, the preference for a specific game did not show any association with the abilities assessed by the children. By interacting with a variety of games, children position themselves from different points of view and must use new skills and make those they already use more flexible. This is because "the way people solve problems depends, in part, on how they understand them" [26]. Thus, challenge games used during the project work together to motivate children to "think hypothesis, experiment, plan, test, perform calculations. In this way, they contribute to the development of logical

reasoning, planning, visual perception, and attention, for example.” (Sternberg & Sternberg, 2016). Thus, the purpose of using cognitive games are put into practice by exercising cognitive skills in the face of challenging situations in order to perfect them, while maintaining its motivating aspect.

Considering these results, it is noticed that the children enjoyed the interaction with the digital games, which, according to Mattar (2010), are resources that effectively motivate the learning intensively, contribute to a culture of interactivity, where it is possible to participate actively in the process. Some children have highlighted the presence of the challenge as something motivating and that gives them a taste for the game. In this sense, motivation is the result of desires, needs and wants of an individual (Spector, 2006) and digital games can influence the motivational aspects related to learning since games have favorable contexts for understanding intrinsic and extrinsic motivation (Katz *et al.*, 2014).

Thus, games can facilitate the teaching-learning process and provide pleasant, interesting and challenging experiences, transforming them into a teaching strategy for educators, as well as being a rich instrument for the construction of knowledge (Grübel & Bez, 2006). In this way, children perceive learning as related to mathematics, sums, knowledge of numbers and associate to a specific digital game that makes up the Brain School.

Gros (2008) realizes that for games to be used for educational purposes, they must have well-defined learning objectives and teach the content of the disciplines to the players, or to promote the development of strategies or skills important to increase students’ cognitive and intellectual capacity. In addition, the relationship between digital games and specific knowledge such as mathematics, has stimulated Neto and Fonseca’s (2013) research that uses educational games as a means to stimulate the learning of mathematics, working with concepts learned in the classroom from a different perspective, in which students felt motivated and interested to exercise the knowledge of mathematics through digital games.

Another aspect highlighted by the interviewees was that the attention exercise was also recognized by the children, since the games exercise attention-related abilities, such as increasing the number of objects that are perceived simultaneously, selective attention and divided attention (Dye & Bavelier, 2010, Feng, Spence, & Pratt, 2007).

6. Conclusions

This research noticed that the motivational aspects are strongly related to the use of digital games in the context of education. Due to this aspect, most children indicated feeling highly motivated by the proposed activity with the use of digital Brain School games. The qualitative data reinforce this position, emphasizing the act of playing by the children as what they had liked the most in the interaction with the Brain School, to strongly emphasize the learning of mathematical knowledge.

In addition, studies indicate that interaction with digital games provides the enhancement of cognitive abilities linked to learning as well as the exercise of executive functions and mathematical skills. In this sense, cognitive skills such as attention and problem solving are related to higher levels of motivation. Many authors investigate this relationship between the use of digital games and the exercise of cognitive abilities, demonstrating potentialities in the field of education.

Thus, the school as a learning space needs to be attentive to the potentialities of the use of digital games. In

this way, the importance of this use is emphasized to favor more interesting and motivating learning, besides exercising the students' cognitive abilities, expanding the possibilities in educational contexts.

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Entrepreneurial Disposition in Brazilian University Students

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ABSTRACT

Higher education is universally recognized as a key pillar in the construction of new knowledge economies. The Brazilian university, in general, does not explore its potential to inspire and stimulate students' ambition and innovation. Is there any neglect in the willingness of young university entrepreneurs to promote economic development and consolidate knowledge transfer? This study aims to analyze how the entrepreneurial intention of Brazilian university students behaves. The field of investigation is the Junior Companies of the country, whose use of the Modeling of Structural Equations represents the method of investigation. The study met the statistical criteria for its validation, in addition to presenting a moderate adjustment index explaining 64.9% of the entrepreneurial intention with only one rejected hypothesis. The findings of this research suggest gaps in the performance of government and universities in promoting entrepreneurial education and have implications for entrepreneurship scholars, universities, and policy makers.

Keywords: Entrepreneurial Intention. Academic Entrepreneurship. Junior Enterprise. Theory of Planned Behavior.

1. Introduction

The ability to undertake has become as important as necessary in the face of transformations in the global economy. In Brazil, the fluctuation in the balance of formal employment, which has recently declined in three consecutive years (2014-2017), together with the considerable informal employment rate, which in large part contributes to a reduction in the unemployment rate in the country, but are a scenario in which entrepreneurship becomes a determining factor of employability for the individuals who complete the university.

This is all the more significant in considering that approximately two-thirds of the young population in developing countries are either unemployed or in low-quality jobs, or not working and not studying (ILO, 2017). This fact shows a waste of the economic potential of these countries and exacerbates social risks.

Thus, it's possible to perceive a demand in the preparation of the young person for the labor market through education, understanding as essential the demand for changes in the conjuncture of the Institutions of Higher Education (HEI), as a starting point of this trajectory, in order to promote and to arouse in the students the spirit, the motivation and the entrepreneurial formation in order that they become able to construct their own space in the work market, and instead of depend on the economic condition of the country, they start to contribute for that she present good results and reach global prospects.

Welch (2011, p. 331) points out that higher education "is universally recognized as a key pillar in the construction of the new knowledge economies of the 21st century," and that it has been increasingly challenged to demonstrate its contribution together with economic and social development by today's society, also known as the knowledge society (Audretsch, 2014; Etzkowitz, 2013).

Although around the world, several universities already recognize the role and power of entrepreneurship education on innovation and economic development of countries, in Brazil this scenario is still immature. As explored in the research conducted in 2016 by Endeavor and SEBRAE, which was attended by 2230 students and 680 professors from more than 70 HEIs from all regions of the country, the understanding is that the Brazilian university, in a way general, does not prove to be active in the market and the community, and does not exploit its potential to inspire and stimulate ambition and innovation in university entrepreneurs. For the study, the student's entrepreneurial profile is largely similar to that of the average Brazilian entrepreneur, demonstrating that the institution is not exerting transformative influence on the student or is not the main reason for it to have a disruptive profile.

Thus, the relevance of discussing the correlation between employability and academia is evident, given the lack of policies and strategies that contribute to the transformation of Brazilian universities into entrepreneurial ecosystems and, therefore, also serve as the engine of economic development in Brazil. region in which it operates. The challenge is to know how to promote the necessary skills and entrepreneurial skills in people, so that they can act in this scenario in which they become protagonists of activities and entrepreneurial actions (Souza, 2015).

In the light of this perspective, entrepreneurial intentions are fundamental to understanding entrepreneurship (Schlaegel & Koenig, 2014), since they correspond to the first step in the process of discovery, creating and exploiting opportunities (Kolvereid, 2016).

Some studies have been developed with a focus on entrepreneurial intent (Liñán & Fayolle, 2015; Schlaegel & Koenig, 2014; Souza, 2015) and other studies (Liñán, Rodríguez-Cohard & Rueda-Cantuche, 2011; Miranda, Chamorro-Mera & Rubio, 2017) employed and confirm the usefulness of Theory of Planned Behavior (TPB), developed by Ajzen (1991), which seeks to predict and explain the behavior of the individual in specific contexts.

However, despite this diversity of research, there is a shortage of studies that explore the entrepreneurial intention of Brazilian university students already involved in an initiative that is conducive to the development of entrepreneurial skills (Pennarola, Pistilli & Dawson, 2016), which is the case of Junior Company (EJ). Thus, this research aims to answer the following question: How do the factors of the TPB influence the formation of the entrepreneurial intention of the students linked to the Junior Company in Brazil?

Although there may be factors that imply intentions to undertake, there are provisions in Junior Enterprises (EJ) experienced as actual behavior that may be relevant to the foreshadowing in undertaking. That is, it is considered that entrepreneurial intentions can be seen as a willingness of university students to experiment or propose some effort in exercising or forming their own business plan. Thus, in this way, a new business emerges as well, and can be considered as a result of intentions whose entrepreneurship represents a planned and intentional behavior (Liñán & Chen, 2009).

Based on the evidence that universities foster academic university students for professional purposes, it's necessary to understand the intentions of these early potential entrepreneurs so that it may be possible to know what factors stimulate them to entrepreneurship. Hence the need to respond to the identified gap through the research problem.

In this context, the objective of this work is to analyze how the entrepreneurial intention of Brazilian university students linked to EJ behaves through the Modeling of Structural Equations (MEE).

For this, a study was conducted with 445 EJ students in Brazil and the data collection instrument used is a questionnaire used by Souza (2015) based on Ajzen's TPB (1991) and adapted by Liñán & Chen (2009) with psychometric scale adjusted by Liñán, Urbano and Guerrero in 2011.

The main contribution of this study lies in the lack of academic decisions, which lack empirical evidence at the university level, regarding the entrepreneurial intentions of scholars through EJ, because they are prone to new business creation. In addition to evaluating the willingness to undertake, the present study also examines the behavioral effect of entrepreneurial intentions in the JE because it deals with real business gestation activities, capable of providing an understanding of possible influences of prospective factors in these intentions.

The article is structured as follows: a) first, there was a review of literature on intentionality and its determinants, and; b) the model of entrepreneurial intentions based on theory and behavior is presented; c) in the following section, the procedures and research methods are described; d) and, later, presenting the results of the hypothesis tests; e) Finally, the article concludes with discussions, implications, limitations and future research opportunities.

2 Theoretical background and hypotheses

In seeking to develop a general theory of entrepreneurship, Shane (2003) suggested that the discovery of opportunities depends on access to information and the characteristics of opportunity recognition (eg, intelligence).

According to the European Commission (2006, p. 4), "entrepreneurship refers to the individual's ability to turn ideas into action. It includes creativity, innovation and risk acceptance, as well as the ability to plan and manage projects to achieve goals. " Considering that university students act not only on creativity, but also an important prerequisite for entrepreneurship, there are also means of applying what they perceive in the university under the supervision of even teachers. With this, they are expected to become more confident in undertaking the moment their practices can be tracked and orchestrated by the educational institution through Junior Business (EJ).

In a meta-analytic review involving 73 studies, Bae et al., (2014) observed a significant, albeit small, correlation between entrepreneurial education and post-education entrepreneurial intentions, which is the case with the application of knowledge via EJ and what is expected of the students after this opportunity to undertake.

In this context, it is known that the motivation of the initial entrepreneurs can occur by necessity or opportunity. Regarding the object of this study, what is configured is the opportunity to undertake. GEM (2016) defines entrepreneurs by opportunity as capable of identifying a business opportunity or niche market, undertaking even having competing alternatives of employment and income. It was evidenced in their study that the proportion of entrepreneurs by opportunity in 2016 was higher in groups of countries driven by innovation, and that present higher levels of socioeconomic development. Brazil ranks in the efficiency-driven groups of countries, according to the Global Competitiveness Report (GDP per capita and the share of exports of primary goods), presenting the value of 57.4% for the Entrepreneurs by Opportunity, while innovation-driven countries such as Sweden and the United States had 89.0% and 87.5%, respectively. In addition, Brazil reached the 64th place in 2018, among 126 economies listed in the world ranking of innovation prepared by Cornell University, together with the business school Insead and the World Intellectual Property Organization.

However, it can still be inferred that there is a high index of entrepreneurs by necessity in Brazil, and this reflects in a significant part of the population that undertakes to survive, a reflection of the economic crisis and consequent high unemployment rate, develop businesses with low innovation and technology, generating a minimum of wealth and jobs. In a more robust view, it can be added as a reflex, the low level of schooling in the country, which does not contribute to the entrepreneurial formation and the proactive profile of these professionals.

However, there are several studies that advocate the importance of promoting entrepreneurship in order to stimulate economic development and job creation (Degen, 2009; Van Praag & Versloot, 2007). In particular, education for entrepreneurship has been considered as one of the main tools to increase the entrepreneurial attitudes of springs, and potential entrepreneurs (Potter, 2008; Liñán et al., 2011). In this regard, Etzkowitz (1983) used the term entrepreneurial university to define educational institutions that have become critical of regional economic development.

On the other hand, China, highlighted as a fast-growing economy, has given significant importance to entrepreneurship education. The Chinese government, starting in 2014, has adopted a strategic initiative in the country to stimulate entrepreneurship and innovation in order to promote economic growth in a continuous and sustainable way. As Chinese educational institutions, particularly universities, are the precursors to developing and implementing innovative systems (including changing teaching curricula for higher education), offering education for entrepreneurship (MyCOS, 2018). This action aimed to promote the entrepreneurial competence of young people and their attitude and intention to make choices for entrepreneurial career.

This has also been reported in some studies, where Fayolle & Liñán (2014) have pointed out that the results of empirical research reveal significant differences in attitudes and intention levels of students participating in entrepreneurship education programs and those who do not participate.

Understanding intentions, according to Salhi (2018), helps to understand the phenomena and behaviors associated with entrepreneurship, and in turn, behavior being a direct function of intention.

In the context of entrepreneurship, a new business arises over time and involves considerable planning, so it's exactly the type of planned behavior (Bird Model, 1988), for which the models of intention are adequate (Saeed et al., 2015). It's noteworthy that the intention to create new businesses proved to be a fundamental, long-term and frequently used construct in entrepreneurship research (Carr & Sequeira, 2007).

There is the theory of planned behavior proposed by Ajzen (1991), who in principle considers that all social or human behavior is motivated, controlled and planned. In this aspect, Salhi (2018), emphasizes that the behavior can be explained through the intention to adopt it, where any behavior requires some planning realized by an intention. Therefore, the creation of a company stems from the intention to adopt a planned behavior.

Several theoretical contributions support Ajzen (1991) theory of planned behavior, which in the face of other theoretical results have revealed that there is an entrepreneurial intention in predicting behavior (Ajzen 1991; Choo & Wong 2009; Pihie & Akmaliah 2009; Kim-Soon et al., 2013, Salhi, 2018). They emphasize intention as the main factor that explains the entrepreneurial behaviors in different contexts, which in the case under study, refers to the intention originated in EJ.

For Fayolle & Liñán (2014), three main models serve as a guide for understanding the development of entrepreneurial intentions: Bird Model (1988), Shapero & Sokol's Entrepreneurial Event Model (1982), and Theory of Ajzen Planned Behavior (TPB) (1991). However, TPB is more structured (Liñán et al., 2011), and has become the dominant model of attitude-behavior relations, corresponding to the most influential model to date (Schlaegel & Koenig, 2014; Fayolle, 2015).

Regarding this model, Ajzen (1991, 181) already advocated that: "Intentions are taken to capture the motivational factors that influence behavior and are indications of how people are willing to try, how much effort they are planning to engage in in order to perform the behavior".

In summary, in TPB the behavior of a person is immediately determined by the intention to execute (or not) this behavior (Miranda, Chamorro-Mera & Rubio, 2017) which, for Ajzen (2002) is guided by behavioral, normative and control beliefs. Therefore, the formation of Entrepreneurial Intent (IE) to perform a behavior is determined by three independent variables: Personal Attitude (AP), Subjective Norms

(NS), and Perceived Behavioral Control (CP), in which the relationship between these three elements and EI grow proportionately, which in turn predict behavior (Ajzen, 1991).

Given the relevance identified in the literature, this article intends to apply the model used by Souza (2015), for being adapted and considering what the dominant attitude-behavior model advocates, based on the TPB discussed by Liñán & Chen (2009). psychometric scale adjusted by Liñán, Urbano & Guerrero in 2011. The following are the factors that will be investigated as explanatory variables of IE.

2.1 The influence of Personal Attitude (AP) on entrepreneurial intent:

By AP, the degree to which the individual holds a personal assessment of entrepreneurship, including affective and evaluative considerations (Liñán & Chen, 2009), in synthesis refers to the individual's impression of being an entrepreneur.

For Schlaegel & Koenig (2014), an increase in this attitude must have a positive influence on the individual's desire to carry out the behaviors related to the founding of the company itself and achieve the goal of becoming an entrepreneur. People dedicate effort and time to entrepreneurship if they perceive that this activity is positive and professionally stimulating, or if they are aware of the marketing potential of their research (Goethner, Obschonka & Silbereisen, 2012).

Therefore, it's understood that positive attitudes towards entrepreneurship will positively affect the personal attractiveness of starting the business itself. Thus, the following hypothesis is postulated:

H1: Personal Attitude will have a positive and significant relationship with the entrepreneurial intention.

2.2 The influence of Perceived Behavior Control (CCP) on entrepreneurial intent:

The variable CP is seen as the perception of the ease or difficulty of starting a business and its capacity to undertake (Ajzen 2002; Liñán & Chen, 2009; Saeed et al., 2015), similar to the concepts of perceived viability (Shapero & Sokol, 1982) and Bandura (1997) self-efficacy, insofar as they are concerned with the perceived ability to perform behavior (Ajzen, 2002). In general, literature tends to agree that perceptions of control are positively related to the intention to become an entrepreneur (Schlaegel & Koenig, 2014).

Considering that entrepreneurial intentions still depend on the personal convenience of entrepreneurship (personal attitude), from the perceived social acceptance of entrepreneurship to a normative reference group (social norms), there is therefore concern about the perceived viability of becoming an entrepreneur (perceived behavioral control). The latter being theorized in the TPB to influence behavior, expressing that a person's intention can only lead to real behavior if he feels able to perform the behavior in question. Therefore, perceived behavioral control plays a dual role in the TPB model, shaping intentions and interacting with them to affect behavior together.

Associated with this fact, it has been that the experimental learning emphasizes the transformation of the experience in knowledge, that in the case in study, the students count on the opportunity to learn doing, under the context of the education for the entrepreneurship, since they are in a university that has EJ. In turn, it attributes experiential learning, which includes a wide range of experiences for students, enabling them to experience the real world through entrepreneurial activities, promoting business and working with real entrepreneurs to assist their business ventures. In this aspect, there is the perception of control and intention to become entrepreneurial on the part of the students in the EJ. With this, students are expected to become more creative and innovative in their thinking and problem solving applications, leading to

perceived behavior in a positive way (Ajzen, 1991; Maes, Leroy & Sels, 2014; Bandera, Collins & Passerini, 2018; Canziani & Welsh, 2019). These discussions lead to the following hypothesis:

H2: The Perceived Behavior control will have a positive and significant relationship with the entrepreneurial intention.

2.3 The influence of Subjective Norms (NS) on entrepreneurial intention:

NS refers to the social pressure exerted on the individual to become or not entrepreneur, coming from his social circle. The values and norms maintained by these individuals and this social pressure directly influence their intention (Ajzen, 1991).

An individual's perception of positive expectations about starting a venture of his own will encourage him to form favorable perceptions of the behaviors necessary to achieve the goal of becoming an entrepreneur, and consequently negative expectations will create unfavorable perceptions of the suitability of these behaviors.

However, there are effects of social pressure that must also be considered as perceptions of entrepreneurship, and it is necessary to decipher problems and contemplate them in the business plan, including in occasions where it involves education for entrepreneurship, as is the case of incubators where it's also the ability to transform perceptions into actions (Chen et al., 2018). Even if this effect may be opportune, it's still necessary to consider, according to Krueger, Reilly & Carsrud (2000) the "subjective norms" of the planned behavior, so that even if the perception of behavior and its planning is desirable and opportune, it is necessary to consider as a premise to its fulfillment (or violation) existential social norms, capable even of increase or decrease the expected satisfaction under a given business to undertake.

Other studies in academic entrepreneurship also considered that the social environment exerts influence on the entrepreneurial intention of the individual (Bercovitz & Feldman, 2008; Obschonka et al., 2015). Therefore, we hypothesize that:

H3: The Subjective Norms will have a positive and significant relation with the entrepreneurial intention.

2.4 The Influence of Subjective Norms on Personal Attitude and Control of Perceived Behavior

Few studies that analyze the correlation between NS and PA and between NS and CP are found. The highlights are for Liñán (2008), Liñán & Chen (2009) and Souza (2015), which are used as reference to the model applied here.

Linñán & Chen (2009) obtained among the results of their study that the main influence of the NS was exerted through its effects in the AP and CP, obtaining significant paths for the respective hypotheses tested. There may be reasons to consider that NS have an effect on PA and PC. When individuals realize that the people whom they consider relevant would approve of their decision to become entrepreneurs, they would be more attracted and would feel more capable of accomplishing it satisfactorily. Therefore, the last hypothesis arises:

H4: Subjective Norms will have a positive and significant relationship with Personal Attitude.

H5: Subjective Norms will have a positive and significant relationship with Perceived Behavioral Control.

3 Method

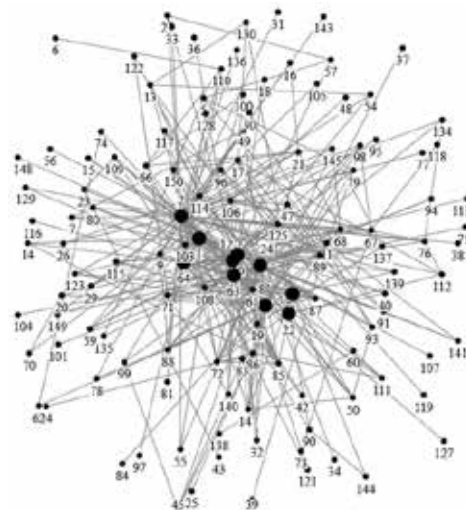
In order to reach variability and representativeness, the IE analysis has as object the population of the students that compose the Junior Companies because they are considered motivated to undertake. In this analysis, a quantitative approach is taken by virtue of the measurement and statistical analysis of population data. It is defined as a descriptive study for describing characteristics of a given population (Collis & Hussey, 2014) and explanatory, for attempting to establish relationships among variables, using standard methods of data collection and analysis. By using questionnaires, this work is configured as a survey.

The Web of Science, Science Direct and Scopus databases were searched for credibility, quality and quantity of publications and citations, directing research in three different combinations of keywords: "Entrepreneurial Intention", "Academic Entrepreneurship" and "Entrepreneurial Intent". The survey allowed to delimit and deepen under the object of the IE study, whose empirical focus is the Brazilian university students. The collection of articles in the databases did not limit a specific period, although the preference for readings and analyzes of the most cited and current articles was adopted. Only journal articles were considered, since they were recognized as a validated knowledge (Podsakoff et al., 2005).

From this, 268 articles were obtained, and after reading the abstracts, those that have a scope aligned with the object of the study remained, totaling 150. Thus, it was possible to elaborate a network of authors (Graph 1), relating the citations of each article which reflect the interconnection between the researchers and the conjunctions between the scientific conceptions (Kraus et al., 2014), therefore, his analysis reveals the central names that denote recognition in academia.

Graph 1: Network of

authors



Source: Authors.

Access to the population of Brazilian university students was made through contact with federations and / or electronic pages of the JS and also in the Brazilian Confederation of Junior Enterprises (Brazil Júnior). In September 2018, 651 EJs were mapped representing the population of this research. The data collection process was performed through the survey monkey platform and sent by e-mail to the members of these 651 EJ and requested distribution among the other members. The sample of students who answered consolidated in 445.

The applied questionnaire is composed of two blocks, with Block 1 responsible for raising the "Profile of the Respondents" and Block 2 "Measures of Elements of the Model of Intent", where it has 20 objective assertions that address the analysis variables, according to the adaptation of the questionnaire of Liñán (2008). The adopted version consisted of the first part of the data collection instrument, which refers to the psychometric scale used in the perspective of the TPB, with a free translation initially applied by Souza (2015). In the questionnaire was used a seven-point Likert scale that seeks to obtain students' perceptions regarding the latent variables of the model.

It's worth noting that in the data tabulation, the acquiescence bias was considered, which is the proposal of the modified version developed by Liñán (2008) and Liñán, Urbano & Guerrero (2011), in which some items were redrawn.

The method of quantitative approach employed is based on the Modeling of Structural Equations (MEE) used to test the hypotheses of causality between the variables. Based on the theoretical approaches and assumptions raised, four primary constructs that influence EJ entrepreneurship are indicated: i) AP, ii) CCP, iii) IE, iv) NS.

SmartPLS software, version 3.2.8 was used for the modeling application. The MEE was used to estimate the relationships between the constructs and their unobserved latent indicators. Finally, the structural model is adjusted and verified by adjusting the fit.

Regarding the characterization of the sample, it was considered that the minimum number of observations is between five and ten respondents for each variable (Hair et al., 2014). For the applied questionnaire composed of 20 assertions, the sample obtained from 445 students is 4.45 times larger than the minimum required, and is therefore satisfactory.

In addition to a brief descriptive analysis of the data, the PLS-SEM (or, PLS-MEE), which is a non-parametric statistical method, is not required to be distributed normally. Hair et al. (2014) emphasize that it is important to analyze how distant the "normal" data are, since they may prove problematic in the assessment of significance if they are extremely "non-normal". For this analysis Hair et al. (2014), use asymmetry and kurtosis, which in terms of reference values, the authors evaluate that both kurtosis and asymmetry should have results between -1 and +1. As for Maroco (2014), absolute values of asymmetry <2 and kurtosis <7 do not indicate a violation of normality. When analyzing the data obtained through the SmartPLS, it is observed that the highest and lowest values for the asymmetry were -0.01 and -1.68, respectively, whereas for kurtosis the results in the same order were 2.44 and -1.19. In order to avoid extremely non-normal data that could distort the results of the multivariate analysis, it was decided to eliminate the variable P_5 (Figure 1), because it presents a kurtosis value greater than 2.

From the defined descriptive parameterizations, therefore, a multivariate analysis was used using the Structural Equation Modeling (MEE) method.

In the theoretical or reflective model considered in this research, the systematic evaluation of SEM results and partial least squares involves, according to Hair et al. (2014), the analysis of the measurement and structural model. The main indexes that evaluate the quality of the models suggested by Hair et al., (2014) are presented in Table 1 with their respective reference values.

Table 1: Statistical Parameters

Parameters	Reference Values
Cronbach Alpha	> 0,60
Compound Reliability	Between 0,70 a 0,90
AVE	> 0,50
Discriminating Validity	Cross loads should have higher external loads in their respective constructs than in the others. The square roots of the AVEs should be larger than the correlations of the constructs (Criterion of Fornell and Larcker).
VIF	<5
R ²	Between 0 e 1
T value	>1,96 (to level of significance = 5%)
P value	< 0,05
f ²	The f ² values indicate a small (0.02), medium (0.15) or large (0.35) effect.
Q ²	The Q ² values indicate a small (0.02), medium (0.15) or large (0.35) effect.

Source: Adapted - Hair et al. (2014).

Before starting with the measurement model, it was necessary to perform a recoding of the responses obtained for the variables that were inverted in the questionnaire in order to reduce the tendency of respondents to agree with the statements. Following the importation of the data into the SmartPLS, the measurement model was constructed based on the theoretical model adopted (Figure 1).

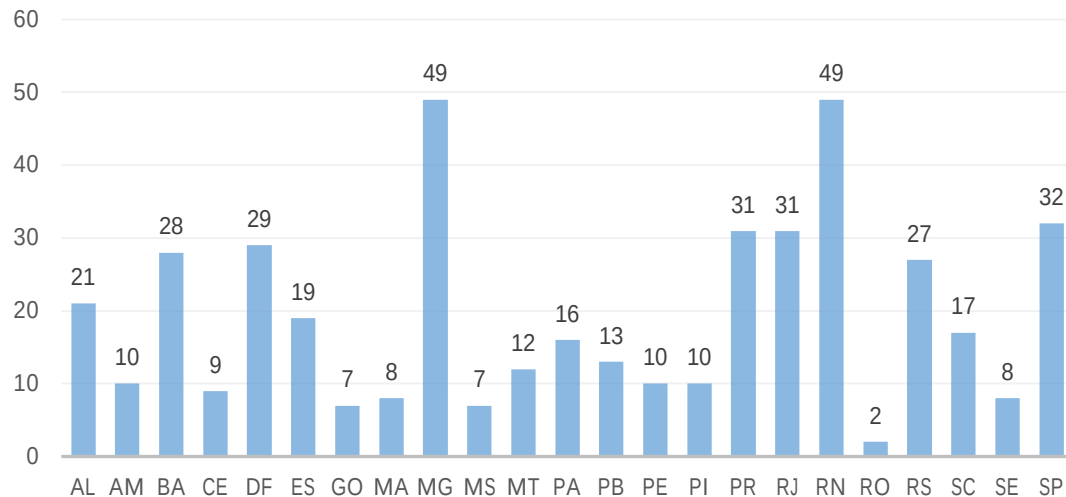
For Maroco (2014), the measurement model defines how the constructs or latent variables are operationalized by observed or manifest variables. In the theoretical model, the direction of the arrows is of the construct for the variables, indicating the assumption that the construct is responsible for the measurement of the indicators (Hair et al., 2014).

4 Results, Analysis and Discussion

Analyzing the profile of the respondents, they have to be aged between 18 and 35 years, with the highest concentration of them between 20 and 22 years (65.1%); 13.3% reported having between 18 and 19 years, and the remaining 21.6% between 23 and 35 years. They are distributed among 114 different HEIs and 317 EJs in various regions of the country, according to Graph 2.

Regarding the gender, 52.8% are male, 46.3% are female, and 0.9% are non-female. A reasonably superior representation of men is observed, which is a characteristic of the entrepreneurial profile in Brazil.

The sample is made up of students from 22 states and the Federal District, according to Graph 2. The only missing states correspond to Acre, Tocantins, Amapá and Roraima, the latter two of which were recently confederated to Brazil Júnior, and therefore, the Junior Firm Movement in these states is in a developmental stage. Acre and Tocantins also have low representativity, with one and three EJ mapped, respectively.

Graph 2: Distribution of the Sample by State

Source: Authors.

Analyzing the result of the Average Extracted Variances (AVE), it can be seen in Table 1 that the value was less than 0.5 for the CCP construct, demanding the adjustment. In order to reach the reference value, external loads less than 0.7 were considered as the exclusion parameter until reaching the AVE limit (> 0.5).

According to Hair et al. (2014), indicators with external loads between 0.40 and 0.70 should be considered for scale removal only when the exclusion of the indicator leads to an increase in WC or stroke. Thus, the variable P_16 (Figure 1) that had the least external load (0.516) was taken. The values for the indicators of quality and convergent validity are presented in Table 1.

Table 1: Criteria related to quality and convergent validity

Construct	Cronbach Alpha	Compound Reliability	AVE
AP	0,839	0,886	0,609
CCP	0,687	0,807	0,512
IE	0,849	0,888	0,571
NS	0,731	0,846	0,649

Source: Authors.

When convergent validity is reached, the reliability of the internal consistency should be analyzed by Cronbach Alpha (CA), which provides an estimate of the reliability based on the intercorrelations of the variables of the observed indicators. Considering that values of AC above 0.60 and 0.70 are considered in exploratory research, it is observed that this criterion was also met.

Next, it is observed that the Composite Reliability is also within the reference limit. In relation to the criterion of Discriminant Validity (DV) by the method of Fornell and Larcker. For Fornell and Larcker (1981), the DV examines whether the observable variables of a construct relate to other constructs in the model. The results showed, in Table 2, the lack of DV for the IE construct.

Table 2: DV - Criterion of Fornell and Larcker

	AP	CCP	IE	NS
AP	0,780			
CCP	0,408	0,716		
IE	0,805	0,521	0,756	
NS	0,349	0,373	0,325	0,806

Source: Authors.

Therefore, it is necessary to make an adjustment, excluding variables following the parameter of the smallest difference in the cross factorial loads. Thus, P_19 (Figure 1) presented the smallest difference (0.069) between the constructs, and therefore was excluded from the model.

After this withdrawal, new values were obtained superior to the correlations of the constructs with other latent variables, according to the criteria of Fornell and Larcker.

In order to complete the DV and verify if the measurement model is adjusted, it was observed that cross loads are having higher factor loads in their respective constructs. Following Hair et al. (2014), since the model is considered to be reliable and valid, one should proceed with the analysis of the structural model. Before starting the analysis of the structural model, Hair et al. (2014) point out that it is necessary to evaluate collinearity (VIF), since the path coefficients can be biased if the estimate involves significant levels of collinearity between the predictor constructs. All variables presented VIF values lower than limit 5, therefore, it is understood that the criterion was met.

The first analysis related to the structural model is related to the path coefficients, which represent the hypothetical relationships between the constructs and have standardized values between -1 and + 1, so that values close to +1 represent strong positive relations and vice versa for negative values (Hair et al., 2014). Considering Table 3, it is observed that the relationship is stronger positively between the AP and IE (0.670), whereas between NS and IE the correlation is non-existent (-0.001).

Table 3: Test Result for Significance of Path Coefficients

	Original Coefficient	Test t	p value
AP -> IE	0,670	243,108	0,0000
CCP -> IE	0,256	73,055	0,0000
NS -> AP	0,351	84,763	0,0000
NS-> CCP	0,373	81,160	0,0000
NS -> IE	-0,001	0,0372	0,9703

Source: Authors.

In addition to the size of the coefficient, it's pertinent to interpret its total effects, that is, the intensity with which the exogenous NS construct ultimately influences the target variable IE through the AP and CCP mediator constructs. The total effect of NS on IE was 0.330, higher than the direct effect of CCP (0.256) and lower than that of AP (0.670).

Also regarding Table 3, the statistical significance of the path coefficient can be verified from Test t , where all coefficients are statistically significant at the 5% level, except for the correlation between NS-IE ($t = 0.0372$). We can also use p -value for significance analysis, which shows that all correlations are significant, except for the relation between NS-IE ($p > 0.05$), and, therefore, this hypothesis should be rejected, confirming what had already been found in the analysis of Test t .

In this study, we evaluated the effects of the exogenous latent variables on the endogenous latent variable (Hair et al., 2014), which corresponds to a measure of predictive accuracy and represents the combined effects of exogenous latent variables. The values of R^2 and R^2 adjusted for AP (0.124, 0.122), CCP (0.139; 0.137) and IE (0.654; 0.641), suggesting a small, moderate and large effect, respectively, were obtained.

In relation to the effect size or utility indicator for the model construction (f^2), this measure corresponds to another way of evaluating the effect of altering R^2 (Garson, 2016), and allows to analyze the relevance of the constructs in the explanation of the selected endogenous latent constructs. Table 4 presents the values of f^2 , where it is verified that the construct with the greatest explanatory power was the AP ($f^2 = 1.017$), suggesting a very relevant value in the size of the effect on the latent variable IE.

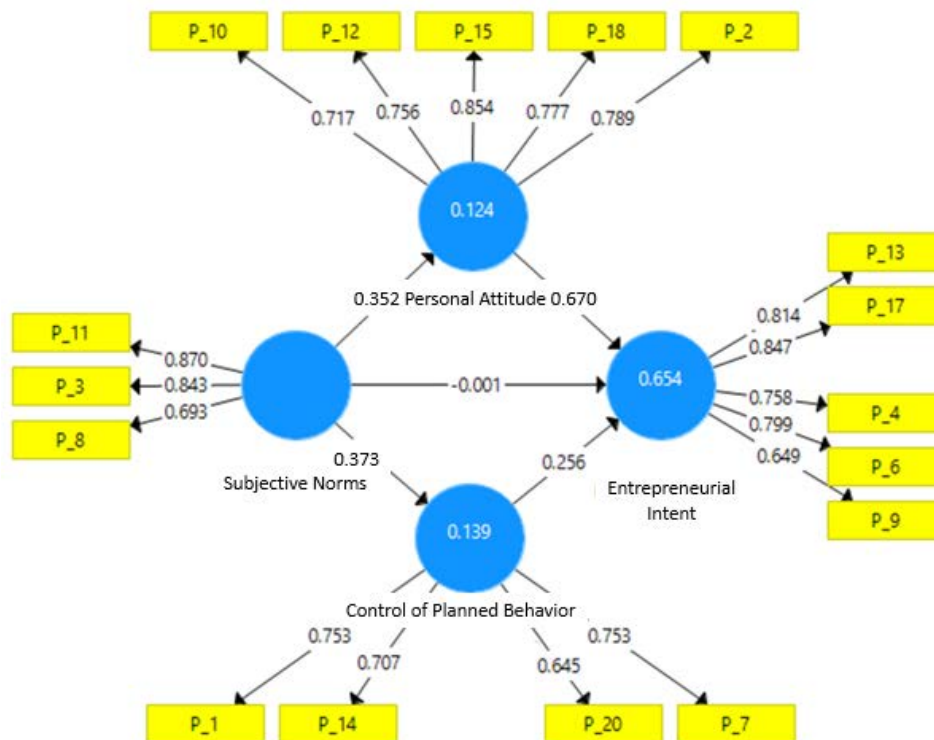
Table 4: f^2

	AP	CCP	IE	NS
AP			1,017	
CCP			0,146	
IE				
NS	0,141	0,162	0	

Source: Authors.

Finally, in relation to Q^2 , Hair et al. (2014) and Garson (2016) point out that there are two versions of Q^2 , redundancy and commonality, so that while redundancy is calculated only for endogenous variables, commonality is calculated for all constructs and indicators. In addition, the commonality coefficients are higher than those of redundancy, and their calculation is performed without the knowledge of the path model, based only on the construct scores. However, the redundancy calculation is based on both the structural model and the data prediction path model estimates, and therefore, this analysis is more appropriate and recommended for the PLS-SEM approach (Hair et al. 2014).

With the obtained data, it can be seen that the endogenous factor IE (0.3667) has a high degree of predictive relevance, whereas there is a small to medium effect for the constructs AP (0.0682) and CCP (0.0647). Thus, it can be said that all constructs have $Q^2 > 0$, providing support for the predictive relevance of the model in relation to latent endogenous variables. Figure 1 summarizes the adjusted measurement and structural model.

Figure 1: Measurement Model and Structural Adjustment

Source: Authors.

The H1, H2, H4 and H5 hypotheses were accepted for validation, whereas H3 was rejected because it did not reach statistically significant coefficients, presenting values $t < 1.96$ and $p > 0.05$ to a significance level of 5%.

In detailing the analysis for each hypothesis, in Figure 1 it's possible to visualize, in relation to H1, that the AP presents positive relation (0.670) and significant in IE, implying the greatest effect among the constructs of the model, and this explains 12.4% of its variance thanks to the contribution of NS. Therefore, it is understood that the students evaluate in a positive way the decision to become an entrepreneur. The low percentage indicates that the scenario for entrepreneurship requires greater strengthening, either through universities or through public policies, so that this attitude can be amplified and consequently there is a positive influence on the individual's desire to perform behaviors related to foundation of the company itself and achieve the goal of becoming an entrepreneur.

In this context, Krueger, Reilly & Carsrud (2000) point out that policy makers benefit from the understanding that government initiatives will affect business creation only if such policies are perceived in a way that influences attitudes or intentions. In other words, it is noted that robust empirical support argues that the promotion of entrepreneurial intentions requires the promotion of perceptions of feasibility and convenience.

The validation of this hypothesis corroborates with several studies that applied the TPB for IE analysis, such as Línñān & Chen (2009) with university students in Spain and Taiwan (with explained variance of 19.2%); for Moriano et al. (2012) with students from Germany, India, Iran, Poland, Spain and the Netherlands; and also for Karimi et al. (2016) with students from six Iranian universities.

As far as H2 is concerned, it can be observed that it reached a positive effect (0.256) in the EI and significant ($t = 73,055$ and $p = 0,0$), and the adjusted model explains in 13.9% the variance of the CCP construct also influenced by NS, which indicates that there is entrepreneurial behavior in students. However, this percentage indicates that there is still space to be effectively worked out, the training and the necessary knowledge to the students to start their own business, which can be achieved through disciplines and programs that provide theoretical background and possibility to put in practice this knowledge, bringing students closer to the real world.

In light of this perspective, Segal, Schoenfeld & Borgia (2007) argue that entrepreneurship education can play a significant role in the development of entrepreneurial self-efficacy by applying appropriate educational activities and teaching methods. In addition, Saks & Gaglio (2002) point out that the identification of opportunities can and should be taught, and it is even recommended to be a central theme in programs aimed at training future entrepreneurs.

In addition, self-efficacy can be built and strengthened in four ways: experience of mastery or repeated performance, vicarious experience, verbal persuasion, and judgments of one's own physiological states such as arousal and anxiety (Bandura, 1997).

This finding is also shared by Liñán & Chen (2009) in which CCP was the most relevant predictor (0.579) in IE of Taiwanese students (with explained variance of 15.4%) and by Iranian students studied by Karimi et al. (2016). While Moriano et al. (2012) found similar results to this research in the sense that in all cultures analyzed, AP was the strongest predictor of IE followed by CCP.

It should be noted that this difference in research can be explained by the fact that in Brazil only about 38.8% of the universities offer programs or initiatives focused on entrepreneurship, according to research conducted by Endeavor and Sebrae in 2016, which reflects the fact of which only 57.4% of Brazilians undertake by opportunity (GEM, 2016), making Brazil far from the countries driven by innovation.

As for H3, it was observed that with the results obtained, it was not possible to support this hypothesis, which showed an effect of approximately zero ($-0,0001$) in the IE, and values $t < 1.96$ (0.0372) and $p > 0.05$ (0.9703) for a significance level of 5%, and was therefore not statistically significant. In view of this, it is understood that the social pressure perceived in carrying out or not an entrepreneurial behavior for the students who are part of EJ in Brazil does not influence the intention to undertake.

In the literature this finding is consistent with results from several studies. For example, Liñán & Chen (2009) and Maresch et al. (2016) with Austrian students of sciences and engineering distributed in 23 IES. In this context, Armitage & Connor (2001) also point out that the NS construct is generally considered a weak predictor of intentions.

Complementarily, Moriano et al. (2012) identified that NS appeared to be the least important predictor of IE among students in all cultures and the only predictor. On the other hand, Karimi et al. (2016) found positive and significant effect of NS on IE.

As justification for not supporting the H3 hypothesis, Krueger, Reilly & Carsrud (2000) and Maresch et al. (2016) emphasize that the generally weak influence of NS may be related to the idea that in individual thinking it can be confused with other attitudes (because NS is positively correlated to both act and perceived viability). Similarly, Armitage & Connor (2001) attribute this effect in part to a combination of precarious indicators and the need to expand the normative component.

Another relevant factor may be due to the fact that the young public is characterized by making career decisions based more on personal (attitudes and self-efficacy) rather than social (NS) considerations or it's still possible to have cultural differences in importance of NS in economic activity (Krueger, Reilly & Carsrud, 2000).

For Liñán & Chen (2009), the main influence of the NS would be exerted through its effects on the PA and the CCP. This is confirmed by hypotheses 4 and 5 below.

Regarding H4, it has a positive effect (0.352) and significant ($t = 84,763$ and $p = 0,0$) at a significance level of 5%. Thus, in Figure 1 it can be noticed that the NS present positive and significant relation in the AP, contributing to the variance of this one.

Likewise, H5 presented a positive (0.373) and significant ($t = 81.160$ and $p = 0.0$) effect at a significance level of 5%. In this approach, it can be seen in Figure 1 that the made of NS in the CCP corresponds to the second largest in the model.

In view of this, it's observed that although the NS are not significant for IE, they explain the AP and CCP constructs with 0.352 and 0.373, respectively. Thus, the three constructs explain 65.4% of the variance in IE, which is a robust result when compared to other studies, such as Autio et al. (2001), who analyzed IE from Linköping University students in Sweden, Finland University of Technology in Finland and Universities of Colorado and Stanford in the United States, reaching the respective variances: 21.4%, 30.1%, 24, 1% and 35.3%. More expressive results were found later by Liñán & Chen (2009), who obtained 55.5% and Souza (2015) with 57.3%.

5 Final Considerations

This work had as objective to analyze how the entrepreneurial intention of Brazilian university students linked to the junior company behaves, through the modeling of structural equations.

The adopted model is based on the Theory of Planned Behavior and was adapted from Liñán & Chen (2009), which made it possible to form the constructs Personal Attitude, Subjective Norms, Control of Perceived Behavior and Entrepreneurial Intent, and its variables were measured from of the collection instrument made up of the first part of the Entrepreneurial Intention Questionnaire. The sample reached 445 valid answers of students distributed in 22 Brazilian states beyond the Federal District.

Observance of the ESM assumptions indicated the exclusion of the variables P_5, P_16 and P_19. However, the exclusion of these items did not invalidate the model, which was confirmed with 4 constructs and 17 variables. Thus, it was concluded that the measurement and structural model accepted the criteria required for psychometric properties, with positive and significant relationships and that the model was able to explain 12.4% of the AP variance, 13.9% CCP and 65, 4% of EI, reaching, therefore, satisfactory and robust results, superior to the findings of previous researches.

As for the hypotheses delineated, we have that H1, H2, H4 and H5 were confirmed, while H3 was rejected because it did not reach statistically significant coefficients. It was possible to infer that the hypothesis H1 presents the greatest effect and significance in the promotion of IE, and this corresponds to the most explained variable, with R^2 of 0.654 and Q^2 of 0.3676. It is important to highlight the low influence of NS that did not demonstrate direct correlation with IE, as well as findings from previous research.

It's also observed that the target public of the research has a strong enthusiasm to be an entrepreneur, considering it as an alternative for the future, although they do not yet feel totally competent, which can be a reflection of the low effectiveness in the entrepreneurial formation.

Thus, it's possible for IE's research in line with academic entrepreneurship to contribute to the development of more effective educational initiatives aimed at the development and exploitation of the skills of Brazilian university students and, consequently, of society. In partnership with the government, the universities are constantly encouraged in all areas, in order to walk in line with what literature has argued about IE, which plays a very relevant role in the decision to start a new business (Liñán & Chen, 2009).

In this sense, the path of the entrepreneurial university presents itself as an almost inevitable route for the countries that seek development and a more entrepreneurial culture, and consequently a growth in the economy. As in North America, where most of the 3.1 millionaires are entrepreneurs who have won by their own efforts, and in Brazil, due to the existing social inequalities, one sees an arduous and necessary walk (Dornelas et al. 2014).

Therefore, as a practical and academic consequence, it is noted that this research contributed to obtain a knowledge not yet explored of this population, since the research instrument used had national coverage, and thus, it was possible to obtain data that represent a population in the country.

In addition, an empirical demonstration of IE's prediction was obtained through the TPB model in the population of students who are part of an entrepreneurial initiative (Empresa Júnior), contributing to the construction of a representative picture of the Brazilian scenario with studies in other countries. Bearing in mind, however, entrepreneurship education is fast-growing and corresponds to a rising subject in universities around the world, and "its supposed benefits have received much praise from researchers and educators" (Karimi et al., 2016).

In view of this discursive tonic, it is suggested as future work the deepening of the study of the application of the MEE with a focus on new constructs aimed at evaluating the impact of education for entrepreneurship in Brazilian universities, considering also the cultural difference, based on the comparative analysis between students who study in HE with a more advanced entrepreneurial profile versus students of HEI who have beginner or non-existent entrepreneurial education. In addition, the relevance of multi-group analysis with students directly involved in entrepreneurial activities and of potential in technological innovations is highlighted, seeking to evaluate possible significant differences in IE between the different programs, so that from this, institutions and government have a foundation in directing efforts towards initiatives that have the greatest effect on the development of EI.

Finally, there is a gap in assessing the impact of entrepreneurship education on the ability of students to identify real business opportunities. Something that can be investigated through longitudinal studies with alumni who followed their entrepreneurial career and their involvement during the university period in programs focused on entrepreneurship.

Regarding the limitations of this research, it is pointed out that it does not cover all the Brazilian states, as well as the smaller scope of data collection in the North region and in some Northeastern states, which could imply different results in view of the cultural difference between the regions. This is also explained by the fact that the Junior Firm Movement is more recent in the North, and soon there are fewer students engaged in this initiative or with little sensitivity in the participation of research in correlated subjects. The

achievement of an equivalent quantity by region and within the minimum limit necessary for the application of the MEE technique would also provide a Multi-Group Analysis in order to identify possible cultural and social influences in the same population.

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Specialized Educational Service: Mishaps and challenges

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Abstract

inclusive education is still a controversial, non-consensual issue that generates doubts and insecurities for educators. In this sense, this article aims to reflect on the educational reality found by this public, and present the work done by the NAPNE (Center for Assistance to People with Specific Educational Needs) of the Federal Institute of Education, Science and Technology of Rio Grande do Sul Regarding the methodology used, this is a qualitative research, with a theoretical nature, through a literature review of the current legislation and the IFRS Institutional Pedagogical Project.

Keywords: school inclusion; curriculum adaptation; pedagogical practice;

1. Introduction

since the 1990s, significant advances have been experienced for special education, because, taking into account the slowness of this process, a more concrete, participatory and dignified space has been achieved in society and educational institutions for people with disabilities, special needs. However, it is known that for many years these people were excluded and neglected.

even today, inclusive school is the subject of debate and disagreement. Initially, some necessary adjustments have to be taken into account, as school difficulties should be recognized without focusing only on student limitations, but rather on the institution itself. This reflection reveals the most urgent adaptations to be made in order to better serve the special public.

these adaptations are necessary due to the diversity of cases that can be found, and their demands may be very different from each other, especially considering the structure of the federal network, object of this article, which receives students from Basic, Technical, Higher Education and graduate. In addition to these broader adaptations, we also need to prepare to implement curriculum adaptations that are relevant to the individual needs of students.

in the search for learning effectiveness, institutions have provided a differentiated, often personalized service: Specialized Educational Service (ESA). However, many problems present themselves for its implementation, such as lack of infrastructure, lack of trained professionals, time, overcrowded rooms...

aiming to achieve the purpose of a school for all, which also includes these special students, the IFRS Institutional Pedagogical Project (IFRS, 2011) addresses issues related to inclusion and affirmative action, aiming at equal access and permanence of people with specific educational needs.

in view of the above, this paper will address issues pertaining to Specialized Educational Care (ESA), possibilities of implementing this work, issues related to physical space and human resources for the

realization of this process, difficulties and anxieties, and ways to better meet students, who for some reason need some form of adaptation.

this article, built from a qualitative and bibliographic research, addresses these topics, and firstly, a reflection on the ESA, and then shows a brief history of the institution in question, as well as the proposal of care work performed by them.

2. A reflection on specialized educational care

when it comes to learning and school inclusion, many doubts arise and there are many obstacles to this process, such as the lack of teacher training, the lack of accessibility and structure of the school and, furthermore, the lack of commitment of some families that end up for transferring all responsibility to the institution.

in this context, curriculum adaptation emerges as a strategy to find immediate solutions for everyone is right to education, since the Brazilian Inclusion Law, which came into force on January 2, 2016, shows that disability is in the middle and not in people, requiring schools to be prepared to include students with specific educational needs. With this in mind, and having in mind that adapting content and material is not always sufficient, it is necessary to provide extra-individual or group care to facilitate understanding and fixation of past knowledge in the classroom, but at the pace of each individual.

according to Oliveira et al. (2009, p. 103), these attendances may occur outside the classroom, and the teacher, or the professional responsible for the student service, will produce a report to measure their frequency and their progress. They also say, "The teacher's role in his classroom is not limited to activities with students. It is necessary that their pedagogical practice is articulated with the work of other professionals of the school team". For Pasian et al. (2017, p. 973), the success of specialized care also depends on the preparation of the teachers involved. Since there is a set of specificities that require knowledge to work with a particular student, it is necessary that teachers have adequate training for this, and this training needs to be specific for the teacher to be able to enhance the learning of their students, providing the best teaching possible for them.

complementing this idea, regarding the preparation of ESA professionals, it can be said that this is one of the biggest challenges encountered in inclusive education. Many teachers feel unprepared and therefore afraid to face the education of students with special needs, not to mention the lag in the number of students and teachers. The government has been offering distance-learning courses, qualifying professionals to work in the ESA. However, there is still a significant demand regarding both the number of professionals and the way such qualification has happened for the proposal to occur effectively and with quality (Braun and Vianna, 2011, p. 6).

analyzing this limited number of professionals, many schools have the help of their own students, understanding that this service can involve their peers in a process of helping each other learn, learn from each other while teaching, and realize that everyone learns together, although having different goals and processes. Specialized care, as mentioned before, can occur outside the school context, and in view of this, it is possible to affirm that the inclusive curriculum is built through interdisciplinary, projects, thematic axes, transversally, among others, trying to overcome the limits of the organized curriculum by disciplines,

aiming at the significant appropriation of the knowledge that make up the curriculum, associating themes that permeate the various areas of knowledge to the practices of curriculum components. Thus, students are able to understand that the contents complement each other in the relationships of different experiences. Thus, it can be thought that ESA does not necessarily take place in a private room, but through attitudes and projects that facilitate learning.

3. The Institution – IFRS Campus Ibirubá

in order to fulfill its social function, linking theory and practice, the Federal Institute of Education, Science and Technology of Rio Grande do Sul - Campus Ibirubá was created on June 6, 2009, as Advanced Campus, after the federalization of the Technical School Alto Jacuí. Occupying an area of 101 hectares, the Campus began its activities in February 2010.

aiming to reach the public with special needs, the institution has the Nucleus of Assistance to People with Specific Educational Needs (NAPNE) that works aiming at the inclusion of any person, with permanent or temporary limitations, that presents cognitive, physical or sensorial disabilities. . The work goes against the search for the “inclusive school”, despite the resistance of fundamental pieces in this educational process, considering its recent insertion in the didactic-methodological discussion circles, and the lack of education for teachers and managers regarding thematic of inclusion.

the IFRS Institutional Pedagogical Project (IFRS, 2011) addresses issues related to inclusion and affirmative action, aiming at equal access and permanence of people with specific educational needs. For this purpose, the principles of inclusive action in the IFRS are listed, which constitute - respect for difference; - equal opportunities and conditions of access, inclusion and permanence; - ensuring free and quality public education for all; - the defense of interculturality; - integration with the school community. NAPNE, in addition to attending to the student and ensuring the principles mentioned above, works directly with the teacher in the construction of curriculum adaptation, assisting in the production of strategies for the success of the teaching-learning process, and shortening the path to materialize a “school for all”. According to Carvalho (2004, p. 29), inclusive schools are schools for all, involving an educational system that recognizes and addresses individual differences, respecting the needs of any student. From this perspective, not only people with disabilities would be helped, but all students who, due to numerous causes, endogenous or exogenous, temporary or permanent, have learning or developmental difficulties.

the fears and insecurity of education professionals are barriers that delay the successful insertion of these students in regular education. In order for the institution to use the term “inclusive school” with merit, it is often necessary to review practices and methodologies, forcing the disengagement of thoughts and the breaking of prejudices.

4. The proposal of implementation of specialized educational attendance (AEE)

the implementation of this type of project, in many cases, makes one think of a room with specific materials, with a multidisciplinary team, a lot of financial, human and time investment. Certainly, this would be the ideal scenario, but most institutions do not have it. In the case of the campus in question, this is the context presented. There is no room available to be intended exclusively for this purpose. Over time, it is hoped

that this will be possible with the completion of other blocks under construction. However, with the current situation, one must think of alternative ways to provide this service, without harming students and teachers. given the current conditions, the Campus has monitoring projects that provide the exchange of knowledge between monitors and students, not only content, but also providing cooperation and solidarity, fundamental values in pedagogical practice, enabling not only the structuring of the individual's knowledge, but, above all, the structuring of the individual as a subject and as a citizen.

the methodology used in this project is associated with the inseparability between Teaching, Research and Extension that seeks to know the cognitive and cultural universe of those involved, and based on this develop interactive and participatory teaching and learning processes, involving many moments of study and research by the monitor to support student activities in ESA.

the intervention is designed and developed from the interdisciplinary perspective, where the monitor and the student have conditions arising from their experience, learning in practice with real life issues and their daily life, combined with the condition of learning theoretically systematized knowledge, enabling give them a globalizing understanding of reality.

the structuring of curriculum adaptations and individualized care provided by Campus teachers, as well as NAPNE members, has gone through and still goes through various moments of awareness, discussion, studies and actions. Inclusion challenges changes in diverse philosophical conceptions, curriculum organization, and teaching procedures.

5. Conclusion

the work carried out by NAPNE, regarding the specialized educational attendance at the Ibirubá Campus has been reaching satisfactory and expressive goals even outside the state, being its members invited to give courses and lectures throughout Brazil. Nevertheless, the mishaps along the way are not few. Quoting Carvalho (2005, p.103), educational inclusion requires us to explain school difficulties not only by focusing on students, but also by considering the limitations that exist in our education systems and schools. The challenge implies a new vision of special educational needs, which, besides those of students, translate into the needs of schools, teachers, and all the human resources that work in them.

the view that ESA is not just the role of the teacher brings the reflection of what would be the best way to successfully perform an inclusive education, with principles based on the integrated education of students, offering all the same opportunities. In the search for renewal of didactic-methodological actions, teachers and students become subjects of the evaluation, through continuous and permanent evaluation process, prioritizing the qualitative aspects over the quantitative ones. The evaluation by projects allows analyzing the educational action and, if necessary, to readjust the objectives, methodologies and activities proposed during the action. Much has been achieved to this day, but it is still far from ideal. Some attitudes are no longer taken because of expenditure restraint, as, unfortunately, the government does not see these "expenditures" as an investment, and other progress does not leave the paper because of the resistance of society. However, advocates of inclusive education continue to pursue the constitutional rights: quality education for all, in regular classes, guaranteed access and permanence.

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The Importance of The Brand in The Internationalization of Exporting Companies

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Abstract

The actual article succinctly approach the importance of the brand in the internationalization process and how well-founded strategies in this process are gaining prominence in the business context, since the current phase of globalization, the increase in competition, the pace for innovation and the opening of new markets, are directly impacting in the performance of companies in their market. Therefore, this study defined the objective of analyzing the importance of the brand in the internationalization process of companies. The methodology used was literary research opted for bibliographic review, which is based on the analysis of the literature already published, from articles and dissertations in recent years in Portuguese and English, found in periodicals indexed in the SciELO databases. (Scientific Electronic Library Online) and Google Scholar, beyond books relevant to this theme.

Keywords: Internationalization; Globalization; Brand; Innovation; Market

1. INTRODUCTION

The internationalization of companies has become increasingly important since the early 1990s with the economic opening, which has brought to companies the need of improving the productivity and the quality of its products. According to Ricupero; Barreto (2007), in the period between 1984 and 1998 the total flow of direct world investment abroad increased tenfold. Companies without competitive ability are increasingly out of the market, being replaced by those that are more efficient or by the increase in imports of products in which the country is less efficient. The internationalization process demands from companies capacity and their own production characteristics, having technology and a human resources management where there is an integration directed at the awareness of being part of the foreign market. (FLORIANI, 2010).

The internationalization process is extremely necessary for the national economic development, which represents a very important milestone for the national economy, indicating structural changes in the global economy and in the country pattern of development. For Minevini (2008) the internationalization of a company demands a plan, a chart, whereby the goal will be achieved, beyond the enthusiasm of a great challenge. Besides that, the export capacity is that according to which the company has to adapt to the international market variables, carrying out internally several modifications, whether in the area of human resources, design, productivity, communication or management. (MINEVINI, 2008).

For Barreto (1999, p. 266), “the study of the internationalization of companies [...] can then, help to understand the general phenomenon of internationalization, for its peculiarities”. Thus, one of the main aspects for the progress of a company internationally is the brand whose distinct name and/or symbol is destined to identify its assets or services to stand out from others. Therefore, a brand signals to the consumer the origin of the product and protects both the consumer and the fabricant from competitors offering products that look identical. (AKER, 1998).

In front of the global market trend, the goal of this study is to analyze the importance of the brand in the process of internationalization of companies. It is important to stress that the process of internationalization of the brand provides an effectiveness in increasing its competitiveness, promoting the development of the country and facilitating the access to resources and markets, once it conquers a spot at global economy, as well it also helps with the results of the increasement statement of the country economy.

The present study is based on a literary research, the bibliographic review was chosen, which relies on the analyzes of the literature already published, through articles and essays in the last years in Portuguese and in English, found at periodicals linked at SciELO (Scientific Electronic Library Online) and Google Academy data base, in addition to relevant books to this topic.

2. THEORETICAL FOUNDATION

2.1 Internalization of Companies in the Globalized World The globalization of economy has created new opportunities, but also challenges, which have led the companies to make efforts in the adoption of internationalization strategies, as a way to survive. Countries encourage exports and internationalization of companies, as well as unite to form trade blocs in order to increase their participation and competitiveness in the global economy. The concept of internationalization of a company can be described as the participation of it in the international market. (BUCKLEY; CASSON, 2000).

The Dom Cabral Foundation (2002, p. 5), proposes a clearer definition: "internationalization is the process of obtaining part or all of the revenues from international operations, whether through export, licensing, strategic alliances, acquisition of companies in other countries or construction of own subsidiaries. According to Lemaire et al (1997), among the factors that trigger the insertion of companies in the international market are the inevitable process of international opening and the globalizing trend of economies and markets, which was established after one or two decades, within a scenario where the exchange of goods, services and capital became more complex.

Thus, according to Johanson and Vahlne (1977), the process of internationalization focuses on the acquisition, integration and use of knowledge in a sequential manner about foreign markets and operations, increasing the degree of commitment of the firm in its foreign markets. This means that the better the knowledge about the market, the more valuable the resources and the stronger the commitment of the company with this market. Therefore, knowledge and commitment are the key elements for the internationalization of companies from the perspective of Johanson and Vahlne (1977). In line with these authors, the definition of knowledge is subdivided between experimental, general and market-specific.

According to Buckley and Casson (2000), there are two interdependent decisions for the entry of the organization in another country: the location and the control mode. The first refers to the choice of the

country and, more specifically, of its region. In other words, it refers to the question: where to internationalize? There are two generic strategies: market diversification and market concentration. (BRADLEY; CASSON, 2000). By diversifying, the goal is to achieve a high return with low commitment of resources in many markets. By concentrating, the company devotes a high level of marketing effort to each of the few markets in an attempt to obtain a significant share in them. The company only enters other markets after building a strong position in the initial market.

The control mode, in turn, is related to the definition of the process which can be: i) export, with the organization located in its country of origin and administratively controlled; ii) licensing, with the location outside the country of origin and contractually controlled; iii) direct investment, with the organization located and administratively controlled outside its country of origin. (BUCKLEY; CASSON, 2000).

An important positioning for the growth of the internationalization process was the Uppsala School model that emphasized the gradualism of entry as one of the appropriate strategies for the internationalization process of organizations (JOHANSON; VAHLNE, 1977). According to this model, there is a scale of commitment in entry modes, from the last committed to the most. Thus, the gradual process of internationalization performs the following steps: export by third parties; direct export; licensing; association or strategic alliances with foreign companies; franchising; establishment of subsidiaries (first with their own sales offices and then with production units) and, finally, installation of a research center. For the authors, the knowledge coming from the experience is critical and must be gradually acquired, enabling the company to formulate opportunities with this learning.

When entering the international market, companies have a set of strategies, and the decisions for this entry vary according to the capacity and resources that they have in face of the opportunities found externally (PIPKIN, 2005). Internationalization can be interpreted as an incremental process, aiming at having several benefits. However, despite this concept, the paths to be followed in the internationalization process are often faced with certain obstacles and irregularities, resulting from some threats that do not emerge in a continuous or controlled manner. (KOVACS, MORAES, OLIVE TREE, 2007).

On the other hand, the internationalization can also happen in an intended way, i.e., in a way intentionally planned by the company (ZEN, 2012). As the degree of internationalization increases, companies gain more experience and consequently become more efficient in relation to the foreign market. (FLORIANI, 2010). Normally, the international market presents greater risks in relation to the domestic market, however, the risks assumed by the companies may vary according to the strategic choice of entering the foreign market. In direct investment, for example, the risks are greater than in exports, requiring greater commitment and performance of the company, but profitability and learning are also greater. (PIPKIN, 2005).

The internationalization of companies is related to their active participation in foreign markets in order to be the natural way to keep them competitive. The fact that they are increasingly present in international markets makes companies adopt certain criteria, among these political and cultural to those of the destination countries (PIPKIN, 2005). There are several reasons that lead companies to develop their internationalization process, seeking a series of advantages in relation to their competitors, since the entry into foreign markets makes this activity indispensable for their growth, both nationally and internationally (MINERVINI, 2001).

Internationalization is not free of difficulties, conversely, the fact that the foreign market is composed of

very diverse countries whose languages, cultures, habits, clothing, policies and laws are different from each other, their consumers are much more selective and demanding, and consequently the market becomes much wider and certainly more competitive. (LOPEZ; GAMMA, 2005).

In Keedi's (2008, p. 86) conception, the difficulties encountered by companies when entering the foreign market are: "language, variation in the degree of mobility of production factors, increased logistics costs related to distance between countries and disparity between currencies since the currencies received must be converted into national currency". Therefore, for a company to succeed in the international scenario it is indispensable to formulate a well defined and structured strategic planning, which allows the company to analyze its strengths and weaknesses as well as the threats and opportunities of foreign markets. (LOPEZ; GAMA, 2005). However, it is noticeable that internationalization is not an easy activity which requires continuous investments and requires from organizations information, knowledge and above all export mentality. (DAYS, 2007; RODRIGUES, 2007).

In front of this reality of internationalization of companies, Brazil has not yet reached a significant estimate in the export market and still plays a minor role, due to the bureaucratic process and the still precarious infrastructure. However, globalization has enabled significant changes in this scenario.

2.2 Brazil and the Franchising System in the Globalized World

Brazil, in the context of globalization, coexists simultaneously with the impact of international transformations and the process of stabilization of the economy. Both significantly affect the economic performance and the productive complex, implying new challenges for economic policy and business performance. The process of internationalization of production, which has advanced substantially since the 1980s, has brought about transformations at the technological, organizational and financial levels, which have intensified competition on a global scale.

Thus, Brazilian companies are late entrants in the globalization process, even in comparison with companies from other emerging countries, including Latin America, and their participation in international markets is still very limited (FLEURY; FLEURY, 2007; ROCHA et al., 2007; CYRINO; TANURE, 2009). However, there are already some cases of very successful Brazilian multinationals. Learning from the mistakes of companies that have entered the international market before, as well as from their own mistakes, always keeping the focus on the organization's growth, is the effective way to recover lost time.

The internationalization process of an organization needs to be thought out and planned in order to minimize possible problems when entering a new cultural, social, political and economic reality. Throughout this process, company leaders reflect on the motivations for internationalization, decide the ways to enter and face a number of difficulties. (KHAUAJA and TOLEDO, 2011). Therefore, the entry methods are: export through third parties or directly; licensing, association or strategic alliances with foreign companies; franchising; production or service contracts; joint venture; mergers and acquisitions and divisions abroad (Greenfield), with the establishment of subsidiaries or their own offices (aimed at marketing, installation of subsidiary or production unit) and research center.

Currently, the International Franchise Association (IFA) defines franchising or franchise system as an ongoing relationship between franchisor and franchisee, in which the reputation (brand) and knowledge of the franchisor (production and marketing techniques) are transferred to the franchisee. Thus, the franchise

system is in a more advanced stage, called "continuous learning network". It is a relationship of reciprocal knowledge exchange, in which the active participation of the franchisees in the process of strategic decision-making is growing (FRIEDHEIM, 2005).

Hoffman and Preble (2004) consider that the franchise system, while benefiting from globalization, is an important driver of this process. In emerging markets, for example, such as countries where there is no history of entrepreneurship, the franchise system provides structure, support and a competitive advantage to local investors through the use of previously successful products and recognized brands. They believe that the growth of the new middle class - which has emerged from the increased purchasing power of low-income populations - will stimulate the franchise system this decade. Amos (2001) reinforces this thought, since, for him, the concept of the franchise system is easily "translated", allowing the business to be adapted to different cultures and environments.

There are no objective reports that identify who originated the business model that became franchising, but the general consensus suggests that it emerged in North America and was the founder of Singer Sewing Machines, Isaac Merritt Singer (WEBBER, 2013). According to data from the International Franchise Association (IFA) there are reports attributed to SINGER, a sewing machine factory, of the first modern franchise model contract, which enabled it to grow its sales throughout the American territory in relation to a relatively low investment. "At the beginning, car and gas station franchises prevailed in the United States, concentrating on these two segments almost half of all franchises then in existence". (ABRÃO 1992).

The history of franchising in Brazil began in the 1960s, with the entry of Yazigi and CCAA (English schools), over the years, this scenario underwent major changes, with the creation of the Brazilian Franchising Association (ABF) in the 1980s and the promulgation of law 8.955/04 on December 15, 1994. For Mauro (2006), the franchise sector in the country until the beginning of the 80's, was concentrated in the areas of fuel, vehicle and beverage sales. With the growth of the shopping center sector throughout the country and the strong internalization of the business, there was the incentive for the growth of the retail chains, in the apparel, cosmetics and accessories branches. The expansion of large shopping centers was a crucial factor in the development of franchising in Brazil. Today, around 1/3 of the shopping centers' revenue comes from franchises.

Faced with this reality, the brand system in the internationalization process together with franchises has enabled an advance in the international market in the last years.

2.3 The Brands World

The most widely used definition of a brand is that of the American Marketing Association (AMA), which was written in 1960 and is present in Kotler and Keller's book (2006, p. 269): a brand is - a name, term, sign, symbol or design, or a combination of all of these, designed to identify the products or services of a

which we could interpret as the benefit. This author adopts a holistic conception, in which brands are seen as living objects that relate to consumers.

Aaker and Joachimsthaler (2000, p. 47/54) sustain that brand identity is - the cornerstone for the strategy - a set of associations that the brand strategist seeks to create or maintain. The authors state that a strong brand must have a rich and clear identity in order to form a solid and relevant image in the minds of consumers. If the company is effective in building its brand, consumer perception, i.e. the brand image, will be equivalent to the brand identity, which represents what the company wants its brand to mean.

Kapferer (2003) makes a clear distinction between identity and image, placing the first as a concept of emission and the latter as a concept of reception. This means that identity is the conception that the brand has of itself and image is a decoding made by the public of all the signals emitted by the brand. Image 1 below shows the difference between identity and image:

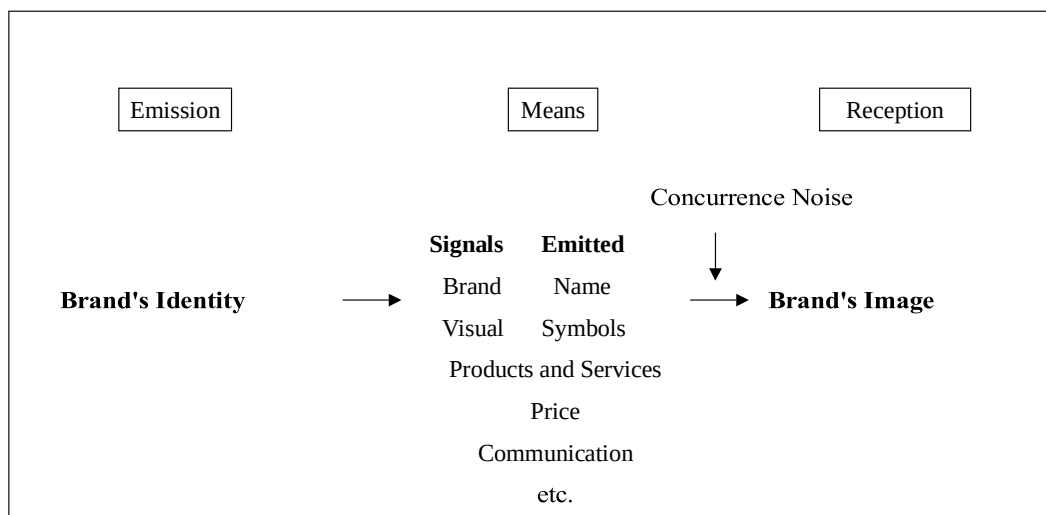


Figure 1. Difference between identity and image

Source: Adapted from Kapferer (2003, p. 87)

Brand identity is used to establish the company in the market, i. e.; it allows the organization or a part of the organization to have the feeling of existing as a coherent and specific being, assuming its history and taking a place in relation to others. (KAPFERER, 2003). The first effort to build a brand identity must be employee-oriented, since it is through the perception of them that it can establish itself in the external environment. (TAVARES, 1998). To project a certain image, the company's managers need to take care of the internal reality. Just like brands, a solid corporate identity must be based on organizational values, which must, in fact, be practiced on a daily basis.

Performance refers to the quality of the product. Keller (2003) states that the experience of customers with the brand needs at least to meet their expectations and when the results meet or exceed expectations, customer satisfaction happens. Besides referring to the intrinsic characteristics of the product, the performance is related to the added services, the style and design, the price and the reliability and durability of the product. The brand image refers to the extrinsic characteristics of the product, such as the profile of users; situations of purchase and use; the personality of the brand; its values, history and experiences. These

are the so-called intangible factors. The goal of product performance and brand image is to give meaning to the brand by building favorable associations. (KELLER, 2003).

Judgments are the personal opinions of clients and their evaluations of the brand, that is, the way clients relate tangible and intangible attributes to form an opinion about the brand. Thus, customers judge the quality of the brand; the credibility of the brand (and of the company that manufactured or owned the brand); the consideration of purchase and the superiority of the brand (if it is considered unique and/or superior to others). Feelings, on the other hand, are the emotional responses motivated by the brand, that is, the emotions caused by the brand and its marketing program, the way in which the brand affects the perceptions that customers have of themselves and their relationship with other people. (KLEIN, 2002).

People, in turn, in their role as consumers, expect brands to promote enriching experiences for them, whether by acquiring knowledge or by offering moments of leisure. The 21st century consumer does not want to buy products that just satisfy their needs: he wants to consume ideas, stories and emotions. And brands, when well constructed, have a history, defend ideas and transmit emotions. Finally, brands are part of people's day time and are invited to participate in their daily lives. People even use brands as a means to stigmatize other individuals in social interactions (SOUZA LEÃO; MELLO, 2008), because those who buy a brand theoretically share its values.

Brands today occupy such a privileged place in the world of the ephemeral that there are those who strive to become brands, as is the case of several foreign and Brazilian celebrities, who, once having achieved this feat, profit a lot by licensing their brand to companies that sell assets and services. (KLEIN, 2002, p. 85). Regarding the construction of global brands, Aaker (1998) declared that they are brands whose positioning, communication strategy and personality are, in most aspects, the same in different countries and markets. They state that it is necessary to develop strong brands in the various markets through global brand leadership, which includes using organizational structures, processes and cultures to globally allocate brand building resources creating global synergies, as well as developing a global brand strategy that coordinates and leverages the strategies of each country. However, they also point to the challenge of finding a balance between empowering the brand globally and respecting local differences, a recurring subject in the global marketing discussion.

Local brands are differentiated from international brands by Kapferer (2004), to whom local brands are those that exist in a country or are limited to a geographic area and may belong to a local or global company. International brands, on the other hand, are those that have elements of the globalized marketing strategy or compound. Quoting Levitt (1983), they consider that, in a more radical way, global brands are defined as brands that use the same marketing strategy and marketing mix in all target markets.

Temporal (2001) tried to go beyond and differentiate the concepts of international brand and global brand, although this seems a little confusing. For the author, the global brand is the one that is present in almost every country in the world, uses the same name, has the same values and the same positioning in every country. In this case, its products have universal appeal and are targeted at global target segments (for example, young executives). In contrast, international brands are those that are present in a few countries, use different names, make adaptations to their positioning and offerings. According to the author's criteria, possibly only a handful of brands could be considered truly global.

Holden (2006) concluded that to launch a global brand, it must be assessed whether it meets the needs of

global consumers, whether it can be adapted to the differences in food behavior and income of different cultures, and whether the magnitude of the opportunity offsets the challenges. For the author, -one of the greatest challenges in building global brands is balancing local and global branding best practices. The goal is to complement global standardization with local customization (HOLDEN, 2006, p. 288). She therefore recommends that the brand (identity and positioning) and the product (quality and main characteristics) be global and that pricing, distribution and integrated communication be adapted to local needs.

As can be seen, Ramsay (2003) and Holden (2006) have shed light on the danger of generalizing the analysis about global brands, given that each area has its peculiarities. In the service sector, for example, which is too dependent on people to deliver the brand promise, Vallaster and Chernatony (2005) highlighted the difficulty of conveying brand values to employees in different countries with different cultures, meaning that in this sector cultural differences have an even greater impact.

Melewar and Walker (2003) listed the impacts of culture on brand management:

1. colors and numbers have different meanings in different cultures;
2. names can also have different meanings;
3. the notion of time changes between cultures;
4. different cultures have different attitudes towards gender and race;
5. the role of people in society may be different between cultures;
6. people's priorities change according to culture and religion.

The authors concluded that strong global brands are those capable of translating corporate values into different markets. Although they preach adaptation to different cultures, they consider that companies should not give up consistency in the global positioning of brands. The three main implications to be considered in global brand management, according to them, are (a) to emphasize the global character of the brand, valuing the exclusive characteristics of brands with a large global presence; (b) to adopt a global positioning (as advocated by other authors), but make local certain characteristics of the marketing approach and (c) to satisfy the foundations for building solid brands, since assuming a global approach is not, in itself, a guarantee of success, but may, on the contrary, make brand management even more complex. One of the most common mistakes that Brazilian companies make in internationalization processes is the non-development of brands. This reality is exposed annually in the rankings of the most valuable brands in the world since, among the hundred brands considered most valuable, only one (Bradesco) is Brazilian. (INTERBRAND, 2009).

3. Conclusion

The process of internationalization of a company is characterized from the moment it decides to start its activities in another country. This decision can be defined by the search for new markets, expansion and increase of its sales, as well as the growth of competition generated by globalization.

Many companies see the foreign market only as an opportunity, enabling them to escape certain crises faced in the domestic market itself. However, other companies realize that the performance in the international markets, even obtaining some difficulties, can provide them innumerable benefits, extending their

knowledge, generating greater profits, new products to be offered, technological incorporation and business growth, this if they develop a good strategic planning.

The launching of a brand in the international market, however, in order to obtain success, it is important that the companies evaluate their exported capacity, being able to meet the requirements and needs of international customers, since they are more selective and have different characteristics defined by language, tastes, customs and cultures.

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Determination of oxidative stress parameters in fluoxetine users

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Abstract

Fluoxetine (FLU), a selective serotonin reuptake inhibitor, is the first line in depression treatment and it is involved in oxidative stress (OE). Thus, this study aimed to analyze the OE parameters in patients diagnosed with depression and treated with FLU. Were evaluated 121 volunteers divided into two groups: 58 fluoxetine users (with major depression) and 63 non-fluoxetine users (control group, without major depression). The OE was evaluated by determining the levels of malondialdehyde (MDA), total antioxidant power (FRAP) and activity of antioxidant enzymes glutathione peroxidase (GPx) and superoxide dismutase (SOD). MDA, FRAP, GPx and SOD were dosed in plasma. The influence of age, smoking, alcoholism, comorbidities, use of another drugs and antioxidants in the OE were evaluated. The results were compared between the groups. In relation to the fluoxetine daily dose, MDA presented higher levels in patients using 20 mg daily FLU when compared to the control group, as well as the activity of the GPx enzyme and the FRAP levels. In this way, the use of fluoxetine may interfere with the OE parameters, causing an increase in OE levels.

Keywords: antioxidants; fluoxetine; reactive oxygen species; oxidative stress; major depression

1. Introduction

Depression is a neuropsychiatric condition with worldwide prevalence reports ranging from 6.5 to 21% [1]. Studies on the causes of depression have shown an increase in the activation of inflammatory immune markers [2], increased production of reactive oxygen species (ROS) [3], and changes in the phospholipids and cholesterol that constitute the cell membrane [4, 5]. In fact, OE has been involved in the occurrence of cognitive disorders. There is evidence that increases in OE levels and/or deficiencies in antioxidant defenses are risk factors for cognitive decline. In this way, the EO seems to play an important role in the pathogenesis of depression [3, 6, 7]. Still, these changes lead to a process of neuroinflammation

and consequent neurodegeneration, which seems to play an important role in the pathogenesis of depression. Several biomarkers have been established in patients with depression, such as cytokines, oxidative stress markers and tryptophan catabolites [8, 9].

The condition known as oxidative stress is a result of the imbalance between the production of reactive oxygen species (ROS) and the antioxidant system. ROS are molecules with an electron spliced and very reactive. This large group of molecules is represented mainly by the radical superoxide ($O_2^{\bullet-}$), peroxy radical ($ROO^{\bullet-}$), hydroxyl radical ($OH^{\bullet-}$), and nitric oxide ($NO^{\bullet-}$). The enzymatic and non-enzymatic systems that form the antioxidant system, act in a synchronized way to protect the cells from the damage caused by free radicals. The main antioxidant enzymes include superoxide dismutase (SOD), catalase (CAT) and glutathione peroxidase (GPx) [10, 11]. Non-enzymatic antioxidants include endogenous molecules such as bilirubin, uric acid, and glutathione, as well as exogenous compounds, such as vitamins A, C, and E [10-12]. The action of these compounds along with the antioxidant enzymes result in what we know as total antioxidant status [10, 13].

The oxidative stress is detrimental to cellular metabolism. The process of lipid peroxidation, which also results in the production of free radicals, is the most known damage caused by oxidative stress [14]. Malondialdehyde (MDA) is the main product of lipid peroxidation. This aldehyde is a highly toxic molecule that interacts with proteins and DNA [15]. Studies that address lipid peroxidation in patients with depression describe an increase in the levels of MDA and other lipid peroxidation products [16, 17].

According to some studies, the antioxidant enzymes activities in patients with depression are different from those observed in healthy individuals [18-23]. Indeed, antioxidant enzymes activities are decreased in patients with depression when compared to healthy subjects [22]. Decreased levels of SOD, GPx, and CAT, and increased levels of MDA have been reported in patients with affective disorders [23], and increased urinary excretion of F2 isoprostane in patients with depression [7].

Fluoxetine (FLU) is a first line drug for the treatment of depression. It has emerged as the treatment of choice for depression because of its safer profile, fewer side effects and improved tolerance compared to tricyclic antidepressants and other selective serotonin reuptake inhibitors (SSRIs) [24, 25]. Several studies have reported important effects of fluoxetine on the central nervous system. Novio *et al.* (2011) [26] demonstrated the positive effect of fluoxetine against oxidative damage in stress-induced cells. Zafir and Banu (2007) [27] also showed the antioxidant potential of this drug, stating that this potential could contribute to its therapeutic action. Kolla *et al.* (2014) [28] demonstrated greater survival of neurons and a reduction of oxidative substances with the use of fluoxetine. In addition, Bilici *et al.* (2001) [18] found that ROS may play an important role in major depression and that MDA and antioxidant enzymes may be markers of major depression, as they returned to normal intervals after antidepressant treatment. In this context, this study aimed to analyze the OE parameters in patients diagnosed with depression and treated with FLU.

2. Material and methods

2.1 Study population and sample collection

A cross-sectional study was carried out with 121 individuals, divided into two groups: 58 fluoxetine users (FLU group) and 63 non-fluoxetine users (control group). All volunteers were members of CIES - FEEVALE, Integrity Center of Health Specialties of FEEVALE University, Novo Hamburgo, Brazil and were at least 18 years of age. This study was approved by the Ethics and Research Committee of FEEVALE University (CAAE 44035115.0.0000.5348), and it was carried out according to the resolution 466/2012 of the National Council of Education and Research. All volunteers signed the free and informed consent form.

The fluoxetine user group is designed for patients diagnosed with major depression and taking fluoxetine (doses of 20, 40 or 60 mg/daily) for at least 6 months. Subjects classified as control group were not diagnosed with depression and were not using any antidepressants. Patients that did not present cognitive conditions to respond to the questionnaires, or in use of another antidepressant drug, or were using the fluoxetine less than six months ago were excluded. Both groups had age-related comorbidities (diabetes, hypertension, heart disease, thyroid disorders, and dyslipidemia) and use the same classes of medicines for comorbidities treatment.

All volunteers responded to a structured questionnaire about their lifestyle (use of tobacco, alcohol or antioxidant substance) and socio-demographic profile. The clinical characteristics [age, sex, body mass index (BMI), systolic blood pressure (SBP), diastolic blood pressure (BPD), comorbidities and medications in use] were evaluated from medical records. Blood samples were collected in EDTA and Heparin tubes. Later, they were centrifuged for 10 min at 2500 rpm for plasma separation, which was stored in an ultra-freezer at -80 °C.

2.2 Oxidative stress

The EO was evaluated through the dosages of MDA, FRAP and the enzymatic activities of SOD and GPx.

MDA dosages were initiated with alkaline hydrolysis of plasma in order to release the protein bound fraction, subsequently precipitated by the addition of HClO_4 . DNPH-derivatized protein was added to the supernatant [29]. The chromatographic run was performed in a Shimadzu Class VP HPLC diode array detector with a Lichrospher RP-18 Merck column (250×4 mm, 5

superoxide radicals which react with 2- (4-iodophenyl) -3- (4-nitrophenol) -5-p-phenyltetrazolium chloride to produce formazan, a compound which absorbs light at 450 nm. Inhibition of chromogen production is proportional to the SOD activity present in the sample. The reading was performed on spectrophotometer microplates and the results expressed as % inhibition of SOD.

The enzymatic activity of GPx was performed by the method described by Pleban; Munyani and Beachum (1982) [31]. First, the working reaction was prepared with 50 mmol / l Tris buffer at pH 7.6, containing 1 mmol Na₂EDTA per liter, 2 mmol reduced glutathione, 0.2 mmol NADPH, 4 mmol sodium azide and 1000 U of glutathione reductase. The mixture was incubated for 5 minutes at 37 ° C. To determine enzymatic activity in plasma, 50 L of plasma was added to 950 L of the working reaction. The activity of GPx was expressed in plasma U/L. After a period of 30 seconds, the decrease in absorbance will be linear with time. At the beginning of the reaction, 10 L of 8.8 mmol/L hydrogen peroxide was added and the spectrophotometer read at 340 nm for 3 minutes.

2.3 Statistically analysis

The clinical characteristics and oxidative stress parameters of fluoxetine users and control group were compared by Student's *t* test, Mann-Whitney *U* test or Pearson Chi-Square, according to the data. The oxidative stress parameters for fluoxetine users, grouped according to the daily fluoxetine doses (20, 40 and 60 mg), and control group were analyzed using the One-way Analysis of Variance (ANOVA), followed by Tukey *post hoc* test for multiple comparisons. Multiple linear regression models were carried out to test the association of oxidative stress parameters (dependent variable) and factors with possible biological relevance (age, use of fluoxetine, anti-inflammatory or antioxidant drugs) or significance at univariate analysis (BMI, SBP, and DBP) were used like independents variables. All independent variables selected were added in a block in a single step. Different oxidative stress parameters were included as dependent variables in each model, one at a time. Data were expressed as medians (percentile 25 and percentile 75) or means $\pm$ SD. *P* values < 0.05 were considered statistically significant. The software SPSS 25.0 (SPSS, Chicago, IL) was used for the statistical analyses.

4. Results

The clinical characteristics of users of fluoxetine and the control group are shown in Table 1. There was no significant difference between the mean ages of both groups. There was a predominance of women among the volunteers, but the proportion of men and women in the groups did not show a statistical difference between them. Both groups contained hypertensive patients, with diastolic and systolic pressures being significantly higher in users of fluoxetine as well as body mass index. Among the drugs used by the volunteers of both groups, we identified anti-inflammatory drugs and antioxidants as possible interferers of the oxidative profile. There was no statistical difference between the groups in relation to the number of non-steroidal anti-inflammatory users (NSAIDs), and only the FLU group presented users of anti-inflammatory drugs of corticosteroids. There was also no statistical difference in the proportion of users of antioxidant drugs in both groups.

Table 1. Clinical characteristics of fluoxetine users and control group

Characteristics	Control group (n=63)	FLU group (n=58)	
Age (years)	59 ± 11	56 ± 13	0.128
Sex			
Female	81 %	83 %	0.763
Male	19 %	17 %	0.670
BMI (kg/m ²)	26.7 ± 4.02	29.58 ± 6.38	0.004
SBP (mmHg)	118.28 ± 18.92	125.94 ± 18.29	0.026
DBP (mmHg)	76.17 ± 13.80	81.20 ± 13.51	0.045
Smoking			
No	94 %	83 %	0.327
Yes	6 %	17 %	0.109
Alcoholism			
No	100 %	100 %	1.000
Uses antioxidante			
No	74 %	84 %	0.838
Yes	26 %	16 %	0.162
Uses anti-inflammatory			
No	78 %	71 %	0.399
NSAI	22 %	22 %	0.847
Corticosteroide	0 %	7 %	<0.001

BMI: body mass index. SBP: systolic blood pressure. DBP: diastolic blood pressure. NSAI: non-steroidal anti- inflammatory.

The Student t test (for age, BMI, SBP and DBP variables) and Pearson Chi Square are used in statistical analysis.

Table 2 shows the comparison of the parameters of oxidative stress among control group and users of different doses of fluoxetine. The daily doses of fluoxetine among users of fluoxetine in the study group were 20 mg (n = 49), 40 mg (n = 7) and 60 mg (n = 2). Thus, users of 40 and 60 mg of fluoxetine were grouped for the statistical analyzes related dose of fluoxetine and parameters of oxidative stress. The MDA presented higher levels in patients using 20 mg daily FLU when compared to the control group [1.62 M (1.16 – 2.80) vs 1.34 M (1.09 – 1.57) respectively; $p < 0.001$], as well as the GPx activity [0.87 U/L (-2.07 – 19.30) vs -1.59 U/L (-31.04 – 4.79) respectively; $p = 0.004$] and FRAP levels [1176 M (980 – 1298) vs 1091 M (738 – 2733) respectively; $p = 0.017$].

Table 2. Oxidative stress parameters of fluoxetine users and control group

OE parameter	Control group (n = 63)	Fluoxetine group		P value	a	b	c
		20 mg (n = 49)	40/60 mg (n = 9)				
FRAP (μM)	1091 (738 – 2733)	1176 (980 – 1298)	1045 (962 – 1121)	0.011	0.017	0.152	0.926
SOD (% inhibition)	85.7 (74.3 – 99.5)	90.4 (84.1 – 93.9)	89.1 (81.7 – 92.9)	0.142	0.338	0.211	0.626
MDA (μM)	1.34 (1.09 – 1.57)	1.62 (1.16 – 2.80)	1.62 (1.45 – 2.34)	<0.001	<0.001	0.125	0.871
GPx (U/L)	-1.59 (-31.04 – 4.79)	0.87 (-2.07 – 19.30)	0.39 (-0.79 – 36.32)	0.006	0.004	0.497	0.812

FRAP: ferric-reducing ability of plasma; SOD: superoxide dismutase; MDA: Malondialdehyde; GPx: glutathione peroxidase. The results are expressed as median (percentile 25 and percentile 75). The One-way Analysis of Variance (ANOVA), followed by Tukey *post hoc* test for multiple comparisons are used in statistical analysis. P value: a) Control Group vs 20 mg; b) Control Group vs 40/60 mg; c) 20 mg vs 40/60 mg.

The statistical differences found in the oxidative stress indicators were adjusted by biological variables (age, BMI, SBP, DBP) and concomitant use of fluoxetine, anti-inflammatories, and antioxidants. The linear regression data for this analysis are presented in Table 3. The use of fluoxetine was shown to be influencing the statistical difference of FRAP, MDA and GPx parameters, while the use of anti-inflammatory drugs seems to influence only the GPx enzyme activity.

Table 3. Multiple linear regression analyses by oxidative stress parameter in FLUOX group (n=58) and Control group (n=63)

Dependent variables	FRAP		MDA		GPx		SOD	
R ²)	0.360 (0.025)		0.416 (0.003)		0.364 (0.023)		0.181 (0.797)	
Independent variables	P / beta value		P / beta value		P / beta value		P / beta value	
Use of fluoxetine	0.015	-0.237	<0.001	0.423	<0.001		0.103	0.166
Use of anti-inflammatory	0.236	0.107	0.789	0.023	0.351		0.900	-0.012
Use of antioxidant	0.562	0.053	0.480	0.063	0.050	-0.178	0.662	-0.042
Age	0.553	-0.055	0.447	0.069	0.590	0.050	0.564	0.056
BMI	0.844	-0.019	0.975	-0.003	0.191	0.122	0.660	-0.044
SBP	0.753	-0.040	0.243	-0.145	0.444	-0.074	0.998	0.000
DBP	0.117	-0.192	0.414	0.097	0.642	-0.059	0.983	0.052
					0.547	0.073		

BMI: body mass index; SBP: systolic blood pressure; SBD: diastolic blood pressure. FRAP: ferric-reducing ability of plasma; MDA: malondialdehyde; GPx: glutathione peroxidase; SOD: superoxide dismutase.

5. Discussion

The primary antioxidant defense system involves the coordinated effects of antioxidant enzymes such as SOD, catalase (CAT) and GPx. In this study, we observed differences in OE parameters in users

and non-users of fluoxetine. In fact, the MDA levels, the GPx enzyme activity and the FRAP levels are higher in patients using 20 mg daily FLU when compared to the control group. These findings suggest that the use of fluoxetine may increase oxidative damage (MDA increased), leading to a compensation of antioxidant defenses, both enzymatic (GPx) and non-enzymatic (FRAP) [10]. Another finding of this study concerns the non-difference in levels of SOD enzyme activity between the control and FLU groups.

Studies have shown that patients with depression have increased levels of OE compared to healthy patients [18, 19, 21], as well as levels of MDA, a product of lipid peroxidation. The increased activity of ROS levels, in turn, comes from the activation of immune cells, another feature of major depression [4]. Higher ROS levels trigger lipid peroxidation in polyunsaturated fatty acids (PUFAs) present in cell membranes, destabilizing them and interfering with their functions. In this context, there is information on the influence of fluoxetine on antioxidant enzymes. While some studies suggest that this antidepressant restores the antioxidant capacity in the brain [18, 26], Djordjevic *et al.* (2011) [32] and Zlatkovi *et al.* (2014) [33] suggested that fluoxetine affects the antioxidant system of rat liver, and another study has reported that such therapy does not alter the OE in patients with depression [16].

In the present study, we identified higher MDA levels in fluoxetine users (20 mg daily dose) when compared to the control group. These findings differed from Bilici *et al.* (2001) [18], which showed that after three-month treatment with 20mg daily FLU, MDA levels were significantly reduced. In addition, Belowski *et al.* (2004) [34] showed the ability of fluoxetine to reduce the cytotoxic activity of macrophages, which are sources of ROS. This effect appeared after 2 weeks of treatment with 10 mg fluoxetine. However, the four-week treatment with the same dosage is not shown in the process above. This demonstrates that the effect of fluoxetine may be dependent on the duration and dosage of the treatment. The non-decrease in the levels of MDA in the treated patients could also be attributed to the lack of effectiveness of the treatment in the low adhesion function or without the metabolism of this drug. Further studies in this direction would be necessary.

FRAP (total antioxidant power) measures the antioxidant status, adding the activity of enzymatic and non-enzymatic antioxidant systems. This study found a significantly higher level of this parameter in the FLU group (20 mg daily dose) compared to the control group. Bilici *et al.* (2001) [18], as well as Caiaffo *et al.* (2016) [15], reported that FLU has a significant effect on improving the antioxidant defense system. They suggested an inhibition in the production of pro-inflammatory cytokines, leading to a decrease in the production of free radicals. In this way, they indicated the antioxidant action as a clinical benefit of the administration of this drug. In the multiple linear regression analyses, we found that the concomitant use of anti-inflammatory or antioxidant drugs by volunteers in both groups also did not influence the results of FRAP.

In relation to the GPx enzyme, this study identified a greater activity in the FLU group (20 mg daily dose) in comparison to control group. This increase in GPx activity in the FLU group conflicts with that reported by Bilici *et al.* (2001) [18]. These authors evaluated the antioxidant enzymatic activity in control patients and patients with major depression, before and after three months of treatment with FLU. The latter group significantly reduced the GPx activity. To justify this finding, two mechanisms had been suggested: (i) SSRI treatment has a suppressive effect on cells of the immune system, which can lead to a decrease in ROS levels and consequently levels of antioxidant enzymes; and (ii) Cytochrome P450

enzymes may play a role in ROS production, and these enzymes are inhibited by SSRIs. Thus, according to these authors, it can be speculated that FLU can reduce levels of antioxidant enzymes by inhibiting cytochrome P450 enzymes. Still, this topic requires further investigation.

At the end of this study, we verified whether, in addition to fluoxetine, biological variables (age, BMI, SBP, BPD) and the concomitant use of anti-inflammatory or antioxidant drugs influenced the statistical differences found. The linear regression showed that the use of fluoxetine influenced the results of the FRAP, MDA and GPx parameters. However, the use of anti-inflammatories also showed to influence the GPx parameter.

The main limitations of this study are the small sample size and the non-assessment of fluoxetine users in their baseline status, which is difficult due to the fact that depression requires medical treatment. Therefore, we suggest that one or more factors not considered in this study may be interfering with these results, such as adherence to FLU treatment or alterations in the metabolism of this drug. Complementary studies with these groups are necessary.

6. Conclusion

In this study, we observed differences in OE parameters in users and non-users of fluoxetine. The MDA levels, the activity of the GPx enzyme and the FRAP levels are higher in patients using 20 mg daily FLU dose when compared to the control group, suggesting that the use of fluoxetine may increase oxidative damage (MDA increased), leading to a compensation of antioxidant defenses, both enzymatic (GPx) and non-enzymatic (FRAP).

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A comparison of the Normal and Laplace distributions in the models of fuzzy probability distribution for portfolio selection

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Abstract

The propose of this work is applied the fuzzy Laplace distribution on a possibilistic mean-variance model presented by Li et al which appliehe fuzzy normal distribution. The theorem necessary to introduce the Laplace distribution in the model was demonstrated. It was made an analysis of the behavior of the fuzzy normal and fuzzy Laplace distributions on the portfolio selection with VaR constraint and risk-free investment considering real data. The results shows that were not difference in assets selection and in return rate, however, There was a change in the risk rate, which was higher in the Laplace distribution than in the normal distribution.

Keywords: Fuzzy number; VaR; Portfolio selection; Risk; Fuzzy Laplace distribution; Fuzzy Normal distribution.

1. Introduction

A financial portfolio is a distribution of financial resources among the various investment assets such as stocks, bonds and derivatives. With countless possible combinations of assets, the aim is to select the optimal portfolio, where the optimization depends on the purpose of the investor. The two most commonly searched objectives are: maximization return, to give acceptable level of risk, and risk minimization, to achieve a predefined level of return. The Nobel Prize winner in Economic Sciences, Harry Markowitz M. demonstrated that it is impossible to increase returns without increase risk; thus, it is common that higher expected return is associated with higher risk. Therefore, a profit-oriented investor, in order to guarantee an increase on his capital, would diversify by investing in several assets, instead of investing in only one asset, (HC Investment).

The least complex and most natural way to represent the problem of optimal portfolio selection is a constrained optimization problem. The aim is to maximize or minimize an objective function (usually maximize returns or risk minimization) subject to constraints. However, the objective function and constraints are usually not simple functions. They often rely on more than one characteristic of each asset, and these characteristics are usually combinations of functions that are much more complex than a linear

or quadratic function. So, finding a solution to this optimization problem requires more complex techniques.

For these and other reasons, many researchers seek models that can measure all of these variables. In this sense, Markowitz [9],[10] proposed a model for the mean-variance portfolio selection and probability theory associated to optimization techniques to model the performance of investment under uncertainty.

In particular, [1],[17] and [18] analyzed the economic implications of using a mean-VaR model for portfolio selection and the portfolio selection implications arising from imposing a value of risk constraint on the mean-variance model.

However, due to the complexity of financial systems, there are several situations where the input data are not precise but only fuzzy. Therefore, the decision makers should not consider parameters (goals and constraints) using numbers or unique distribution functions, but instead they should use fuzzy numbers or fuzzy probability distribution functions (see, for example [19]). Recently, researchers investigated many fuzzy portfolio selection problems (see, e.g., [15], [11], [7], [13], [12] and [20]). Knowledge of methods to rank fuzzy numbers is extremely important for this purpose ([2], [3], [5], [6], [14], [16]). Carlsson and Fuller [4] introduced the notations of upper and lower possibilistic mean values, and introduced the notation of crisp possibilistic mean values and crisp possibilistic variance of continuous distributions. Zhang and Nie [21] extended the concepts of possibilistic mean and possibilistic variance proposed by [4], and introduced the concepts of upper and lower possibilistic variances and covariances of fuzzy numbers.

Li et al [8] proposed a model portfolio of possibilistic investment restrictions under the VaR and risk-free. This model shows that risk-averse investors want to not only achieve the expected return rate on their current investment, but also they would prefer to ensure that the maximum of their potential future risk is lower than the VaR. With the assumption that returns of assets are fuzzy variables with normal distribution, with VaR restriction and risk-free.

The propose is to make a comparison using their model, but instead it will be applied fuzzy Laplace distribution and fuzzy normal distribution. We also demonstrate the theorem which is necessary for the inclusion of this distribution to the model proposed by [8]. So, we evaluate the behavior of this model with these two distributions functions.

This paper is organized as follows. In section 2, it is proposed a possibilistic portfolio model under constraints of VaR and risk-free investment. In section 3, it is presented a fuzzy normal distribution demonstrated in [8]. In section 4, it is presented fuzzy Laplace distribution. In Section 5, numerical examples are given to illustrate our effective proposed approaches. And finally, Section 6 presents our conclusions.

2. Portfolio Model under constraints of VaR and risk free investment

In order to define the model, it is necessary to make the following considerations. First, there are n risk assets and one risk-free asset for investment and the asset return rate $\tilde{\varphi}_i$ is a fuzzy number, $i = 1, 2, \dots, n$. x_i represents the proportion invested in assets i , and r_f is the risk-free asset return. From this, and taking into account the definitions of Carlsson and Fuller [4] for upper and lower possibilistic means and upper and lower possibilistic variances and covariances of a fuzzy number $\tilde{A}$ with γ

Theorem 3.1. Assume that the return rates of assets are fuzzy variables with fuzzy normal distribution expressed as $\tilde{\varphi}_i \sim FN(\mu_i, \sigma_i), i = 1, 2, \dots, n$, then

$$\sum_{i=1}^n x_i \tilde{\varphi}_i \sim FN \left[\sum_{i=1}^n x_i \mu_i, \left(\frac{4-\pi}{8} \right) \left(\sum_{i=1}^n x_i \sigma_i \right)^2 \right], \quad (4)$$

where $x_i, i = 1, 2, \dots, n$.

Proof. Refer to [8].

Moreover, Li et al [8] defines the possibilistic portfolio model under constraints of VaR and risk-free investments, whereas the variables are fuzzy with fuzzy Normal distribution. Thus:

$$\begin{cases} \min & \sigma^2 = \left(\frac{1}{2} - \frac{\pi}{8} \right) \left(\sum_{i=1}^n x_i^2 \sigma_i^2 + 2 \sum_{1 \leq i < j \leq n} x_i x_j \sigma_i \sigma_j \right) \\ \text{s.t.} & \sum_{i=1}^n x_i (\mu_i - r_f) + r_f \geq \tilde{r} \\ & (VaR - \sum_{i=1}^n x_i \mu_i)^2 \leq \ln(1 - \beta) \left(\frac{1}{2} - \frac{\pi}{8} \right) \left(\sum_{i=1}^n x_i \sigma_i \right)^2 \\ & \sum_{i=1}^n x_i \leq 1 \\ & l_i \leq x_i \leq u_i, i = 1, 2, \dots, n. \end{cases} \quad (5)$$

4. Fuzzy Laplace Distribution

Suppose that the return rate of asset i is a Laplace distribution fuzzy variable expressed as $\tilde{\varphi}_i \sim FL(\mu_i, \sigma_i)$, and its membership function is

$$\begin{aligned} A_i(t/\mu_i, b) &= \frac{1}{2b} \exp \left(-\frac{|t - \mu_i|}{b} \right) \\ &= \frac{1}{2b} \begin{cases} \exp \left(-\frac{t - \mu_i}{b} \right) & \text{if } t \geq \mu_i \\ \exp \left(-\frac{\mu_i - t}{b} \right) & \text{if } t < \mu_i \end{cases} \end{aligned}$$

$\frac{\sqrt{2}}{2}$

where $\sigma_i^2 = 2b^2$ and $b = \frac{\sqrt{2}}{2} \sigma_i$,

The γ level set of $\tilde{\varphi}_i$ is defined as

$$[\tilde{\varphi}_i]^\gamma = \left[\mu_i - \frac{\sqrt{2}}{2} \sigma_i \ln \sqrt{2} \sigma_i \gamma, \mu_i + \frac{\sqrt{2}}{2} \sigma_i \ln \sqrt{2} \sigma_i \gamma \right] \quad (6)$$

Theorem 4.1. Assume that the rates of return of the assets are Laplace fuzzy distributions variables expressed as $\tilde{\varphi}_i = FL(\mu_i, \sigma_i)$, $i = 1, 2, \dots, n$. Then

$$\sum_{i=1}^n x_i \tilde{\varphi}_i \sim FL\left(\sum_{i=1}^n x_i \mu_i, \frac{1}{8} \left(\sum_{i=1}^n x_i \sigma_i\right)^2\right) \quad (7)$$

where $x_i \geq 0$, $i = 1, 2, \dots, n$.

Proof. According to Li et al [8], the possibilistic mean value of $\sum_{i=1}^n x_i \tilde{\varphi}_i$ can be calculated by

$$M\left(\sum_{i=1}^n x_i \tilde{\varphi}_i\right) = \sum_{i=1}^n x_i M(\tilde{\varphi}_i) = \sum_{i=1}^n x_i \mu_i.$$

From definitions of upper M_U and lower M_L possibilistic means and the equation (4), it can be deduced that

$$\begin{aligned} M_U(\tilde{\varphi}_i) &= 2 \int_0^1 \gamma \left(\mu_i + \frac{\sqrt{2}}{2} \sigma_i \ln \sqrt{2\sigma_i \gamma} \right) dy \\ &= \mu_i + \sqrt{2} \sigma_i \int_0^1 \gamma \ln \sqrt{2} \sigma_i \gamma dy \\ &= \mu_i + \frac{\sqrt{2}}{2} \sigma_i \left(\ln \sqrt{2} \sigma_i - \frac{1}{2} \right). \text{ and} \end{aligned} \quad (8)$$

$$\begin{aligned} M_L(\tilde{\varphi}_i) &= 2 \int_0^1 \gamma \left(\mu_i - \frac{\sqrt{2}}{2} \sigma_i \ln \sqrt{2\sigma_i \gamma} \right) dy \\ &= \mu_i - \frac{\sqrt{2}}{2} \sigma_i \left(\ln \sqrt{2} \sigma_i - \frac{1}{2} \right). \end{aligned} \quad (9)$$

In the same way, the following results can be obtained:

$$\begin{aligned} \sigma_{2U}^2 &= 2 \int_0^1 \gamma [M_U(\tilde{\varphi}_i) - a_2(\gamma)]^2 dy \\ &= 2 \int_0^1 \gamma \left[\mu_i - \frac{\sqrt{2}}{2} \sigma_i \left(\ln \sqrt{2\sigma_i} - \frac{1}{2} \right) - \left(\mu_i + \frac{\sqrt{2}}{2} \sigma_i \ln \sqrt{2\sigma_i \gamma} \right) \right]^2 dy \\ &= \frac{1}{2} \sigma_i^2, \end{aligned}$$

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and

$$\begin{aligned} \sigma_{2L}^2 &= 2 \int_0^1 \gamma [M_L(\tilde{\varphi}_i) - a_2(\gamma)]^2 dy \\ &= \frac{1}{2} \sigma_i^2, \end{aligned}$$

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Thus, the possibilistic variance can be written as

$$\overline{\sigma_{\tilde{\varphi}_i}^2} = \frac{\sigma_U^2 + \sigma_L^2}{2} = \frac{1}{8} \sigma_i^2. \quad (10)$$

Furthermore, the upper and lower possibilistic covariances are given by

$$\begin{aligned} Cov_U(\tilde{\varphi}_i, \tilde{\varphi}_j) &= 2 \int_0^1 \gamma [M_U(\tilde{\varphi}_i) - a_2(\gamma)][M_U(\tilde{\varphi}_j) - b(\gamma)] d\gamma, \\ &= \frac{1}{8} \sigma_i \sigma_j, \end{aligned}$$

The possibilistic covariance is

$$Cov(\tilde{\varphi}_i, \tilde{\varphi}_j) = \frac{Cov_U(\tilde{\varphi}_i, \tilde{\varphi}_j) + Cov_L(\tilde{\varphi}_i, \tilde{\varphi}_j)}{2} = \frac{1}{8} \sigma_i \sigma_j. \quad (11)$$

According to [8] and considering $(x_i, \tilde{\varphi}_i)$, it can be computed the possibilistic variance of $\sum_{i=1}^n x_i \tilde{\varphi}_i$

$$\begin{aligned} \overline{\sigma_{\sum_{i=1}^n x_i \tilde{\varphi}_i}^2} &= \sum_{i=1}^n x_i^2 \overline{\sigma_{\tilde{\varphi}_i}^2} + 2 \sum_{i=1}^n \sum_{j=1}^n x_i x_j Cov(\tilde{\varphi}_i, \tilde{\varphi}_j) \\ &= \sum_{i=1}^n \frac{1}{8} x_i^2 \sigma_i^2 + 2 \sum_{i=1}^n \sum_{j=1}^n \frac{1}{8} x_i x_j \sigma_i \sigma_j \\ &= \frac{1}{8} (\sum_{i=1}^n x_i \sigma_i)^2. \end{aligned}$$

So the proof of the theorem is complete.

According to Theorem 4.1 the membership function of $\sum_{i=1}^n x_i \tilde{\varphi}_i$ is defined by:

$$\mu_{\sum_{i=1}^n x_i \tilde{\varphi}_i}(t) = \begin{cases} \frac{\sqrt{2}}{2} \sigma & \text{if } t \in [a, b] \\ 0 & \text{otherwise} \end{cases} \quad \text{where } a = \sum_{i=1}^n x_i \varphi_i, \quad b = \sum_{i=1}^n x_i \bar{\varphi}_i$$

So pos

$$A(t) = \exp \left\{ -\frac{1}{2b} \left(\sum_{i=1}^n x_i \tilde{\varphi}_i - t \right)^2 \right\}$$

$$\begin{aligned} VaR) &= \sup_{t \in [a, b]} \left\{ \frac{1}{2b} \exp \left\{ -\frac{1}{2b} \left(\sum_{i=1}^n x_i \tilde{\varphi}_i - t \right)^2 \right\} \right\}, \\ &= \frac{1}{2b} \exp \left\{ -\frac{1}{2b} \left(\sum_{i=1}^n x_i \tilde{\varphi}_i - t \right)^2 \right\}, \end{aligned}$$

2b

b

$$\begin{aligned}
&= \frac{1}{2b} \exp \left(-\frac{\sum_{i=1}^n x_i \mu_i - VaR}{b} \right) \text{ if } VaR < \sum_{i=1}^n x_i \mu_i \\
&= \begin{cases} \frac{1}{2b} \exp \left(-\frac{\sum_{i=1}^n x_i \mu_i - VaR}{b} \right) & \text{if } VaR < \sum_{i=1}^n x_i \mu_i \\ \frac{1}{2b} \exp \left(-\frac{VaR - \sum_{i=1}^n x_i \mu_i}{b} \right) & \text{if } VaR \geq \sum_{i=1}^n x_i \mu_i \end{cases} \quad (12)
\end{aligned}$$

According to equations (2) and (12), it is obtained

$$\begin{aligned}
(VaR - \sum_{i=1}^n x_i \mu_i) &\leq b \ln[2b(1 - \beta)] \quad \text{if } VaR < \sum_{i=1}^n x_i \mu_i \\
(\sum_{i=1}^n x_i \mu_i - VaR) &\leq b \ln[2b(1 - \beta)] \quad \text{if } VaR \geq \sum_{i=1}^n x_i \mu_i.
\end{aligned} \quad (13)$$

It is known from equations (1), (8) and (9), that when the return rate of assets are Laplace distribution fuzzy variables, the upper and lower possibilistic means of $\tilde{r}_p$ are given by:

$$\begin{aligned}
M_U(\tilde{r}_p) &= \sum_{i=1}^n \left(\mu_i + \frac{\sqrt{2}}{2} \sigma_i \left(\ln \sqrt{2} \sigma_i - \frac{1}{2} \right) - r_f \right) x_i + r_f \\
M_L(\tilde{r}_p) &= \sum_{i=1}^n \left(\mu_i - \frac{\sqrt{2}}{2} \sigma_i \left(\ln \sqrt{2} \sigma_i - \frac{1}{2} \right) - r_f \right) x_i + r_f
\end{aligned}$$

Thus, the possibilistic mean of $\tilde{r}_p$ is written as

$$M(\tilde{r}_p) = \frac{M_U(\tilde{r}_p) + M_L(\tilde{r}_p)}{2} = \sum_{i=1}^n (\mu_i - r_f) x_i + r_f.$$

Moreover, for a Laplace fuzzy variable distribution, the portfolio model of VaR restrictions and risk free investment can be formulated as:

$$\begin{aligned}
\min \quad & \overline{\sigma^2} = \frac{1}{8} \left(\sum_{i=1}^n x_i^2 \sigma_i^2 + 2 \sum_{i > j=1}^n x_i x_j \sigma_i \sigma_j \right) \\
\text{s.t} \quad & \sum_{i=1}^n x_i (\mu_i - r_f) + r_f \geq \tilde{r} \\
& (VaR - \sum_{i=1}^n x_i \mu_i) \leq b \ln[2b(1 - \beta)] \quad \text{if } VaR < \sum_{i=1}^n x_i \mu_i \\
& (\sum_{i=1}^n x_i \mu_i - VaR) \leq b \ln[2b(1 - \beta)] \quad \text{if } VaR \geq \sum_{i=1}^n x_i \mu_i \\
& \text{where } b = \frac{\sqrt{2}}{16} \left(\sum_{i=1}^n x_i \sigma_i \right)^2 \\
& \sum_{i=1}^n x_i \leq 1 \\
& 0 \leq l_i \leq x_i \leq u_i, i = 1, 2, \dots, n,
\end{aligned} \quad (14)$$

5. Numerical Example

We may believe that in order to have a more profitable investment, we need only increase the risk. So in an ideal world, you would choose the desired risk and receive the expected return. In the real world, the history is different. Risky investments do not imply or guarantee higher returns. If it were in this way, the idea of risk would not make sense. For this reason, we have created a rating for the investor as a result of desired risk and from there select the best expected portfolio allocation for this profile (see Table 1).

For $P_i (i = 1, \dots, 100)$ denoting the set of the $i\%$ of the portfolio with least risks. The investor profile is defined in the Table 1, with Su

Little Aggressive (Aggressive (and Very Aggressive (in term of P_i 's.

Type of Investor		Rating Interval
Super Conservative	0.10	Maximum return of risks lesser than P10
Conservative	0.25	Maximum return of the risks between P10 and P25
Moderate	0.50	Maximum return of the risks between P26 and P50
Little Aggressive	0.75	Maximum return of the risks between P51 and P75
Aggressive	0.90	Maximum return of the risks between P76 and P90
Very Aggressive	1.00	Maximum return of the risks greater than P91

Table 1. Investor Profile

In order to compare the results using the two models of fuzzy distributions, namely, Normal and Laplace, whenever they are in the context of possibilistic mean-variance model described by [8], it was selected three assets of the Bank of Brazil, correspond to three period of the application (12, 14 and 36 months), conform shows the Table 2.

In a next step, a database has been generated $x_i, i = 1, 2, \dots, n$, representing the proportion invested in assets i , namely, $l_i \quad x_i \quad u_i$. For this work, will be considered $n = 3$ assets and return rate for each asset i $FN(i, i)$ and $i \quad FL(i, i)$ is calculated from the frequency distribution of monthly returns of the tree assets in each period of the application, see Table 2.

	Investment Portfolio								
	STPF – Short-term portfolio funds			LTPF – Long-term portfolio funds			Stock Market		
	Rate Return (%)			Rate Return (%)			Rate Return (%)		
Months	12	24	36	12	24	36	12	24	36
Accumulated	5,026667	15,10417	26,50833	10,43517	16,22708	31,75975	24,5475	48,646	40,64295
μ	0,418889	0,41956	0,736343	0,869597	0,676128	0,882215	2,045625	2,068583	1,128971
	0,186846	0,29036	0,403642	1,412328	1,680308	1,310872	6,024559	7,289093	5,449996

Table 2. The possibilistic distributions of returns of tree assets, data from 2018, the Bank of Brazil

The level set of, is given by $i(i = 1, \dots, 4)$ from the $FN(i, i)$, is given by

$$\begin{aligned}
 [\varphi_1]^r &= [0.0161 - 0.0194\sqrt{\ln\gamma^{-1}}, 0.0161 + 0.0194\sqrt{\ln\gamma^{-1}}] \\
 [\varphi_2]^r &= [0.0247 - 0.0228\sqrt{\ln\gamma^{-1}}, 0.0247 + 0.0228\sqrt{\ln\gamma^{-1}}] \\
 [\varphi_3]^r &= [0.0282 - 0.0171\sqrt{\ln\gamma^{-1}}, 0.0282 + 0.0171\sqrt{\ln\gamma^{-1}}] \\
 [\varphi_4]^r &= [0.0392 - 0.0104\sqrt{\ln\gamma^{-1}}, 0.0392 + 0.0114\sqrt{\ln\gamma^{-1}}]
 \end{aligned} \tag{15}$$

Suppose $\backslash\%$ and $VaR = 0.4\%$ and considering each investor profile defined in Table 1, the results obtained of the selected portfolios to 12, 24 and 36 months are presented in Tables 3, 4 and 5, respectively.

Portfolio						
	0.1 (1)	0.25 (2)	0.5 (3)	0.75 (4)	0.9 (5)	1 (6)
x_1 (%)	47.75	28.75	9.75	5.00	5.00	5.00
x_2 (%)	0.00	60.00	65.00	55.00	30.00	20.00
x_3 (%)	10.00	10.00	23.50	37.00	59.50	73.00
Risk-Free (%)	42.25	1.25	1.75	3.00	5.50	2.00
Return (%)	5.1610	10.1741	13.0583	15.0986	18.0304	20.2754
Risk (%)	0.6177	2.9124	7.1280	11.7204	20.8184	28.3697

Table 3. Normal - the Bank of Brazil year 2018/12

Portfolio						
	0.1 (1)	0.25 (2)	0.5 (3)	0.75 (4)	0.9 (5)	1 (6)
x_1 (%)	5.00	33.50	71.50	62.00	38.25	14.50
x_2 (%)	0.00	0.00	0.00	0.00	0.00	10.00
x_3 (%)	10.00	10.00	19.00	32.50	59.50	73.00
Risk-Free (%)	85.00	56.50	9.50	5.50	02.25	2.50
Return (%)	6.2675	10.4327	20.3036	25.5408	35.3316	40.0681
Risk (%)	1.4225	1.7563	6.5253	16.7199	50.9219	78.7441

Table 4. Normal - the Bank of Brazil year 2018/24

Portfolio						
	0.1 (1)	0.25 (2)	0.5 (3)	0.75 (4)	0.9 (5)	1 (6)
x_1 (%)	5.00	28.75	66.75	66.75	38.25	14.50
x_2 (%)	0.00	0.00	20.00	0.00	5.00	15.00
x_3 (%)	10.00	10.00	10.00	28.00	55.00	68.50
Risk-Free (%)	85.00	61.25	3.25	5.25	1.75	2.00
Return (%)	6.5015	10.2516	20.0598	25.2374	35.1677	40.0607
Risk (%)	1.2338	1.6875	4.4742	12.4493	39.9836	61.4422

Table 5. Normal - the Bank of Brazil year 2018/36

Now it will be considered the Laplace distribution to selected the three assets presented in Table 2. The level set of $i(i = 1, \dots, 4)$ from the $FN(i, i)$ (Figure 1), is given by

$$\begin{aligned}
 [\tilde{\varphi}_1]^y &= \left[0.0161 - \frac{\sqrt{2}}{2} 0.0194 \ln(\sqrt{2} 0.0194 y), 0.0161 + \frac{\sqrt{2}}{2} 0.0194 \ln(\sqrt{2} 0.0194 y) \right] \\
 [\tilde{\varphi}_2]^y &= \left[0.0247 - \frac{\sqrt{2}}{2} 0.0228 \ln(\sqrt{2} 0.0228 y), 0.0247 + \frac{\sqrt{2}}{2} 0.0228 \ln(\sqrt{2} 0.0228 y) \right] \\
 [\tilde{\varphi}_3]^y &= \left[0.0282 - \frac{\sqrt{2}}{2} 0.0171 \ln(\sqrt{2} 0.0228 y), 0.0282 + \frac{\sqrt{2}}{2} 0.0171 \ln(\sqrt{2} 0.0171 y) \right] \\
 [\tilde{\varphi}_4]^y &= \left[0.0392 - \frac{\sqrt{2}}{2} 0.0104 \ln(\sqrt{2} 0.0228 y), 0.0392 + \frac{\sqrt{2}}{2} 0.0104 \ln(\sqrt{2} 0.0104 y) \right]
 \end{aligned} \tag{16}$$

Again, suppose $\alpha = 0.4\%$ and considering each investor profile defined in Table 1, the results obtained of the selected portfolios for 12, 24 and 36 months are presented in Tables 6, 7 and 8, respectively.

Portfolio						
	0.1 (1)	0.25 (2)	0.5 (3)	0.75 (4)	0.9 (5)	1 (6)
x_1 (%)	47.75	28.75	9.75	5.00	5.00	5.00
x_2 (%)	0.00	60.00	65.00	55.00	30.00	20.00
x_3 (%)	10.00	10.00	23.50	37.00	59.50	73.00
Risk-Free (%)	42.25	1.25	1.75	3.00	5.50	2.00
Return (%)	5.1610	10.1741	13.0583	15.0986	18.0304	20.2754
Risk (%)	0.7196	3.3928	8.3049	13.6537	24.2523	33.0493

Table 6. Laplace - the Bank of Brazil year 2018/12

Portfolio						
	0.1 (1)	0.25 (2)	0.5 (3)	0.75 (4)	0.9 (5)	1 (6)
x_1 (%)	5.00	33.50	71.50	62.00	38.25	14.50
x_2 (%)	0.00	0.00	0.00	0.00	0.00	10.00
x_3 (%)	10.00	10.00	19.00	32.50	59.50	73.00
Risk-Free (%)	85.00	56.50	9.50	5.50	02.25	2.50
Return (%)	6.2675	10.4327	20.3036	25.5408	35.3316	40.0681
Risk (%)	1.6571	2.0460	7.6017	19.4778	59.3214	91.7328

Table 7. Laplace - the Bank of Brazil year 2018/24

Portfolio						
	0.1 (1)	0.25 (2)	0.5 (3)	0.75 (4)	0.9 (5)	1 (6)
x_1 (%)	5.00	28.75	66.75	66.75	38.25	14.50
x_2 (%)	0.00	0.00	20.00	0.00	5.00	15.00
x_3 (%)	10.00	10.00	10.00	28.00	55.00	68.50
Risk-Free (%)	85.00	61.25	3.25	5.25	1.75	2.00
Return (%)	6.5015	10.2516	20.0598	25.2374	35.1677	40.0607
Risk (%)	1.4374	1.9659	5.2122	14.5027	46.5789	71.5770

Table 8. Normal - the Bank of Brazil year 2018/36

To illustrate, assume that an investor wants to invest 1,000 in the Banco do Brasil portfolios presented in Table 1. Considering the results presented from the model for the two distributions studied and the investor profile (Table 1), Tables 9, 10, 11 shows a summary of the previous results, with the Normal and Laplace present the best portfolio distribution (Table 11).

Comparing the two distributions, it was observed that the returns for each portfolio (STPF, LTPF and Stock Market) are the same for the two fuzzy possibilistic distributions considered (Normal and Laplace) with theories and equations (5) and (14) previously defined. However, the risks are different. Note that in all cases, the risk is higher when calculated using the Laplace distribution. From this, it is possible in future work to establish a gap between this difference in found risks in Normal and Laplace distributions, with the objective of defining the investor profile of the interval form.

Therefore when comparing the results for Normal and Laplace models of fuzzy distribution, whenever they are inserted into possibilistic mean-variance model described by [8], it can be found out they are very similar to each other, Differing only in the risk rate, which is higher in the Laplace distribution than in the

	0.1 (1)		0.25 (2)		0.5 (3)		0.75 (4)		0.9 (5)		1 (6)	
Portfolio	N	L	N	L	N	L	N	L	N	L	N	L
STPF	477.50	477.50	288.50	288.50	97.50	97.50	50.00	50.00	50.00	50.00	50.00	50.00
LTPF	0.00	0.00	600.00	600.00	650.0	650.0	550.00	550.00	300.00	300.00	200.00	200.00
Stock Market	100.00	100.00	125.00	125.00	235.0	235.0	370.00	370.00	595.00	595.00	730.00	730.00
Free – Risk	422.50	422.50	12.50	12.50	17.50	17.50	30.00	30.00	55.00	55.00	20.00	20.00
Return (%)	5.1610	5.1610	10.1741	10.1741	13.0583	13.0583	15.0986	15.0986	18.0304	18.0304	20.2754	20.2754
Risk (%)	0.6177	0.7196	2.9124	3.3928	7.1280	8.3049	11.7204	13.6537	20.8184	24.2523	28.3697	33.0493

Table 9. Result for an investment value of mil dollar – Normal (N) and Laplace (L) – Bank of Brazil years 2018/12

	0.1 (1)		0.25 (2)		0.5 (3)		0.75 (4)		0.9 (5)		1 (6)	
Portfolio	N	L	N	L	N	L	N	L	N	L	N	L
STPF	50.00	50.00	335.00	335.00	715.00	715.00	620.00	620.00	382.50	382.50	145.00	145.00
LTPF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	100.00

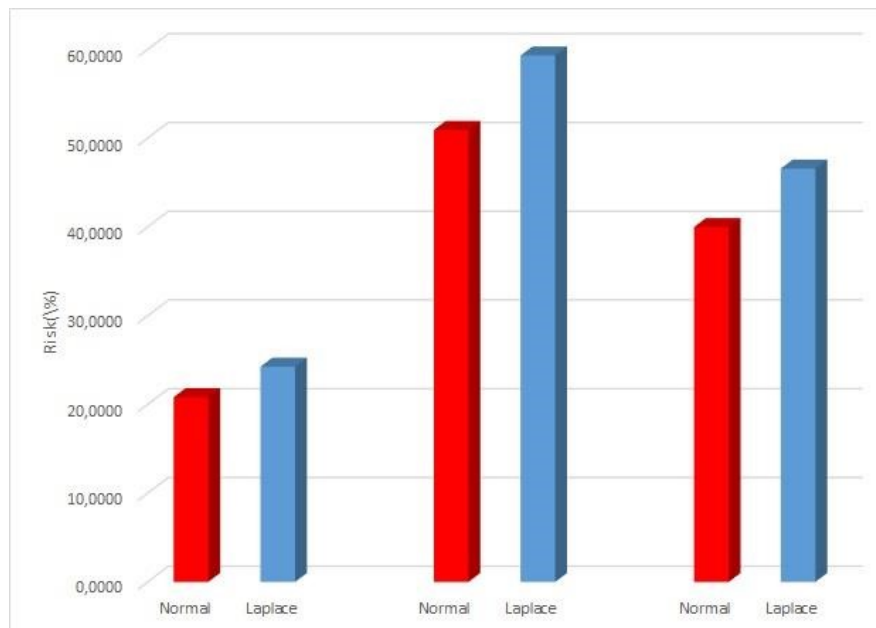
Stock Market	100.00	100.00	100.00	100.00	190.00	190.00	325.00	325.00	595.00	595.00	730.00	730.00
Free – Risk	850.00	850.00	565.00	565.00	95.00	95.00	55.00	55.00	22.50	22.50	25.00	25.00
Return (%)	6.2675	6.2675	10.4327	10.4327	20.3036	20.3036	25.5408	25.5408	35.3316	35.3316	40.0681	40.0681
Risk (%)	1.4225	1.6571	1.7563	2.0460	6.5253	7.6017	16.7199	19.4778	50.9219	59.3214	78.7441	91.7328

Table 10. Result for an investment value of mil dollar – Normal (N) and Laplace (L) – Bank of Brazil years
2018/24

	0.1 (1)		0.25 (2)		0.5 (3)		0.75 (4)		0.9 (5)		1 (6)	
Portfolio	N	L	N	L	N	L	N	L	N	L	N	L
STPF	50.00	50.00	287.50	287.50	667.50	667.50	667.50	667.50	382.50	382.50	145.00	145.00
LTPF	0.00	0.00	0.00	0.00	200.00	200.00	0.00	0.00	50.00	50.00	150.00	150.00
Stock Market	100.00	100.00	100.00	100.00	100.00	100.00	280.00	280.00	550.00	550.00	685.00	685.00
Free – Risk	850.00	850.00	612.50	612.50	32.50	32.50	52.50	52.50	17.50	17.50	20.00	20.00
Return (%)	6.0015	6.0015	10.2516	10.2516	20.0598	20.0598	25.2374	25.2374	35.1677	35.1677	40.0607	40.0607
Risk (%)	1.2338	1.4374	1.6875	1.9659	4.4742	5.2122	12.4493	14.5027	39.9836	46.5789	61.4422	71.5770

Table 10. Result for an investment value of mil dollar – Normal (N) and Laplace (L) – Bank of Brazil years
2018/36

	BB 2018/12		BB 2018/24		BB 2018/36	
Portfolio	N	L	N	L	N	L
STPF	50.00	50.00	382.50	382.50	382.50	382.50
LTPF	300.00	300.00	0.00	0.00	50.00	50.00
Stock Market	595.00	595.00	595.00	595.00	550.00	550.00
Free – Risk	55.00	55.00	22.50	22.50	17.50	17.50
Return (%)	18.0304	18.0304	35.3316	35.3316	35.1677	35.1677
Risk (%)	20.8184	24.2523	50.9219	59.3214	39.9836	46.5789



- Investor

Aggressive

5. Conclusion

This work compared models of fuzzy distribution, namely, Normal and Laplace, whenever they are inside the context of possibilistic mean-variance model described by in [8], where only fuzzy Normal distribution was used. The purpose was to make a comparison of model applying fuzzy Laplace distribution. The theorem which was necessary for the inclusion of the Laplace distribution to the model proposed by [8] was demonstrated. It is well known the importance of having other distributions as parameters for financial analysts, due the volatility of the stock market as well as the behavior of financial market.

It can also be emphasized the importance of working with several fuzzy probability distributions, as demonstrated by the significant variation in the return and risk rates. Besides, this work demonstrated that for the model proposed by [8] and that fuzzy Normal distribution and fuzzy Laplace distribution are the most appropriate ones.

For a comparison between the two fuzzy distributions, it was defined the investor profile with Super

Aggressive types. Next, we show the selected portfolio from your profile.

Therefore, risk-averse investors were given the possibility of a better evaluation, i.e, deciding the best way to distribute their funds in assets investment.

7. References

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Academic Management and Contemporary Gaps

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Abstract

It is challenge to contemporary academic management to fulfill the demands of the labor market, and to have improvements with the this, considering the scientific development; through the analysis of intangibles like student performance, which can generate positive results with repercussion on institutional reputation. According to the Organization for Economic Cooperation and Development (OECD, 2018) the adequate professional qualification results in employment for qualified individuals; while activities more prone to automation are observed, and greater chance of unemployment for those with low qualification. In this research there was the reading of 447 abstracts of publications, obtained by refinements applied on 4,491 initial registers, and selected 20 considering the performance of the students as a parameter of the university administration, with the objective of identifying gaps of academic management, resulting: to contemplate student learning as a dependent variable, and to extend to the documents the origin of the research data.

Keywords: academic management, student learning, scientific research, intangible assets,

1. Introduction

According to the [24], the economies of the countries of the Organization for Economic Cooperation and Development (OECD) depend on adequate training of workers. With the expand educational opportunities, the number of qualified people is enlarged, and these are more prone to be employed. By contrast, while job opportunities still exist for those with lower qualifications, their labor market prospects are relatively challenging - with low incomes and routine activities, thus at greater risk of being automated, which in turn, impacts on the increase of the probability of unemployment, being possible to exacerbate the socioeconomic inequalities.

Thus, the relationship between professional qualification and the labor market challenges educational systems and contemporary academic management, which, interacting with companies, must seek to solver institutional demands for knowledge, skills and behaviors; as well as foresee ways in which scientific

advances can result improvements for organizations.

Another challenge for academic management, according to [27], is the monitoring and intervention of student performance, with a view to evaluating and improving the pedagogical project, and other objectives of university administration, based on individual and accurate tracking; student results; which makes administrative and/or pedagogical decision making possible, "...this type of process can serve as an important support for diagnoses and interventions... according to the prescriptions that may prove necessary..." [27].

Therefore, contemporaneity also encourages academic management to overcome the limitation of turning exclusively to tangible assets and to contemplate intangible factors and assets, such as student achievement; because it can positively impact the institutional reputation and consequently its economy.

During the decades 1980s, 1990s and 2000s, according to the [23], corporate assets were no longer predominantly tangible in nature, and became intangible, and knowledge-based assets such as intellectual property (IP): rights, research and development (R&D), and software, skills, and organizational know-how. Studies in various OECD countries show that companies now invest in both intangible resources, such as innovation-related intellectual assets, as well as in capital such as machinery, equipment and buildings.

However, in this context of integration of intangibles, it is important to distinguish factors and assets, because in order to justify this categorization "... it's necessary the factor or element propitiate, directly or indirectly, for the enterprise, future economic and financial benefits." [32]

For example, according to [19], factors such as professional, functional or personal training, and reputation, may result in intangible assets in the equity scenario. Assets, interacting with other factors, tangible or intangible, result positive or negative effects on the profitability of the respective venture.

These challenges highlight the need for improvement of current educational actions. Thus, the objective is to identify the limitations and gaps of academic management, in the contemporary scenario, from the perspective of student learning.

2. Method

2.1 Search Type

It is a research, as to the origin of the data, according to [18], bibliographic and exploratory, with access to records from the Journals Portal of the Higher Level Personnel Improvement Commission, in portuguese Comissão Superior de Aperfeiçoamento de Pessoal (CAPES).

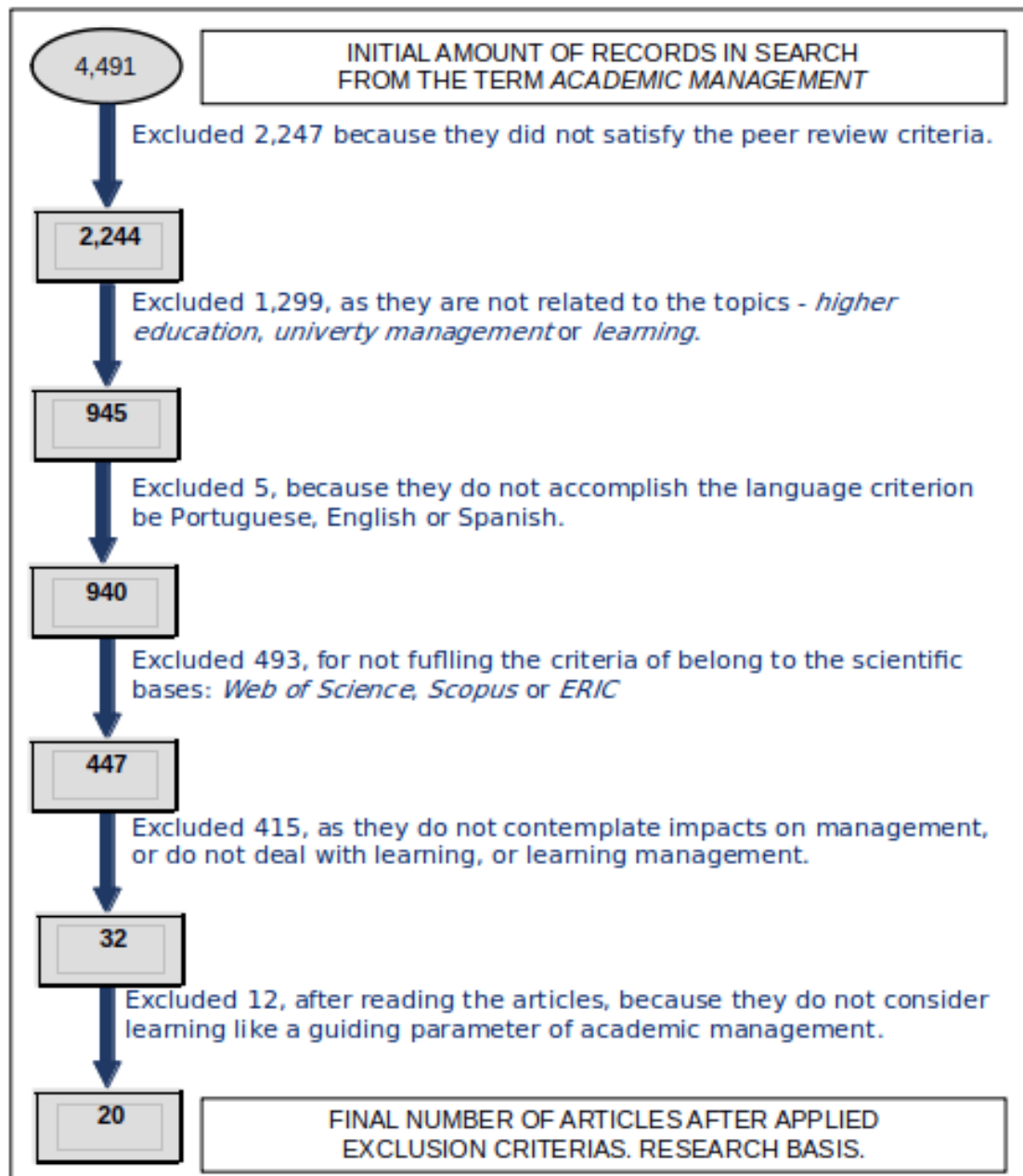
2.2 Data Collect

The data collect began with the search of the term *academic management* on March/30/2019, timeframe from 2008 to 2019, initially identifying 4,491 records.

Those did not satisfy the following criteria, were excluded:

- a) peer reviewed, to ensure greater reliability, resulting the exclusion of 2,247 records;
- b) related to the *higher education* and *management university* and *learning topics*, resulting in 1,299 removals, with the objective of turning the focus to the specificities of academic management;
- c) written in the languages - Portuguese, English and Spanish - 5 records being removed to preserve the researchers' ability to understand, considering the languages with which they are familiar;

d) contained in the following scientific bases, with 493 files being subtracted: (i) *Web of Science* - collection of 5 scientific data sources, which allows access to references and abstracts from all areas of knowledge, covering approximately 12,000 journals, thus ensuring wide coverage; (ii) *Scopus* - composed of research in the areas of technology, medicine, social sciences, arts and humanities; soon interdisciplinary, as well as the subject matter of the present study; and (iii) *Education Resources Information Center (ERIC)* - relating to education studies, maintained by Education's Institute of Education Sciences (IES), of the US Education's Department, considering that the subject under study is educational in nature.



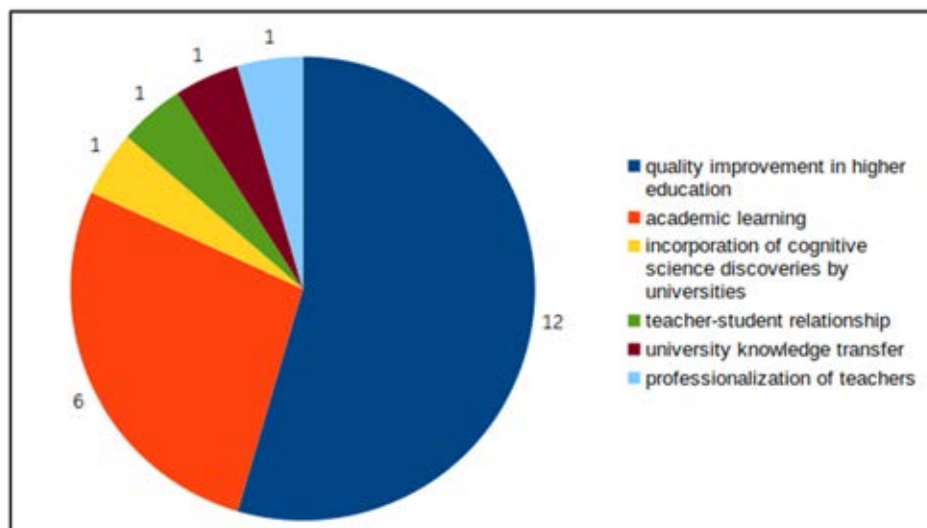


Figure 1. Flow for Selecting Research Sources about Academic Management and Learning

From reading the abstracts of the 447 records resulting from the above refinement processes: (i) 255 were excluded, which did not address academic management, or despite addressing themes that support it, such as: learning methodologies, entrepreneurial training in higher education, qualification of professor; these do not contemplate their effects on the central issue, which is indispensable for the fulfillment of the desired objective; and (ii) 192 publications were categorized that address the themes, such as: student engagement and motivation, retention and profile of graduates, 32 of which were highlighted because deal with learning - key element in the academic management process.

Then, from the 32 pre-selected publications, a sixth filter was applied, which consisted of a thorough reading of the articles, and 20 effectively were selected because are relevant for the management area and for the investigated theme, as they considered learning a important parameter of academic management (Figure 1).

Whereas [25], when dealing with the existence of an organizational model that makes it possible to adapt higher education to the new scenario - of increasing student diversity, of development holistic student skills, and adaptation to the needs of economic and scientific activity; explain that the compass of this improvement is learning, understood as enhancement students' ability to apply their knowledge, as well as for further and continuous learning.

2.2 Data Analysis

From the selected articles - research basis - the figures and tables, components from the Results section, were constructed using the spreadsheet manager, open source, LibreOffice Calc, Version 6.0.7.3, available from LibreOffice – The Document Foundation, identifying:

- dependent and independent variables, aiming to determine causes and discoveries of the scientific investigations analyzed, as stated by [18]; as well as the their relationship with results and impacts, categorizing them into tangible or intangible assets, or intangible factor, according to [32];
- universe and sample, aiming to understand the information that researchers consider relevant in the study about academic management;

c) instruments and techniques applied for data collect, as stated by [18], which are: (i) documentary collect, (ii) observation, (iii) interview, (iv) questionnaire, (v) form, (vi) scale, (vii) tests and (viii) life history;

d) statistical treatment - "...It is possible to conduct na investigation without statistics but impossible to do so without subject matter knowledge. However, by using statistical methods convergence to a solution is speeded and a good investigator beomes na even better one." [5];

e) research classification according to the type of problem, according to [18], being: (i) explanatory predictive, (ii) of information, (iii) action, (iv) of pure investigation or (v) applied research;

f) types of research according to the applied data analysis, being: (i) of interpretation, (ii) of explanation or (iii) of specification; as claimed by [18];

g) categorization of the research according to the source of the data, being six, the types of research, as stated by [18]: (i) documentary, (ii) bibliographic, (iii) descriptive quantitative field, (iv) exploratory field, (v) experimental field, and (vi) laboratory.

3. Results

The dependent variables identified in the research base were: 'quality improvement in higher education', 'academic learning', 'incorporation of cognitive science discoveries by universities', 'professor-student relationship', 'university knowledge transfer' and 'professionalization of professors'.

Six dependent variables were observed, in a total of 22 occurrences, since 2 of the publications have 2 dependent variables each, while the others have only one.

The dependent variable 'improving the quality of higher education' has the highest percentage frequency – corresponding to 54.5%; followed by 'academic learning', equivalent to 27.2%. All other variables were cited by one article each, 4.5% of these (Figure 2).

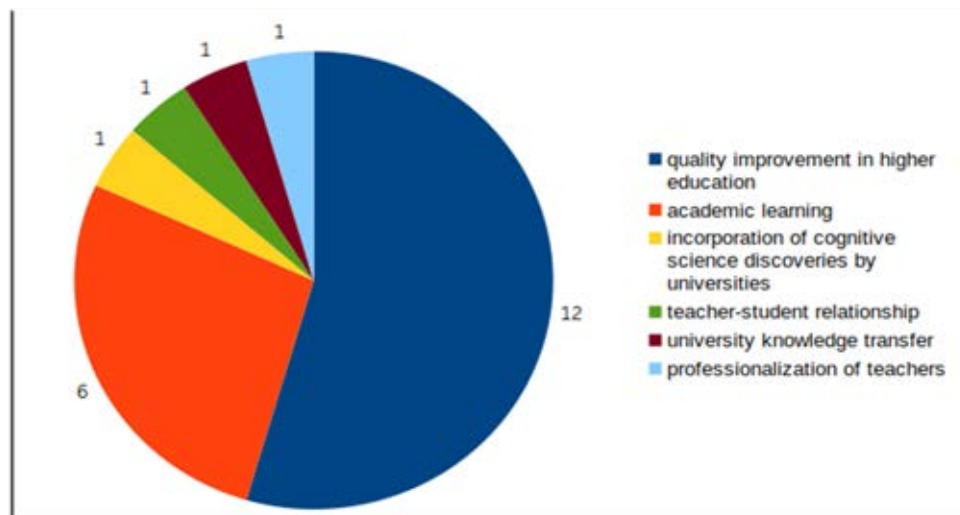


Figure 2. Ocorrences' Number of Dependent Variables in the Research Basis

Independent variables are presented in the Table 1, followed by their results/impacts categorized into tangible or intangible assets or intangible factor.

Table 1. Categories of the Results/Impacts of Independent Variables

Independents Variables	Results/Impacts	Categories
personalization of educational services	introduces innovative software environment	intangible factor
action learning, academic performance and student satisfaction	qualification process with outcomes concerning learning	intangible asset
self-efficacy, student satisfaction and predicting academic performance	11 guidelines applied to Information Technology (IT), for higher education	intangible factor
application of learning analytics	need to investigate learning analysis	intangible factor
technology acquisition	'MIT90s' framework with positive impact on learning	intangible asset
acquisition of competence, validated through the application of scale	scale to measure competence acquisition	intangible factor
video recording of lectures about anatomy and physiology	need to enhance IT resource	intangible factor
management system to evaluate and disseminate educational innovations	presents management system that enables parameterization	intangible factor
continuous update of post disaster professionals	recommendation of skills to consider in Course Pedagogic Projects (PPCs)	intangible factor
scope and depth of e-portfolio practice in higher education	'e-Portfolio' as a higher education product and process with positive outcomes on learning	intangible asset
management framework application	framework proposition of the 'MODES'	intangible factor
apply asynchronous learning network	effects of asynchronous learning network application, with positive outcomes on student performance	intangible asset
to know students in light of educational ethics of care	explains the educational ethic of care	intangible factor
use of systematic evaluation of the results of all the program	guidelines for continuous assessment application	intangible factor
use of Information and communication technology (ICTs) in higher education	guides ICT integration in higher education	intangible factor
training for knowledge transfer	recommends knowledge interchange	intangible factor

Independents Variables	Results/Impacts	Categories
leadership application in academic management	understanding the function of leadership in academic management	intangible factor
Determination of desired learning outcomes by employers	recommends focusing education on the outcomes desired by employers	intangible factor
need for mediation of transformational leadership	apply the transformational leadership	intangible factor
need for cooperation between professors	explains because professors cooperate	intangible factor

The category of results related to the most frequently independent variables is the 'intangible factor', which was identified in 80.0% of investigations of the base. Impacts involving 'intangible assets' correspond to 20.0%; and there was no impact related to 'tangible assets'.

Six universes were most commonly identified: 'higher education institutions', 'employers', 'students', 'professors', 'managers' and 'governments'; and the occurrence of five others in only one article, each: 'researchers', 'administrative technicians', 'graduates', 'school' and 'classroom'.

The universe with the highest absolute frequency was 'higher education institution', corresponding to the population of 52.9% of the scientific investigations analyzed; followed by the 'students', considered the universe in 8.8% of researches. 'Employers', 'professors', 'managers' and 'government' are research universes at 5.8% of the base, each (Figure 3).

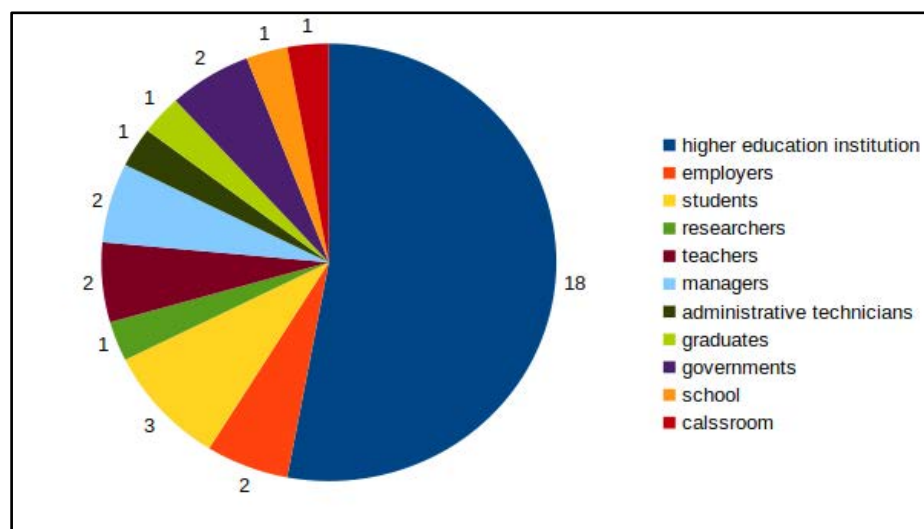


Figure 3. Number of Articles by Composition of Research Universes

It was observed that no documentary collect, or form, was applied, and the instruments that stood out for the highest number of occurrences in the research were the questionnaire, the interview and the tests.

The 'questionnaires' correspond to the most widely used data collect instrument in the research studies, the equivalent of 24.1%. These were followed by the 'interview' and the 'tests', each used in 20.2% of the scientific investigations analyzed. The other collect resources considered - 'documentary', 'observation', 'form', 'scales' and 'life story' - were grouped into one category, with a cumulative frequency of 34.4% of

researches (Figure 4).

Of the 20 scientific investigations under study, 5 applied statistical treatment to the data: 3 with structural equation modeling, 1 with exploratory factor analysis, and 1 through classification distribution.

After data collect, 75.0% of the researches did not apply statistical treatment. In the remaining studies of the considered base: in 25.0%, it is observed application of the statistical methods: 'structural equation modeling', 'exploratory factor analysis', and 'classification distribution'.

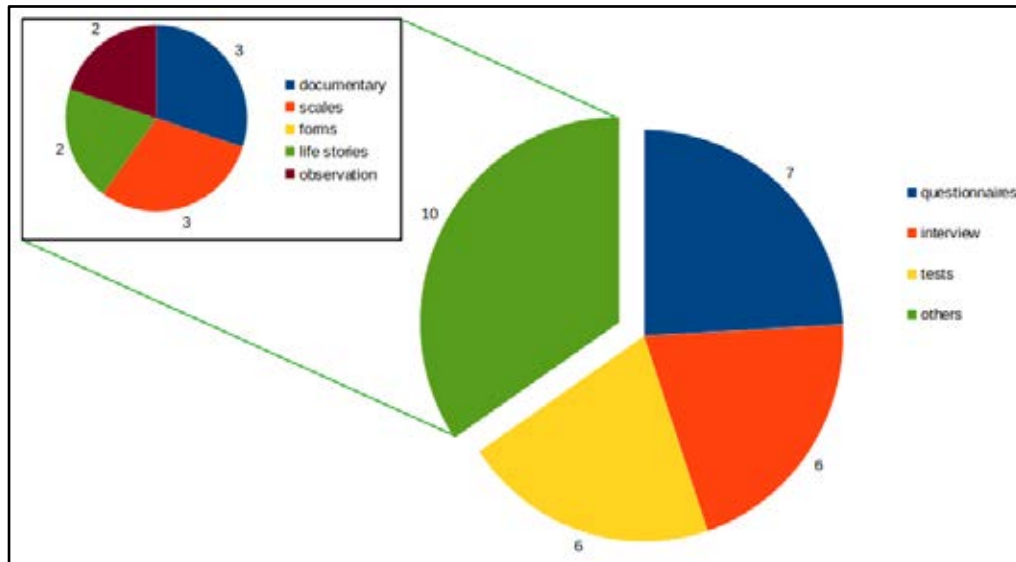


Figure 4. Articles by Main Instruments and Data Collect Techniques Applied

As for the types of problem, more than half of the research analyzed in this are 'explanatory predictive', being 4 of 'applied research', and 3 'pure'. The research approach 'applied research' was the one with the highest frequency - 13, corresponding to 65.0% of the investigations under study; while the of 'pure research' equate 35.0%. Regarding the objectives, the 'of information' have accumulated frequency 8, corresponding to 40.0%, followed by the 'of action' 35.0%, and 25.0% are 'explanatory predictive'.

Analyzing the research base on academic management, as to the method of data analysis applied, it is observed that 70.0% are 'interpretive', while 30.0% are 'explanatory', and no research with character of 'specification'.

Regarding the origin of the data, the category that presented the highest percentage frequency was the 'bibliographic': 86.3%, corresponding to 19 researches, among which 63.1% 'experimental'. And no 'laboratory' investigation was observed (Figure 5).

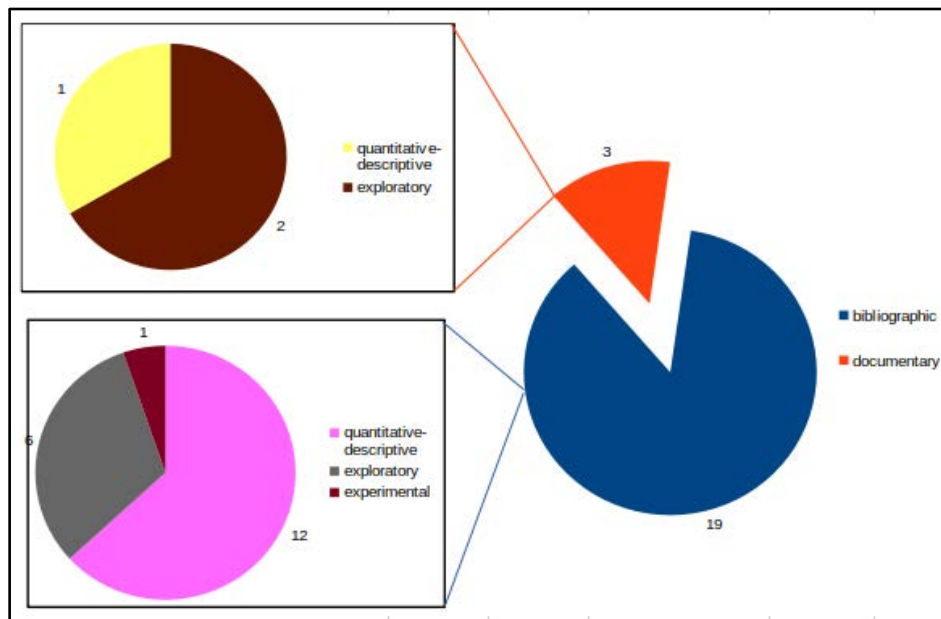


Figure 5. Number of Articles by Data Source

It is observed that the number of researches exceeds the total of 20 scientific investigations contained in the study base, as they are hybrid, that is, the data they manipulate has more than one source. In this scenario there are 17 strictly 'bibliographic', 2 'bibliographic' and 'documentary' searches, and 1 strictly 'documentary', making a total of 22 searches.

4. Discussion

Regarding the analysis of the dependent variables, the fact of the 'quality improvement of higher education' to be the one with the highest absolute frequency, despite signaling commitment to the improvement of higher education, and consequently with the academic management process; It has a generalist nature.

As in South Korea, according to [31], the focus of education on student is the goal of educational reform that drives the country to positions that show education quality, highlighting this in international rankings, and presenting outcomes to a gap resulting of fourth industrial revolution, and requires modern and innovative ideas and practices.

Therefore, to consider the 'learning by academics' would make the researches variables in analysis more specific, turn possible to follow Korean success in education, and promote improvements in academic management.

In synergy with this need to be able to innovate, the [23] affirms that in order to remain competitive in today's knowledge age scenario, the predominant assets in companies are now intangible: knowledge-based assets such as intellectual property. However, 80.0% of the independent variables of the research studies are intangible factors, and do not provide, directly or indirectly, for the institution, future economic and financial benefits, and therefore are not active, according to [32].

Of the research universes under study, more than half correspond to 'higher education institutions', also a generalist scope such as the dependent variables. A single investigation turns to the 'graduates' and two to the 'employers' - stakeholders of the academic education process. According to [29], in universities focused

on the main requirements of employers, when developing their education programs, their graduates are desired by the job market. Therefore, the alignment of educational institutions' performance measures with organizational results is essential for academic management.

Considering the data collection instruments and techniques, the fact that 75.0% of the researches did not apply 'statistical treatment', and that 'questionnaires', 'interviews' and 'tests' stood out as the most widely used collect resources, presenting an accumulated percentage frequency of 44.4%, indicates a predominance of qualitative research in scientific investigations for academic management.

According to [3], as in the qualitative approaches the results are not tested to show whether they are statistically significant or resulting from chance, the conclusions obtained from them cannot be extended to populations. And the number of researchers interested in harmonizing the quantitative and qualitative traditions is gradually increasing, aiming to obtain the advantages of each one of them. Thus, the quantitative approach with statistical treatment should be broadened in research on academic management, aiming to obtain both quantitative and qualitative benefits.

Regarding the types of problems, as for the research objectives, the least frequent ones are the 'explanatory predictive', however, according to [27], when dealing with prediction, they argue that this constitute a “solid item to monitoring of academic managers... allowing timely intervention...”, enabling proactive management, anticipation of problems, avoiding the aggravation of circumventable situations provided that they are solved in a timely manner.

[26] explain that current management practices drive institutions to success because of the predictive power of the future, which highlights the need to overcome the low number of 'explanatory predictive' research on academic management.

Given two of the gaps already observed in the research under study: (i) predominance of independent variables focused on intangible factors, when they should focus on intangible assets, and (ii) research universes that do not include graduates and employers; the observed scenario should give more frequency to the 'explanatory' and 'of specification' investigations, since the verification of the existence of a relationship between the variables, performed in the predominant 'interpretive' researches, is only the initial step to meet the desired goals.

The low percentage frequency of 'documentary' research is not recommended, as the data to be addressed in research on academic management resides in curricula and institutional reports about student performance monitoring, for example; as well as market trends that are ascertained by funding agencies, collegiate advisory bodies, and government.

[29] apply, in their leading research, documentary data from the US Department of Labor Occupational Information Network, and argue that it is for “better defining and assessing program needs” for professional training, for “data of investigation of opinion are learning measures less stable”.

The institutional management model, according to [30], consists of: (i) Institutional Development Plan (IDP), (ii) Institutional Pedagogical Project (IPP), (iii) Pedagogical Course Project (PCP) and (iv) groups of professors should be worked in academic management researches, as these are macro processes that should serve as subsidies for academic management, aligning it with organizational strategies and policies. Among the four macroprocesses cited, three are documents: IPP, IDP and PCP, which reinforces the evidence of the need for documentary research.

The contemporary gaps observed in academic management are:

- a) contemplate student learning as a dependent variable;
- b) advance from intangible factors to intangible assets, in defining the attributes considered independent variables;
- c) contemplate graduates and employers in the research universes;
- d) apply quantitative analyzes, and consequently statistical treatments;
- e) increase the number of research with explanatory predictive objectives;
- f) broaden the scope of data analysis not limited to the verification of the existence of relationship between the research variables, explaining them;
- g) extend to documents the origin of the research data.

Thus, through interpretative analysis of research on academic management were identified justifications and north for scientific investigations on the subject.

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Generativity and the contribution of services among older adults in Taiwan

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Abstract

This study aims to analysis the relationship between generativity and contribution services. Erikson (1997) pointed out in his Psychosocial Developmental Theory that if an individual was lack of active participation while progressing from stage 7 to stage 8, the individual will tend to be in despair, getting pessimistic. This will eventually cause the individual fail to achieve self-identity. Moreover, Schoklitsch and Baumann (2011) emphasized that generativity is an essential factor to maintain psychological health in old ages. This theory had been approved by Baltes and Baltes (1990) that they regarded generativity and wisdom as the best portrayal of the old age life. It can be seen that generativity is indeed an important study issue in the field of gerontology. In addition, older adults have contributive needs, according to McClusky's (1971) Margin Theory of Needs. Older adults wanted to give a helping hand to the society. They hoped that both their contribution and themselves will be valued and appreciated. Through their devotion, they wished they could change public's stereotype of older adults. To be concrete, the purpose of this study is as follows: to understand the relationship between generativity and the contribution of services; to analyze the characteristics, actions and influential factors of generativity; to explore motivations behind, effectiveness of, and influences on the contribution of services. In order to achieve above purposes, this study adopted questionnaire survey method.

Keywords: contribution of services, generativity, older adults

INTRODUCTION

Research Background and Purpose

As of February 2020, Taiwan had 3,644,513 people over 65, or 15.44% of the total population (Ministry of the Interior, 2020). The United Nations Educational, Scientific and Cultural Organization (UNESCO) considers education for older adults to play a crucial role in societies with ageing populations. It stresses that educators of older adults should stop viewing their problems in terms of welfare services, but embrace lifelong learning as a normal part of old age (Lamdin & Fugate, 1997). It is urgent for counties with ageing populations to explore how education and related services can help older adults with development tasks, and realize the significance and value of old age. As the population ages and lifespans extend, generativity will play a pivotal role in the lives of older adults (Ehlman & Ligon, 2012). Villar (2012) agrees that generativity plays a very important role in older adult education, since learning helps prepare older adults for their new roles.

In his theory of psychosocial development, Erikson (1997) regards life as a continuous process of personality development, which he divides into eight stages. Stage seven is concerned with generativity vs. stagnation. An individual progressing from stage seven to stage eight who lacks the quality of active participation will tend to experience despair and pessimism, and ultimately fail to achieve self-actualization. Schoklitsch and Baumann (2011) see generativity as essential to maintaining psychological health in old age. This theory is endorsed by

Baltes and Baltes (1990), who regard generativity and wisdom as the keys to successful ageing. Much research underscores the positive correlation between generativity and the well-being of old adults (Ackerman, Zuroff & Moscovitz, 2000; Keyes & Ryff, 1998). From this it can be seen that generativity is indeed an important issue in the field of gerontology. Countries around the world have been focusing on how to ensure that older adults not only live longer, but also live better. In Taiwan, however, most recent research has focused on active aging, successful aging, and productive aging, and not yet addressed the core issue of generativity.

Older adults also have contributive needs, according to McClusky's (1971) Margin Theory of Needs. Older adults want to help society. They hope that they and their contributions will be valued and appreciated, and that society will change its stereotype of older adults. The purpose of this study is as follows:

- (1) To understand the relationship between generativity and the contribution of services.
- (2) To analyze the characteristics, actions and influential factors of generativity.
- (3) To explore motivations behind, effectiveness of, and influences on the contribution of services.

A Theory of Generativity

McAdams and de St. Aubin (1992) define generativity as the concern of adults for the happiness of the next generation. This perspective is based on a proactive coping perspective. As part of the aging process, adults wish to mentor and to pass on tradition to the next generation. Villar and Celdran (2012) point out that generativity implies a commitment to maintaining and improving the social environment in which individuals participate, in the hope of maintaining their integrity. According to Erikson (1997), during middle age, if individuals are unable to demonstrate their generativity, they will feel their lives gradually lose meaning and become stagnant, which in turn hinders them from experiencing integrity in their old age.

In the literature, the relationship between generativity and older adults is mostly discussed in terms of altruism, self-transcendence, and interpersonal respect. The relationship between generativity and altruism has mostly been linked to volunteer work. Older adults, we are told, feel a need to support their community and future generations (Theurer & Wister, 2010). In addition, volunteering has positive effects on the well-being and successful aging of older adults (Yuen, Huang, Bruik & Smith, 2008; Lin, 2006; Chen, 2011). Generativity is also said to promote self-transcendence, in the sense of expanding beyond previous boundaries. According to Cheng's (2009) research on the issue of generativity and interpersonal respect, valuing the contributions of older adults to their offspring will encourage them to continue this behavior. Respect from younger generations is especially helpful in encouraging older adults to display generativity, and to derive a sense of well-being from this.

In summary, this study considers that generativity represents the inner desire of an individual to assist others or to contribute to the society. As a concern of adults for their next generation, generativity motivates adults to help their descendants improve their well-being. In the progress of aging, adults hope they can continue nurturing, guiding and mentoring their offspring, and pass on their experience and wisdom to the next generation, thus leaving a lasting legacy to their posterity. Generativity is therefore an important aspect of successful aging and self-fulfillment.

RESEARCH DESIGN AND IMPLEMENTATION

Research Instrument

This study adopted the conceptual framework of generativity proposed by McAdams and de St. Aubin (1992) as the basis for the development of the scale used in the questionnaire on generativity and the contribution of services among older adults, including demographic variables, a generativity scale, and a contribution of services scale. Demographic variables included gender, age, education level, marital status,

health status, economic status, years of learning, attitude towards learning, years of contribution, and contribution attitude. The generativity scale included characteristic, action, and the contribution of services scale, including motivation and effectiveness.

The generativity characteristic included three domains: values, self-efficacy, and personality traits. The Cronbach's α coefficient was 0.942, 74.32% of explained validity for the whole scale in terms of generativity characteristic. The generativity action including three domains: passing on experiences, creating values, and helping others. The Cronbach's α coefficient was 0.878, 61.17% of explained validity for the whole scale in terms of generativity action.

“Contribution of services: motivation” included two domains: intrinsic motivation and extrinsic motivation. The Cronbach's α coefficient was 0.915, 56.36% of explained validity for the whole scale in terms of contribution of services motivation. “Contribution of services: effectiveness” included four domains: gaining from service, self-identification, self-integrity, and contributing to society. The Cronbach's α coefficient was 0.960, 79.67% of explained validity for the whole scale in terms of the effectiveness of contribution of services.

To sum up, these scales possess good internal consistency, reliability and validity, and these rating scales make them suitable for related research. Table 1 illustrates the domains, reliability and validity of this research instrument.

Table 1 The domains, reliability and validity of research instrument

Scale	Sub-scale	Domains	Reliability Cronbach's α	Explained Validity
Generativity scale	Generativity characteristic	values, self-efficacy, personality traits	0.942	74.32%
	Generativity action	passing on experiences, creating values, helping others	0.878	61.17%
Contribution service scale	Contribution of services: motivation	intrinsic motivation, extrinsic motivation	0.915	56.36%
	Contribution of services: effectiveness	gaining from services, self-identification, self- integrity, contributing to society	0.960	79.67%

Subjects

Taiwan has three types of older-adult educational institutions: Evergreen Academy (hereafter EA), organized by the Department of Social Welfare; the Senior Learning Center (hereafter SLC); and the Senior Learning Academy (hereafter SLA), organized by the Ministry of Education (Lin, 2008). According to Lin (2015), different social outcomes are generated by different types of courses at these various institutions.

SLC was established in order to (1) provide senior citizens with learning opportunities and enable them to build a healthy body and mind; (2) develop older adult education at the community level; and (3) consolidate community resources and generate a community-based learning culture. At SLC, “contribution of services” courses are associated with better social outcomes (Lin, 2015). According to McClusky (1971),

humans have a need to contribute. "Contribution of services" courses provide older adults with opportunities to participate in volunteer services, and thereby enhance their self-esteem and sense of self-worth. Since they are able to contribute to society, greater social outcomes are generated.

The data in this study was collected from participants in SLC. 170 pre-test questionnaires were sent out, and 143 valid questionnaires were collected. As for formal testing, the researcher examined 221 SLCs that had been established for at least five years (as of 2018). 10 questionnaires were issued to each center. A total of 2,210 copies were issued, and 1,840 copies were collected. After eliminating questionnaires with too many omissions and over-concentrated answers, the number of valid questionnaires was 1,551, for an effective questionnaire recovery rate of 70.2%.

Data Analysis

2.3.1 One-way analysis of variance (one-way ANOVA)

This analyzed subjects with a different number of years of learning, different attitudes towards learning, a different number of years of contribution, and different attitudes toward contribution, to see whether there were significant differences in generativity and contribution of services. If a significant difference was identified, a Scheffe post hoc test was also conducted.

2.3.2 Univariate analysis

This assessed the strength of association between demographic variables and generativity on one hand, and contribution of services on the other, in order to calculate the extent to which years of learning, attitudes toward learning, years of contribution, and attitude toward contribution affected the generativity and contribution of services.

2.3.3 Stepwise regression analysis

Stepwise regression analysis was used to predict contribution of service effectiveness from generativity characteristics and actions.

RESULTS

3.1 The main factors affecting generativity and the contribution of services were the subject's attitude toward the contribution of services and towards learning

Conducting univariate analysis based on generativity characteristics as dependent variables, the researcher found that attitude towards learning ($\omega^2 = .146$) and attitude towards the contribution of services ($\omega^2 = .237$) were highly correlated with the following characteristics: education level ($\omega^2 = .015$), health status ($\omega^2 = .050$), and years of learning ($\omega^2 = .009$). Years of contribution ($\omega^2 = .026$) was modestly correlated to the characteristics. The analysis indicated that the main factors affecting generativity characteristics were the subjects' attitude towards learning and contribution of services.

Conducting univariate analysis based on generativity actions as dependent variable, the researcher found that the contribution services attitude ($\omega^2 = .179$) was highly correlated with actions; attitude towards learning ($\omega^2 = .101$) reached moderate correlation; and the gender ($\omega^2 = .008$), economic status ($\omega^2 = .005$), health status ($\omega^2 = .026$), years of contribution ($\omega^2 = .020$) reached a low correlation. This indicates that the main factors affecting generativity actions were subjects' attitude towards contribution of services, followed by their attitude towards learning.

Conducting univariate analysis based on motivations for the contribution of services as a dependent variable, the researcher found that attitude toward contribution of services ($\omega^2 = .133$) was moderately related to the motivations, while economic status ($\omega^2 = .003$), health status ($\omega^2 = .011$), attitude towards

learning ($\omega^2 = .057$) reached a low correlation. This indicates that the main factor affecting the motivation for the contribution of services was the subjects' attitude towards the contribution of services.

Conducting univariate analysis based on the effectiveness of the contribution of services as a dependent variable, the researcher found that attitude towards the contribution of services ($\omega^2 = .168$) was highly correlated with effectiveness. Attitude towards learning ($\omega^2 = .101$) reached a moderate correlation, while gender ($\omega^2 = .002$), economic situation ($\omega^2 = .006$), health status ($\omega^2 = .018$), years of learning ($\omega^2 = .005$), and years of contribution ($\omega^2 = .019$) had low correlation. This indicates that the main factors affecting the effectiveness of the contribution of services were the subjects' attitude towards the contribution of services, followed by their attitude towards learning.

In summary, through univariate analysis, it was found that the main factors affecting generativity and the contribution of services were the attitude of older adults towards contribution services or learning, while gender, age, education level, marital status, health status, and economic status had only slight impact.

3.2 The more years of learning, and the more active their attitude towards learning, the better the subjects performed in generativity and contribution of services

The number of years of learning led to significant differences in the overall domains of generativity characteristics ($F=4.61$, $p<.01$). Through a Post-hoc Scheffe test, the researcher found that those who had 7 (inclusive) or more years of learning ranked higher than those who had less than one year, indicating that the more years of learning, the higher the generativity characteristics. Although years of learning did not reach significance in the overall actions, there was a significant difference in the domain of creating values ($F=3.89$, $p<.01$). This indicates that the actions of creating values will be affected by the number of years of learning. Through a Post-hoc Scheffe test, it was found that those who had 5 or more years of learning ranked higher than those who had less than one year.

Attitude towards learning led to significant differences in the overall domains of generativity characteristics ($F=88.32$, $p<.001$). Through a post-hoc Scheffe test, the researcher found that the more active the subjects' attitude towards learning, the more they were able to express the generativity characteristics. Attitude towards learning led to significant differences in the overall domain of generativity actions ($F=58.56$, $p<.001$), and through post-hoc Scheffe test, it was found that those who were more devoted to learning showed more generativity actions.

Attitude towards learning led to significant differences in the overall domains of contribution services motivations ($F=32.31$, $p<.001$). Through a post-hoc Scheffe test, the researcher found that the more active the subjects' attitude towards learning, the stronger the motivations of contribution services. Attitude towards learning had significant differences in the overall domain of contribution services effectiveness ($F=58.87$, $p<.001$), and through a post-hoc Scheffe test, it was found that those who were more devoted to learning were more effective in the contribution of services.

In summary, through one-way ANOVA, it was found that the subjects who had more years of learning and a more active attitude, had higher generativity characteristics and were more devoted to generativity actions. The stronger the motivations for the contribution of services, the more effective the contribution of services will be.

3.3 Subjects with more years of contribution, and who more devoted to the contribution of services, had higher performance of generativity and contribution of services

Years of contributing services reached significance in the overall domains of generativity actions ($F=6.79$, $p<.001$). Through a post-hoc Scheffe test, the researcher found that subjects with more years of contribution of services were able to devote more to generativity actions.

Years of contribution services led to significant differences in the overall domain of the effectiveness of contribution services ($F=6.60$, $p<.001$). Through a post-hoc Scheffe test, the researcher found that the contribution of services provided by subjects with over 3 years of the contribution of services was more effective, and it took more than 7 years to achieve self-identification.

Attitude towards the contribution of services led to significant differences in the overall domains of generativity characteristics ($F=91.40$, $p<.001$). Through a post-hoc Scheffe test, the researcher found that subjects whose attitudes were more committed to the contribution of services performed better in terms of generativity characteristics. Attitude towards the contribution of services led to significant differences in the overall domain of generativity actions ($F=64.69$, $p<.001$). Through a post-hoc Scheffe test, the researcher found that the subjects devoted more to the contribution of services demonstrated more generativity actions.

Attitude towards the contribution of services led to significant differences in the overall domain of motivation for the contribution of services ($F=45.49$, $p<.001$). Through a post-hoc Scheffe test, the researcher found that the more devoted the subjects were to the contribution of services, the stronger their motivation for the contribution of services was. Attitude towards the contribution of services led to significant differences in the overall domains of contribution services effectiveness ($F=59.75$, $p<.001$). Through a post-hoc Scheffe test, the researcher found that those who were more committed to the contribution of services attitude were more effective in the contribution of services.

In summary, through one-way ANOVA, it was found that the subjects who had more years of the contribution of services, and were more devoted to the contribution of services, had higher generativity characteristics, and were able to devote more to generativity actions. The stronger the motivations for contributing services, the more effective the contribution of services will be.

3.4 Self-efficacy was the main predictor of the motivation for the contribution of services

The researcher used the three domains of generativity characteristics as independent variables, and the motivations for the contribution of services as dependent variables, in a stepwise regression analysis. According to the results, the order of the significance predictability in the domain of the motivation for the contribution of services was self-efficacy, values, and personality traits. The model could explain 39.3% of the variance of the motivation for the contribution of services, $R^2=.393$, $F=335.659$ ($p<.001$). Furthermore, stepwise regression analysis shows that self-efficacy could explain 32.7% of the motivation for the contribution of services, while values could explain 6.4%, and personality traits could explain 0.2%. That is to say, older adults who have higher self-efficacy, are more likely to have stronger motivations for the contribution of services.

3.5 Values and passing on experience were the main predictors of the effectiveness of the contribution of services

The researcher used the three domains of generativity characteristics as independent variables, and the effectiveness of the contribution of services as dependent variables, in stepwise regression analysis. According to the results, the order of the significance predictability in the domain of the effectiveness of the contribution of services was values, self-efficacy, and personality traits. The model could explain 42.4% of the variance of the motivation for the contribution of services, $R^2=.424$, $F=381.088$ ($p<.001$). Furthermore, stepwise regression analysis shows that values could explain 39.3% of the effectiveness of the contribution of services, while self-efficacy could explain 2.6%, and personality traits could explain 0.6%. That is to say, older adults who have more positive values, are more likely to have a more effective contribution of services.

In addition, the researcher used the three domains of generativity actions as independent variables, and the effectiveness of the contribution of services as dependent variables, in a stepwise regression analysis. According to the results, the order of the significance predictability in the domain of the effectiveness of the contribution of services was passing on experience, creating values, and helping others. The model could explain 42.5% of the variance of the motivation for the contribution of services, $R^2=.425$, $F=574.592$ ($p<.001$). Furthermore, stepwise regression analysis shows that passing on experiences could explain 38.2% of the effectiveness of the contribution of services, while creating values could explain 4.2%, and helping others could explain 0.1%. That is to say, older adults whose main actions were passing on experience, have more effective contribution of services.

DISCUSSION

The effectiveness of the contribution of services will be influenced by the characteristics and actions of generativity. Characteristics are mainly influenced by values. Actions are mainly influenced by passing on experience. To wit:

First, generativity has a positive impact on older adults, who can demonstrate their generativity through participating in the contribution of services, and then by developing themselves in their old age. Erikson (1997) mentions that older adults can experience great generativity by fulfilling various social roles, and by devoting themselves enthusiastically to their later life; and the findings of this study echo this. Jones and McAdams (2013) point out that individuals with high generativity often have higher social participation, leadership, and creativity. These capabilities help older adults commit to different stages of their later life. Additionally, individuals with high generativity have higher social support, greater happiness, and a greater sense of satisfaction in life. That improving generativity will lead to positive outcomes for individuals is also echoed by this study.

Secondly, the main factors affecting generativity and the contribution of services are attitude towards the contribution of service and learning, while gender, age, education level, marital status, health status, economic status had only slight effects. Jones and McAdams (2013) mentioned that studies of different fields are still exploring the relationship between demographic variables (such as gender, economic status, and education level) and generativity. Keyes and Ryff (1998) found that women may be more likely than men to develop generativity because of the impact of their growth. However, studies have shown that men and women may demonstrate generativity in different forms. Therefore, impacts related to gender have yet to be confirmed (Steward & Ostrove 1998; Zucker, Ostrove, & Stewart, 2002). Older adults with higher economic status usually have more spare resources to devote to altruistic behavior, thus showing more generativity (Segal, DeMeis, Wood, & Smith, 2001). In addition, many studies have shown that those with higher education levels generally have more generativity, as do those willing to participate in volunteering services (Keyes & Ryff, 1998; Tang, 2008). However, Jones and McAdams (2013) point out that although demographic variables may affect generativity, they are not the main factors. Active socialization is the important factor in predicting generativity. This is in line with the present study, which finds that generativity is mainly affected by the attitude towards contribution of services and learning.

More specifically, this study finds that older adults participating in generativity activities can not only expand their later life, but also construct a stage for social participation. As McAdams and de St. Aubin (1992) put it, generativity provides a more balanced concept for the individual and society, emphasizing positive interaction and reinforcing a two-way cycle between personal growth and the process of social development.

CONCLUSIONS

5.1 The major factors influencing generativity and contribution of services was the individual's attitude

The researcher conducted univariate analysis of generativity and contribution of services based on variations like gender, age, education level, marital status, economic status, health status, years of learning, attitude towards learning, years of contribution, and attitude towards contribution of services. The main factors that influenced generativity and contribution of services were discovered to be the subject's attitude towards contribution of services and attitude towards learning.

5.2 The more years of learning and years of contributions, and the more committed the attitude, the greater the performance of generativity and contribution of services

Individuals who devoted more years of participation in learning and contribution services, engaged in more generativity behavior of creating values. More years of contribution of services meant more generativity behavior of passing on experiences. In addition, those who were more committed to learning and contribution of service, had stronger motivation to contribute services, and to provide better contribution services.

5.3 Values are the main factors affecting generativity behavior and the effectiveness of contribution of services

Individuals with more positive values were more devoted to generativity behavior, especially in the area of passing on experiences. Individuals with higher self-efficacy were more likely to create values and help others. In addition, positive values not only strengthen self-identification, but also enhance the feeling of gaining from service, and contributing to society through self-actualization.

5.4 The higher the self-confidence of older adults, the stronger their motivation

The contribution of services motivation is most affected by self-confidence. The more that older adults believe they can use their abilities to achieve certain things, the stronger their motivations to contribute services will be. Through the social participation process associated with contribution of services, the goal of a more active old age can be attained.

5.5 Taking action by passing on experiences can produce higher effectiveness of contribution of services

The effectiveness of contribution of services is mainly influenced by passing on experiences. Among all generativity behavior, the act of passing on experiences to the next generation has the most effect on contribution of services, especially when it is conducted spontaneously by older adults through their self-motivation.

6. Acknowledgement

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Relationship between gastro tourism and consumer behavior in food

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Abstract

Modern tourism is a discipline that has only recently begun to attract the interest of professionals from several disciplines. Those who set the course for the development of tourism must cope with changes in technology, climatic conditions, an increasing aging, more sophisticated population, more frequent use of health care products and services. Gastronomy has been recognized as an integral part of the tourism product and as a means of differentiating destinations. It plays a key role in building the unique character, identity and authenticity of the destination. The aim of the paper is to analyze, compare and predict consumer demand of statistically monitored categories of meat, its frequency of consumption, to determine the dependence of meat consumption on life expectancy and to outline the possible consequences of this consumer demand on selected demographic indicators. The object of the research are the countries of Slovak and Bangladesh. Secondary sources and primary data obtained from 1300 respondents were used. The sources were processed by several statistical-mathematical methods, namely we used the method of regression and correlation analysis, the method of time series analysis. The results suggest that there is a correlation between life expectancy and consumption of individual meats, which can significantly influence the development of tourism through gastronomic trends.

Keywords: trends; tourism; gastronomy; consumer; shopping behavior; demography;

1. Gastro tourism

A global dynamic tourism market, a shift in consumer behavior, an increasing need for exclusivity and individualism in communicating with customers, more experienced, more critical, more sophisticated travelers (Beresecká et al. 2018), increasing international competition are the reasons for seeking new innovative, fancy tourism products Kontis AP., Skoultos S. (2018). Magazine literature suggests that different factors that influence destination choice and can be a significant incentive to determine

participation in tourism are caused by various factors: natural wealth, tourist infrastructure, leisure and recreation, culture, history, art, politics and economics, atmosphere (Beerli and Martin, 2004, Novacka -

integrate these dishes with the culinary menu. Recently, food tourism research has become increasingly large and diverse, providing valuable information for scientists and professionals alike. Anderson et al. (2017) encourages that research in this area should be more oriented towards environmental sustainability, economic sustainability and cultural sustainability. From the economic sustainability point of view, "paying particular attention to geographically distant and high local markets (i.e. the local population of the destination) - the first is important for future growth and the second is essential for local food producers and restaurants to they perceive cultural sustainability through building and developing the culinary heritage of cities. This sustainability can contribute to a stronger local culture that is of interest to both tourists and locals. He sees environmental sustainability as a research potential for tourism scientists as environmental forces are increasingly affecting demand, supply and local cultures. Tommy D. Andersson et al. 2017. Research results in the sketched areas could eliminate the barriers to tourism development, eg. under-utilization of potential, quality of services achieved, etc. (Meszárošová and Levický, 2017) Even for gastronomy, quality foods and beverages are the most important and necessary factor of attractiveness for tourism (Eren, Ramazan. (2019)).

The development of the society presupposes changes in the demographic and socio-economic structure of the population (aging of population and increase of easy working). Food is one of the basic life needs of man. The professional structure in developed industrialized countries corresponds to 62% of the population working lightly with a lower energy requirement of the organism, 26% of the population doing moderate work and only 12% of the population working in the hard-working group. Nutritional value and food safety are essential nutrition requirements for food producers. The most important raw materials of animal origin are meat, milk, eggs and honey. This includes meat: pork, beef, poultry, fish, rabbit, mutton and game. (STECOVA - Cinderella, 2005). Man is at the top of the food chain. Although people differ from each other in terms of needs, they are generally required to consume about 60% of the plant diet, the remaining 40% of food of animal origin, and do not do without meat intake individually at least two to three times a week. Appropriate meat is an integral part of good human nutrition (MIHOLA-VOVSÍKOVÁ, 2018). Increasing the standard of living of the population and other social conditions also cause changes in the population's nutrition. Biologically less valuable foods (starch, carbohydrate) are replaced by more valuable and tastier products, such as meat and meat products, to which our agriculture must also comply (ABERLE - FORREST - GERRARD, 2012). This means in particular the expansion of lean meat production, the increase in production and consumption of sheep, poultry, rabbit and fish meat as well as game (BRYCHTA - KLÍMOVÁ - BULAWOVÁ, 2008). Poultry meat is highly valued for its high biological value, palatability and easy digestibility. Compared to the meat of other animals for slaughter, it contains more protein and less fat. For lower energy value it meets the conditions of rational nutrition. It is rich in minerals and vitamins. Its composition is determined by species, age, sex, type and degree of fattening. (SPITZER - CASTLE, 1985). By game we mean meat and edible parts of furry and feathered game. The use of game is conditioned by hunting the game in an authorized way. The value of game depends on the health and nutritional status and the age of the game caught. This meat comes to the market seasonally according to the hunting plan for each species. Divina belongs to foods with high biological value. It has finer muscle

fibers with less fat than slaughter animals. (SPITZER - CASTLE, 1985). At the same time, the biological value of fish meat is not only equivalent to the meat of slaughter animals, but in some respects exceeds it. Fish meat contains mainly valuable animal protein, valuable minerals (especially iodine and phosphorus) and fish oil, which has a higher proportion of unsaturated fatty acids. For these characteristics, fish meat, when properly prepared, can be considered as dietary meat. It has 15 to 20% full-value protein and mineral content is significant iodine content. (SPITZER - CASTLE, 1985). The meat of slaughter animals (especially beef and pork) contains various substances and elements important to the human body. First of all, it is a source of valuable proteins - individual amino acids are represented in it in a similar proportion as in the human body. However, daily consumption is not recommended. Frequent intestinal consumption is also considered unhealthy, eg. a liver that contains a lot of cholesterol but also contains high amounts of vitamins and minerals. The 25th of November was declared International and World Meat Free Day and Animal Rights Day. It has been celebrated for thirty-three years, initiated in India in 1986. People's attitude to meat consumption varies, and is mainly related to religion and cultural traditions. This is largely due to latitude - in areas with abundance of vegetables and fruit, less diet of animal origin is consumed than in cold climates. More and more often, however, the (non) consumption of meat is influenced by the individual attitude of man, consumer (Svetlíková, 2019). Every person is a consumer because he is interested in the things he uses, consumes and affects his daily life (HORSKÁ - UBREŽIOVÁ, 2001). A consumer is also a person identifying his / her wishes and needs, making a purchase and disposing of a product during the various stages of the consumer process. They are individuals who buy products that serve the needs of themselves and their families (SOLOMON - BAMOSS - ASKEGAARD - HOGG, 2006). Man plays the role of the consumer throughout his life, because there are products that surround him and are offered to buy and consume (TUMA, 2007). In a broader sense, we can understand the consumer as the last link in the chain or the last user who creates value from the start of production to the actual distribution, and also as a market economy participant that maximizes its benefit while minimizing its costs (LABSKÁ - TAJTÁKOVÁ – FORET, 2009). We define consumer expressions that can be freely observed in the purchasing and consumption process as consumer behavior. These are all its actions and responses to specific events, which are influenced by a number of stimuli, such as: type of product, attitude and degree of consumer motivation, purchasing situation, influence of opinion leader, resp. fashion etc. Two types of manifestations can be identified in terms of consumer behavior (DARPY - VOLLE 2007)

2. Aim and methods

The aim of the paper is to analyze, compare and predict consumer demand of statistically monitored categories of meat, its frequency of consumption, to determine the dependence of meat consumption on life expectancy and to outline the possible consequences of this consumer demand on selected demographic indicators.

The object of the research are the countries of Slovak and Bangladesh.

Secondary and primary data obtained from the questionnaire survey were used in the paper.

The questionnaire survey was carried out in both printed and electronic form from January to June 2017. Altogether 1300 respondents participated, but due to insufficient completion of parts of the questionnaire

by some respondents, we had to reduce the number of respondents to 931. The questionnaire consisted of two parts. The first part of the questionnaire consisted of 9 questions concerning consumer behavior in the meat and meat products market and the second part consisted of 5 classification questions concerning the respondent. On individual questions concerning consumer behavior in the meat and meat products market, the respondents answered the following questions: 1. You consume meat and meat products with a choice of yes, no, occasionally. 2. How often you consume different types of meat (poultry, beef, pork, game, fish) with the possibility of answering every day, several times a week, once a week, rarely, not at all. Of the respondent's classification questions, they were asked to answer the following questions: gender (female, male), age (under 18, 19-25, 26-35, 36-45, 46-55, 56-65 years and 66 years and more), highest completed education (primary, secondary, university), economic activity (pupil, student; employed; unemployed - unemployed; unemployed - disability, maternity leave, other; pensioner) and net monthly income (up to 500 €, 501 - 700 €, 701 - 900 €, 901 - 1100 €, 1101 - 1300 € and 1301 € and more). 254 men (27%) and 677 women (73%) in the age groups up to 18 years of age 56 respondents (6%) participated in the questionnaire survey, 270 respondents (31%) at the age of 19-25, aged 26-35 130 respondents (14%), aged 36-45 121 respondents (13%), aged 46-55 130 respondents (13%), aged 56-65 149 respondents (15%), and aged 66 and more 75 respondents (8%). Of all respondents, 785 respondents (84.32%) consume meat and meat products, 112 respondents (12.03%) occasionally consume and 34 (3.65%) do not consume meat and meat products at all. The highest completed basic education was achieved by 75 respondents (9%), secondary education 475 respondents (52%) and university education 381 (39%). The survey involved 298 pupils, students (35%), 484 employed (51%), 9 unemployed - unemployed (1%), 28 unemployed - invalidity, maternity leave, other (2%), 112 pensioners (11%). For data processing we used basic approaches used in statistical analysis of time series, which will demonstrate how to build a high-quality mathematical-statistical model that serves not only to explain the development of the surveyed quantity, but also to make a qualified prediction of its value in the following periods. We consider the chronological and factual data of the quantitative statistical feature as a time series. The number of data ordered in one row is called the length of time series. In terms of the quality of the prediction, the maximum length of the prediction should not exceed 1/3 of the time series of the analyzed indicator. In the case of graphical analysis, a line graph is used, where the x-axis indicates the units of time.

The form of the linear trend function: $y_j' = b_0 + b_1 \cdot t_j$

The data are drawn from the FAO website, where we use data on meat consumption (beef, game, pork, poultry) in Bangladesh 1961-2013 and in the Slovak Republic 1993-2013. Due to the longer time series in Bangladesh we can predict the development of consumption of individual types of meat up to 17 years, while in the Slovak Republic only for 7 years.

We used the method of regression and correlation analysis to know and mathematically describe the statistical dependence between quantitative statistical traits. Suppose that between the dependent variable Y and the explanatory (independent) variables X_i $i = 1, 2, \dots, k$, the dependence is described by the equation:

$$Y = f(X_1, X_2, \dots, X_k, b_0, b_1, b_2, \dots, b_k) +$$

which we estimate:

$$y_j' = f(x_{1j}, x_{2j}, \dots, x_{kj}, b_0, b_1, \dots, b_k)$$

where the conditions of the classical linear model are fulfilled and coefficients $b_0, b_1, \dots, b_k$ are estimates

of unknown parameters $\beta_0, \beta_1, \dots, \beta_k$.

Multiple dependence is calculated using the Data Analysis tool in Excel. The output of the regression and correlation analysis consists of three parts: the first part is the output of the correlation analysis, the second part is the output ANOVA, where we test the suitability of the model used, the significance of the correlation coefficient and the determination coefficient. The third part is the output of regression analysis. The first part of the output is the results of the correlation analysis. The value of Multiple R (closer the correlation coefficient) the closer to 1, the stronger the dependence. If the value of the multiple correlation coefficient from 0 - 0.3 is a weak statistical dependence, 0.3 - 0.6 a moderate statistical dependence, 0.6 - 1 a high statistical dependence between the investigated variables. The R Square value (determination coefficient) after multiplication by 100 (%) indicates that to what percentage the chosen regression function explains the variability of the dependent variable, the other part represents unexplained variability, the influence of random factors and other non-specific effects. In the ANOVA section, we test the null hypothesis, which states that the model we chose to explain dependence (in our case a linear model) is not appropriate, the alternative hypothesis claims the opposite. The F test is used to evaluate this claim. Significance F value < 0.05 t. j. H_0 is rejected, which means that the model was chosen correctly.

Bangladesh's regression function has the form $y' = 14,28 + 20,70x_1 + 10,95x_2 + 0x_3 + 13,54x_4$

The regression function of Slovakia has the form $y' = 76,93 - 0,23x_1 + 0,74x_2 - 0,04x_3 - 0,02x_4$

The null hypotheses that are tested in this section relate to the significance of the Intercept and regression coefficients ($\beta_1, \beta_2, \beta_3, \beta_4$), the null hypothesis claiming that the coefficient is insignificant and the alternative hypothesis is its significance. The P-value (P-value) is used to evaluate these statements. If the P-value is > 0.05 , the coefficient is statistically insignificant and if the P-value is < 0.05 , the coefficient is statistically significant (MATEJKOVÁ, E. - PIETRIKOVÁ, M. - POLÁKOVÁ, Z, 2015). The work also used the Human Development Index (HDI), which is a comparative figure of poverty, literacy, education, life expectancy, birth rate and other factors of the world developed by the United Nations. By default, it is used to measure potential social prosperity. HDI includes state data in three basic perspectives on the further potential development of human resources: a long and healthy life measured by life expectancy at birth, knowledge measured by adult literacy (two-thirds of the weight of the data), and the number of enrolled schools weighted value data), a decent standard of living measured by gross domestic product per capita in purchasing power parity in international dollars. Indicator The total fertility rate represents fertility at the replacement level: the average number of children per woman needed for each generation to be accurately replaced without the need for international immigration.

3. Results

Country Slovakia, Slovak Republic is a national state in Central Europe. The total land area is 49 035 km², water is 931 km² (1.9%), with a population of 5 457 873 (estimated 2019), a population density of 111.30 / km², a GDP / inhabitant of \$ 35 130, with a high index human development. Slovakia has developed agriculture, which uses 19 350 km² of agricultural land (39.5% of the country's surface). The country's economy is divided into sectors: agriculture, industry, transport, trade, services and tourism. Agriculture in the country is of declining importance. The livestock production is gradually decreasing the number of

livestock. The numbers of pigs and cattle are decreasing most significantly. Sheep farming is consistently low. The most numerous are poultry. Fishing is of local importance and is mainly carried out on local rivers and reservoirs. In the pre-reform period, the total consumption of food products in the Slovak Republic was characterized by high calorie intake and insufficient nutritional value of consumed food. This was also influenced by incorrect dietary recommendations of "competent", such as. consuming at least one egg a day or claiming that "bananas are low-vitamin snacks". At the beginning of the post-1989 economic transformation as a result of price liberalization, there was a sharp rise in food prices (as well as other goods), which led to a decline in the purchasing power of the population. This has caused a change in the consumer behavior of the population. The consumption of meat products decreased significantly - from 84 kg per person in 1989 to 66 kg per person in 1997, which represents a decrease of approximately 22%. In addition to reducing the amount of food consumed, substitution of more expensive, higher quality, especially meat products, has also been replaced by lower quality and cheaper ones. As a result, the relatively unfavorable structure of food consumption has so far deteriorated.

State in South Asia Bangladesh respectively The People's Republic of Bangladesh is located off the coast of the Gulf of Bengal, with a total area of 143 998 km², a population of 163 187 000, a population density of 1 106 / km². Per capita gross domestic product at purchasing power parity per year is \$ 4,207 (US dollar), with a medium human development index 0,579. Several rivers flow through the country. In economic terms, the country is one of the poorest countries in the world. It is tested by frequent floods, natural disasters. The livestock production is oriented to the breeding of cattle, buffaloes, poultry. The location of the country predetermines another component of economic activity and that is fishing.

Table 1. Development of meat consumption in the compared countries

Bangladesh	year	consumption	change	Slovakia	year	consumption	change
beef	1961	2,35	-	beef	1961	-	-
game	1961	0,06	-	game	1961	-	-
pork	1961	0	-	pork	1961	-	-
poultry	1961	0,37	-	poultry	1961	-	-
beef	1993	1,28	54,47%	beef	1993	17,01	-
game	1993	0,08	133,33%	game	1993	1,78	-
pork	1993	0	0,00%	pork	1993	46,75	-
poultry	1993	0,92	248,65%	poultry	1993	6,86	-
beef	2013	1,28	100%	beef	2013	5,19	30,51%
game	2013	0,1	125%	game	2013	1,62	91,01%
pork	2013	0	0%	pork	2013	31,78	67,98%
poultry	2013	1,4	152%	poultry	2013	15,13	220,55%

Source: FAO, own processing

Between 2013 and 1993 in Slovakia, beef consumption decreased by 69.49%, wild game 8.99% and pork consumption by 32.02%. Poultry consumption increased by 120.55%.

The results show that in Bangladesh the consumption of beef decreased by 45.53% in 1993 compared to 1961. Game consumption increased by 33.33% and poultry consumption by 148.65% in the period under review. There was no change in beef consumption between 2013 and 1993. Conversely, game consumption increased by 25% and poultry consumption by 52% in the period under review.

In the next part we made predictions of meat consumption development in Bangladesh up to 2030 and in Slovakia after 2020 (Figures 1 and 2). In Slovakia, we also expect beef consumption to decline from 2.747 kg / person / 2014 to - 0.357 kg / person / 2020 t. j. 87% decrease. Increase in game consumption from 1,894 kg / person / 2014 to 2,228 kg / person / 2020 t. j. an increase of 17.61%. Pork consumption decreased from 30,117 kg / person / 2014 to 25,428 kg / person / 2020 t. j. a decrease of 15.57% and an increase in poultry consumption from 19.933 kg / person / 2014 to 23.260 kg / person / 2020 t. j. an increase of 16.69%.

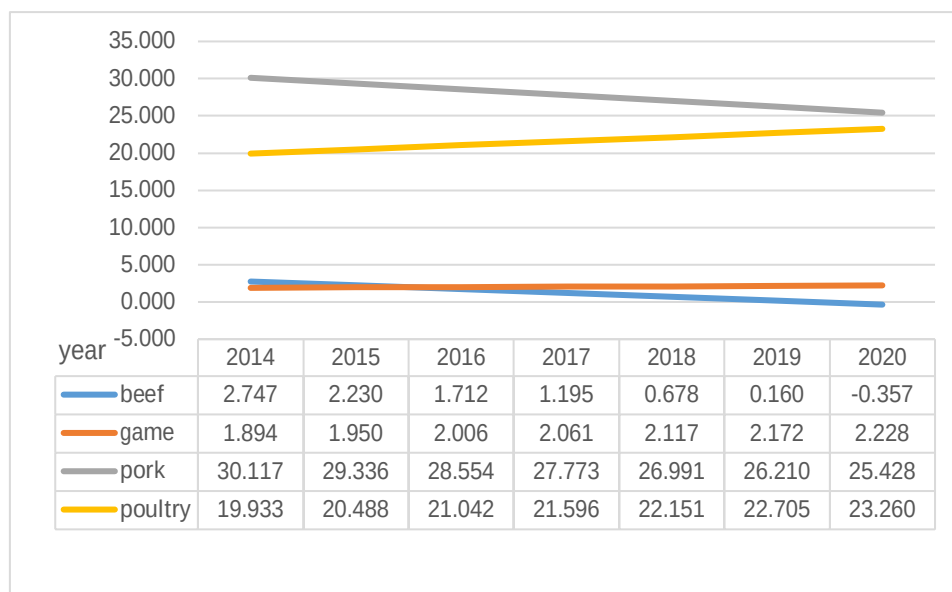


Figure 1. Development of meat consumption in kg / person / year in Slovakia

Source: own processing

The questionnaire survey examined how often respondents consume different types of meat. The interviewees had a choice of five types of meat: poultry, beef, pork, game and fish, and express which kind of meat they eat most often. The results of the survey clearly show that respondents consume the most poultry meat - several times a week. The average consumption of poultry meat for all respondents also showed this frequency (Table 2). On average, pork is consumed once a week. Beef and fish are consumed on average once a month. These types of meat have a significantly higher price than others, which is likely to be reflected in the infrequent consumption, despite the health benefits of these types of meat. Similarly, respondents rarely consume game.

Table 2. Frequency of meat consumption

Meat category	Average consumption	Most common consumption
poultry	several times a week	several times a week
beef	once a month	rarely
pork	once a week	once a week
game	rarely	rarely
fish	once a month	once a month

Source: own processing

In Bangladesh, we expect a slight decrease in beef consumption from 1.0013 kg / person / 2014 to 0.6253 kg / person / 2030 t. j. by 37.55%. For game consumption we expect a slight increase from 0.0925 kg / person / 2014 to 0.0957 kg / person / 2030 t. j. 3.46%. For poultry consumption, we expect the consumption of this meat to increase from 1.2602 kg / person / 2014 to 1.4874 kg / person / 2030 t. j. by 18.03%.

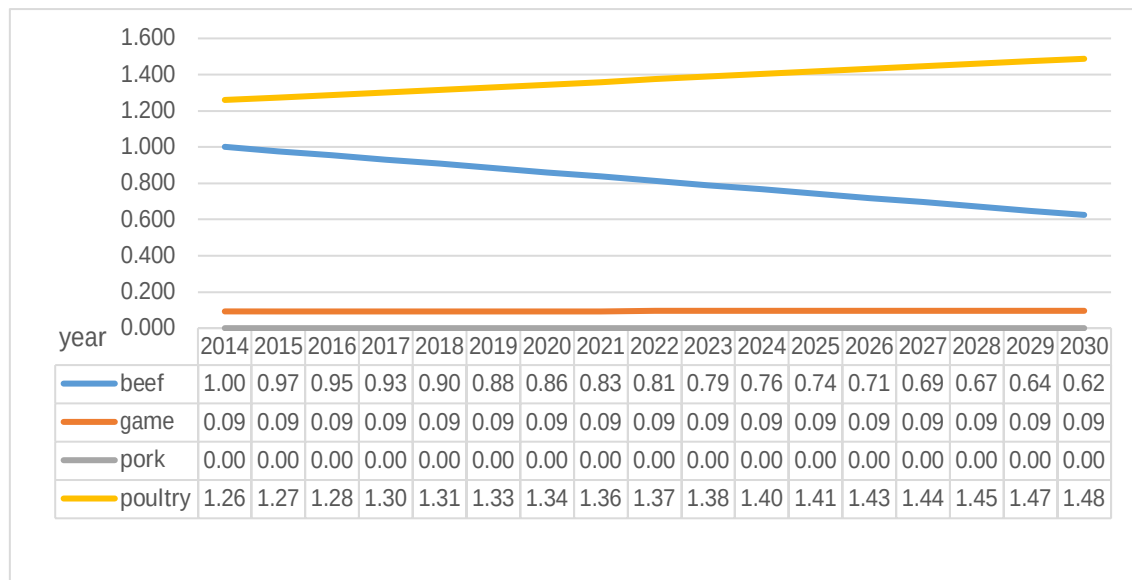


Figure 2. Development of meat consumption in kg / person / year in Bangladesh

Source: own processing

In the following part of the article, the tables (Table 3 and Table 4) show calculation methods by regression and correlation analysis in the countries of the Slovak Republic and Bangladesh.

Table 3. Regression and correlation analysis - Slovakia

SUMMARY OUTPUT -
Slovakia

Multiple R	0,94782
R Square	0,898363
Adjusted R Square	0,872954
Error Standard	0,458255
Observations	21

ANOVA

Regression	4	29,6985	7,424626	35,35574	9,32E-08
Residual	16	3,359964	0,209998		
Total	20	33,05847			

Intercept	76,93555	1,6132	47,69126	1,12	73,51572	80,35538	73,51572	80,35538
Beef	-0,23491	0,066901	-3,51124	0,002894	-0,37673	-0,09308	-0,37673	-0,09308
game	0,744979	0,184856	4,030046	0,000969	0,353102	1,136857	0,353102	1,136857
pork	-0,04531	0,029122	-1,55579	0,00139314	-0,10704	0,016428	-0,10704	0,016428
poultry	-0,02182	0,042907	-0,50853	0,00618023	-0,11278	0,06914	-0,11278	0,06914

Source: own processing

The Multiple R value for Slovakia is 0.94. The closer the value is to 1, the stronger the dependence is. In our example, this is a high degree of dependence of the relationship between life expectancy and consumption of different types of meat. The value of R Square is the value of the determination coefficient; it is a value of 0.89. This value, after multiplying by 100 (%), indicates that the chosen regression function explains the variability of sales to approximately 89%, the other part represents unexplained variability, influence of random factors and other non-specific effects. In the ANOVA section, we test the null hypothesis, which states that the model we chose to explain dependence (in our case a linear model) is not appropriate, the alternative hypothesis claims the opposite. The F test is used to evaluate this claim. Significance F = 0.0000000932 < 0.05 H_0 is rejected, which means that the model was chosen correctly.

The regression function has the form $y' = 76,93 - 0,23x_1 + 0,74x_2 - 0,04x_3 - 0,02x_4$

The locating constant is statistically insignificant. This means that with zero consumption of individual types of meat, we cannot expect an increase in life expectancy. The P-value for the regression coefficient b_1 (beef consumption in kg / person / year) is 0.00289 < 0.05, confirming the significance of this coefficient. Its fair value is -0.23, which means that with an increase in beef consumption of 1 kg, we can expect a decrease in life expectancy of 0.23 years. The P-value for the regression coefficient b_2 (game consumption

in kg / person / year) is 0.000969 <0.05, confirming the significance of this coefficient. Its real value is 0.74, which means that with an increase in game consumption of 1 kg, we can expect an increase in life expectancy of 0.74 years. The P-value for the regression coefficient b_3 (pork consumption in kg / person / year) is 0.0013 <0.05, which confirms the significance of this coefficient. Its real value is -0.04, which means that with an increase in consumption of pork by 1 kg, we can expect a decrease in life expectancy of 0.04 years. The P-value for the regression coefficient b_4 (poultry meat consumption in kg / person / year) is 0.00618 <0.05, which confirms the significance of this coefficient. Its real value is -0.02, which means that if the consumption of poultry meat is increased by 1 kg, we can expect the average life expectancy to decrease by 0.02 years. Based on the results obtained, we tried to point out the consequences of consumer demand by developing demographic indicators, namely the overall fertility rate and life expectancy (Figure 3, 4).

Table 4. Regression and correlation analysis - Bangladesh

SUMMARY OUTPUT - Bangladesh								
Multiple R	0,973253							
R Square	0,947221							
Adjusted R Square	0,934026							
Standard Error	0,87131							
Observations	21							
ANOVA								
Regression	4	218,0002	54,50005	71,78788	5,16E-10			
Residual	16	12,14691	0,759182					
Total	20	230,1471						
Intercept	14,28425	12,11425	1,179128	0,255585	-11,3968	39,96532	-11,3968	39,96532
hovädzina	20,70783	10,50279	1,971651	0,0066195	-1,55709	42,97274	-1,55709	42,97274
divina	10,95904	59,59799	1,838826	0,0084575	-16,7517	235,9325	-16,7517	235,9325
	0	0	65535		0	0	0	0
hydina	13,54042	2,298297	5,891502	0,0053257	8,668247	18,41259	8,668247	18,41259

Source: own processing

The Multiple R value for Bangladesh is 0.97. The closer the value is to 1, the stronger the dependence is. In our example, this is a high degree of dependence of the relationship between life expectancy and consumption of different types of meat. The R Square value is the determination coefficient value, it is 0.94. This value, after multiplying by 100 (%), indicates that the chosen regression function explains the variability of sales to approximately 94%, the other part represents unexplained variability, the influence

of random factors and other non-specific effects. In the ANOVA section, we test the null hypothesis, which states that the model we chose to explain dependence (in our case a linear model) is not appropriate, the alternative hypothesis claims the opposite. The F test is used to evaluate this claim. Significance $F = 0.0000516 < 0.05$ t. j. H_0 is rejected, which means that the model was chosen correctly.

The regression function has the form $y' = 14,28 + 20,70x_1 + 10,95x_2 + 0x_3 + 13,54x_4$

The locating constant is statistically insignificant. This means that with zero consumption of individual types of meat, we cannot expect an increase in life expectancy. The P-value for the regression coefficient b_1 (beef consumption in kg / person / year) is $0.00662 < 0.05$, which confirms the significance of this coefficient. Its real value is 20.70, which means that with an increase in beef consumption of 1 kg, we can expect an increase in life expectancy of 20 years. The P-value for the regression coefficient b_2 (game consumption in kg / person / year) is $0.00845 < 0.05$, confirming the significance of this coefficient. Its real value is 10.95, which means that with an increase in game consumption of 1 kg, we can expect an increase in life expectancy of 10 years. The P-value for the regression coefficient b_3 (pork consumption in kg / person / year) is zero, confirming that they do not consume pork in the country at all. The P-value for the regression coefficient b_4 (poultry meat consumption in kg / person / year) is $0.005326 < 0.05$, confirming the significance of this coefficient. Its real value is 13.54, which means that if we increase the consumption of poultry meat by 1 kg, we can expect an increase in life expectancy of 13 years.

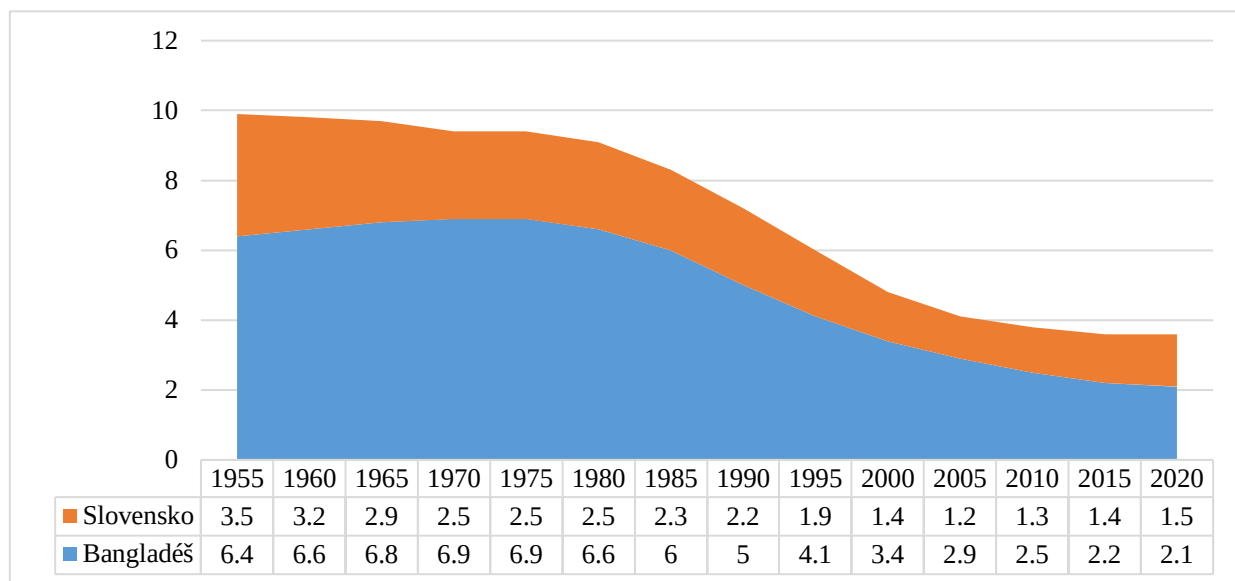


Figure 3. Development of total fertility rate in the compared countries

Source: processed according to data available at: <https://www.worldometers.info/demographics/bangladesh-demographics/>

The 1.5 and 2.1 values in 2020 confirm the decline in the indigenous population. In the Slovak Republic, an increase of 7% between 2015 and 2020 in Bangladesh decreased by 5% between 2015 and 2020. In the Slovak Republic, the indicator declines by 58% (1955 and 2020) in the period under review, and 68% in the Republic of Bangladesh.

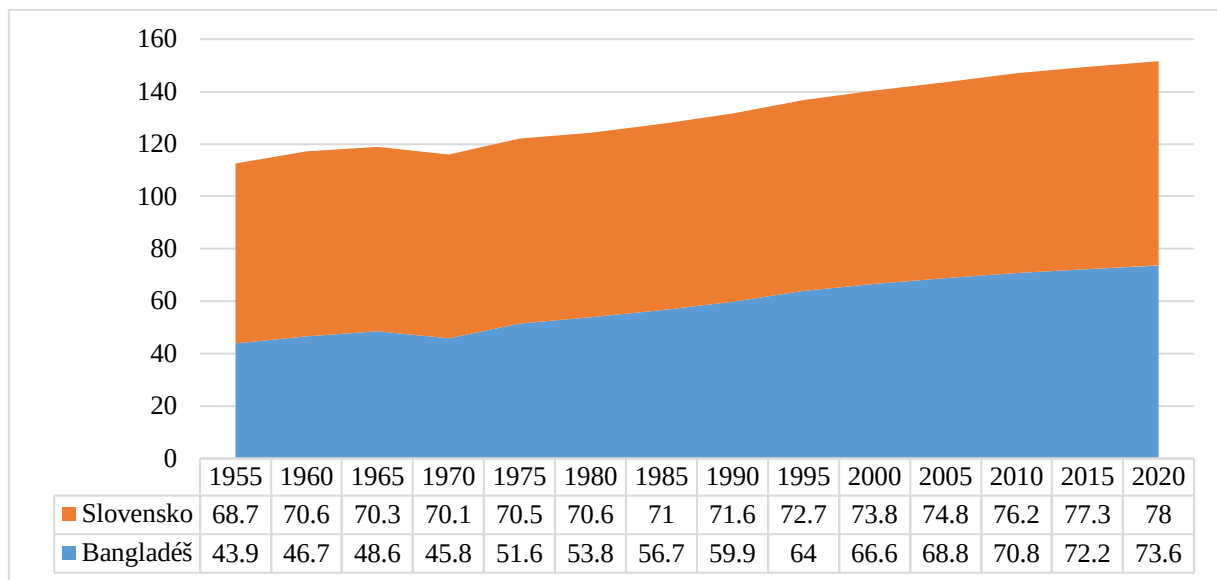


Figure 4. Development of life expectancy

Source: processed according to data available at: <https://www.worldometers.info/demographics/slovakia-demographics/>

The values of 78.0 and 73.6 in 2020 confirm the growth of the indigenous population. In the Slovak Republic by 0.9% between 2015 and 2020 in Bangladesh by 1.9% between 2015 and 2020. In the Slovak Republic, the indicator increases by 13% in the period under review (1955 and 2020), in the Republic of Bangladesh by 67%.

4. Conclusion

The aim of the paper was to analyze, compare and predict the consumer demand of statistically monitored categories of meat, its frequency of consumption, to find out the dependence of meat consumption on life expectancy and to outline possible consequences of this consumer demand on selected demographic indicators. The object of the investigation were the countries of Slovak and Bangladesh.

Secondary and primary data obtained from the questionnaire survey were used in the paper. The sources were processed by several statistical-mathematical methods, namely we used the method of regression and correlation analysis, the method of time series analysis. The results suggest that there is a correlation between life expectancy and consumption of individual meats, which can significantly influence the development of tourism through gastronomic trends. Finding intersections among tourism trends, meeting tourists' expectations through unrepeatable experiences, sophisticated tourists, gastronomy, food quality, consumer behavior in the consumption of meat of animal origin, and its impact on demographic indicators is not easy. It is important to realize that the tourism product needs to be designed in such a way that it is of increasing value for tourists. The tourists are willing and able to pay for the otherness of the tourism product. The results show that the structure of meat consumption has a significant impact on the life span of the population. It is only a matter of time before producers of gastronomy-oriented products, culinary tourism are aware of this fact and are able to sell it through marketing activities. The article has certain limits, whether in selecting indicators when examining demographic potential, selecting or comparing the

countries surveyed. It is limited in scope, but provides incentives for further primary research.

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Bureaucratic Manacles in Financial Autonomy of Public Hospitals in Pakistan: The Case Study of *Allied Hospital*, Faisalabad

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Abstract

The objectives of financial autonomy aimed to reduce government commitments in the financing of public hospitals, to increase efficiency in hospital operations, contain costs, and raise the quality of care. The present survey study of Allied Hospital Faisalabad explores that bureaucratic manacles in financial autonomy of these public hospitals end up in creating low job satisfaction levels among the employees of the hospitals. The dissatisfaction among Doctors, Nurses, Paramedical Staff, and Surgeons towards the management of the hospital was observed. , and irregular flows causes low levels of satisfaction in patients towards doctors, nurses and paramedical Staff.

Key words: *Public Hospital, Financial Autonomy, Bureaucratic Manacles, Irregular Inflow, Low Job Satisfaction Levels, Patient's Low Satisfaction Level*

Introduction

Almost 19 hospitals were given autonomy in the last 17 years in Punjab¹ after the commendation of *Punjab Medical and Health Institutions Act 1998*, *Punjab Medical and Health Institutions Ordinance 2002*, and *Punjab Medical and Health Institutions Act 2003* (Finance Department, Government of the Punjab 2008). The objectives of this hospital autonomy were to help reduce government commitments in the financing of public hospitals, to increase efficiency in hospital operations, contain costs, and raise the quality of care. Moreover the government hospitals were to retain their social mission and to continue to provide free care to those unable to pay.

The recommendations on hospital autonomy were offered in three categories: governance, management, and finance (Saeed 2013). It has been long since these hospitals are being run autonomously and a mix of appreciation and criticism is in the air about the performance of these hospitals. In so far as financial autonomy was concerned all of the hospitals were granted considerable autonomy.

Under the above mentioned Acts, financial autonomy to these hospital means that autonomous hospitals could thus construct their own internal budget without regard to the ministry or treasury controlling allocations to specific line items. All hospitals shifted from treasury accounts to commercial banking, and were no longer required to follow government accounting systems. The hospital management in all cases was encouraged to mobilize resources, though many restrictions were put on raising revenue through fee collection. Hospitals had been allowed to keep revenue raised through fee charge. But in reality, the picture is still skimpy due to several constrains in the usage of budget allocated to these autonomous hospitals. Therefore, present study addresses these constrains and the impact of these constrains on the middle consumers; *Doctors; Nurses, Paramedical Staff* and the end consumers of these hospitals; *the patients*. Before doing so, it is essential to comprehend the concepts of health planning, and autonomy in Pakistan before grasping the true picture of financial autonomy in the public hospitals.

Health Institutions in Punjab (Medical Colleges and Tertiary Care Hospitals) were given the financial autonomy; under Government of Punjab Act 1998, which was later on replaced by an Ordinance in January 2002, and further modified by Punjab Medical and Health Institution Act 2003 to increase the efficiency and effectiveness of these institutions. However, it could not bear the desired results as envisaged in the concept of financial autonomy. Financial autonomy given to these institutions had many limitations which was further curtailed by the later developments and policies of finance department. To comprehend the clear-cut understanding of financial autonomy we need to understand the concept of autonomy in public hospital.

Autonomy in Public Hospitals

Autonomy is destined as a mannerism that individuals can display comparative to any aspects of their lives, not restricted to enquiries of moral compulsion (Dworkin 1988, 34–47), and “delegation of power to lower cadres so they can take decisions independently” (Amir 2012).

¹ Finance Department, “Government of the Punjab”, <http://health.punjab.gov.pk/system/files/download.pdf> (accessed 13 May, 2008).

Therefore, autonomy has a lot to do with power i.e. entrusting and using power. The connotation and implication of power varies from society to society and is explained by its history, social structure, relationship of government and society, view of the fellow human beings and the world view held generally by the society. With respect to power, societies vary, as was explained in the famous study of Hofstede². He explains power distance as:

the extent to which members of a society accept that power in institutions and organizations is distributed unequally. A society's Power Distance norm is present in the values of both the leaders and the led, and reflected in the structure and functioning of the society's institutions.

In local context, Zaidi identified various stakeholders of power in the health planning in Pakistan which include "international agencies, government officials, pharmaceutical companies, health personnel and community and citizen's groups". However, after analysis, he concluded probably the most powerful factor influencing health planning is the influence of international donors, governments and agencies (Zaidi 1994). While analyzing the factors which influenced the policy process for government initiatives in Punjab health sector from 1993 to 2000, Tarin argued that the absence of clearly defined principles, the insufficient involvement of stakeholders, the lack of holistic view of contexts, focusing on the health sector, the shortcomings of policy machines and the need for a proper implementation structure and the administrative fatigue of donors are some main reasons of the implementation (Tarin 2003). Whereas, Abdullah and Shaw (2007) only cover the process of autonomy till the time when first ordinance was in force. It is sort of an evaluative study which tried to evaluate two separate attempts of autonomy in Pakistan, one in Punjab which included Sheikhpura Pilot Project and the granting of institutional autonomy to a number of public hospitals of Punjab and the other in NWFP province which included autonomy to four largest public sector, tertiary care and teaching hospitals in the NWFP which included Lady Reading Hospital (LRH); Khyber Teaching Hospital (KTH); and Hayatabad Medical Complex (HMC) in Peshawar; and the Ayub Medical Complex (AMC) Abbottabad. In more recent study, Amir studied the process of autonomy from the point of view of implementation though using interpretive approach (Seed, Amir 2012). He defines that hospital autonomy is considered by its initiators/implementers as an objective, formal and hard reality depicted by its formal proposals, rules, legislative Acts, and formal actions is indeed a subjective construct brought in existence by the interplay of various social actors involved and related to the arena of health management especially at the tertiary level. This social reality is constructed through the interaction of these stakeholders who are again influenced by its environment be it social, economic, political, geographical, historical or international. All of the formal stakeholders including politicians, federal and provincial bureaucracies, doctors (both technical/professional and administrator) etc. who were thought to have power/authority and influence in this arena had their own meaning of the term (hospital) autonomy, influenced by their interests (institution, position, objectives, expectation etc.). Apart from these, other stakeholder including employees and patients also had their own meaning of the concept.

But, none of these researches have tried to study constraints in financial autonomy of autonomous hospitals and the impact of these constraints on middle and end consumers in a systematic way.

² Hofstede, 'National cultures revisited' 1983, 285.

So, the meaning of autonomy, its giving and taking are embedded in the society of Pakistan and can be understood only in its natural context. The understanding of this concept will be very helpful in understanding the social dynamics of the society in Pakistan. Apart from other reforms like privatization, deregulation, Public-private partnership etc. reforms of autonomy of teaching hospitals were also introduced in first at federal level and then on provincial levels. After experimenting them at federal level, they were introduced in couple of provinces including Punjab.

Since 1998, a significant amount of changes were introduced in different aspects of the hospital including governance mechanism, management, finance, HR, purchasing etc. These changes which incurred huge amount of costs, changed the outlook of the hospital. It made hospitals responsible for arranging for their own expenses, which forced them to introduce user charges, slash free medicine facility and increase charges of different nature. In a finance-starved country like Pakistan which only spends around 10% of its GDP on the social sector, it was a shocking jolt to its poor masses on both accounts i.e. costs of introducing reforms and withdrawing of medical facilities which were already meager and insufficient. With this context placed in perspective it becomes very essential to understand *what actually happened* with reference to the reforms of hospital autonomy and then to analyze and find out as to why and how all this happened, what were the causes of happenings, what are the results of the reforms, and what was the reality of the reforms.

Financial Autonomy of Hospital in Pakistan

Under Punjab Medical and Health Institutions Act 1998

According to this Act Chief Executive was made responsible for the efficient running of the hospital. He had to work in consultation with the Institutional Management Committee (IMC). Chief Executive was entrusted with the task of nominating members of the IMC. Here one local objective of the reform was being clearly met i.e. role of bureaucracy has been trimmed down to the lowest. However soon after the introduction of this reform, the political government in the province was dethroned by coup d'état of Gen Musharraf, which did away with the backing and support that doctors and this initiative had with the result that bureaucracy regained its lost position. It ensured that IMC were not formed which could have saved CE of all the responsibility and accountability of the process. IMCs were to make new rules to run autonomous institutions but when they were not formed there were no new rules. Now CE believed that the previous rules of the Punjab government would not be applied to the new structures and it would only be run under new rules whereas new rules could not be framed. Subsequently, the first autonomy initiative went along for around three years in this state of ambiguity. The running of the institutions needs decisions and decisions are made according to some rules, and when there are no rules, the decisions of the people at the top become rules and final words.

Under Punjab Medical & Health Institutions (PM&HI) Ord. 2002

Hospital autonomy initiative was again relaunched through (PM&HI) Ord. 2002. This ordinance was the next step in the punctuated equilibrium of the process of implementation of autonomy in the province of

Punjab. Autonomy status of the hospitals was reinstated only after a month of halting the process. This time around the role of government in the development of the structure of the management was quite prominent and imposing and bureaucracy came back strongly which in fact defeated the very spirit of autonomy, at least from the perspectives of doctors' community. The whole (previous) system was put to halt and a new scheme was designed which offered few powers to the administration of the hospital headed by Board of Governors (BOG). The administration thus made was toothless and most of the actions needed further approval of the Health Secretary. Whereas, bureaucracy never passed on the financial powers to the hospitals. Even the purchasing has to be done through the purchasing manual of the government. They wanted that hospitals earn money by themselves and spend by their standards. Hospitals were dependent on the government for the grant of the necessary resources. Referring to the powers of the BOG the clause 2(ii) of the PM&HI Rules 2002 says, "Board may request the Provincial Government to sanction additional Grant-in-aid on case to case basis". Director Finance was now to be a BPS 19/20 grade officer from Audit and Accounts Department, Government of the Punjab. He has to work on deputation in the hospital and needed recommendation of the PEO for its posting there [clause 13(3)].

Powers of varying degree have been delegated to Board of Governors, Principal Executive Officer, Deputy Dean, and MS with respect to creation and abolitions of posts, approval of development work, auctioning of surplus items, sanction of telephone, purchase and replacement of motor vehicles, their parts etc, purchase of medicine, machine and equipment, stationary, paying different utility charges and fee (PM&HI Rules 2002). This certainly appears a big, genuine improvement at least on paper but not on practical.

Under Punjab Medical & Health Institutions (PM&HI) Act 2003

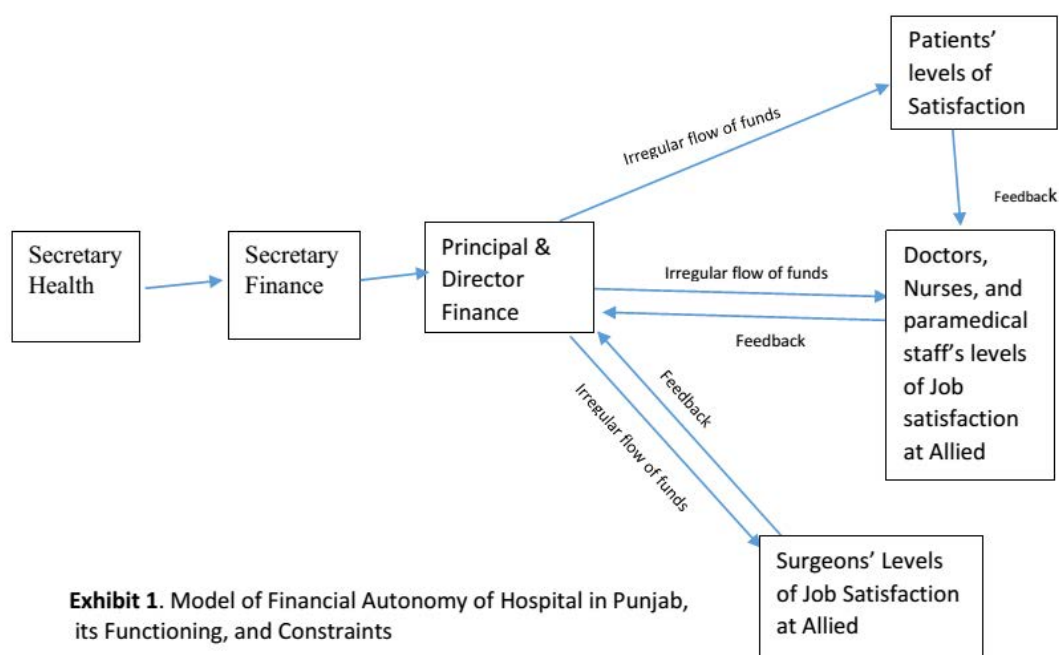
Again in this Act, the previous happenings influenced the structure and its details. BOG, its unlimited powers, perks of the members etc. were done away with but what was not curtailed was the power and influence of bureaucracy which became even stronger as the official permanent members of the board. Listing, selection and nomination of the non-official members were now the sole prerogative of the Department of Health (DOH), Government of the Punjab. In the same vein, DOH had the right to appoint "Principal ... among the teaching cadre who all along had been under the control of DOH (clause 7). The final selection authority of MS of the hospital was again DOH which has to select him out of the three,

Constrains in budget handlings

Before 2013, the budget of autonomous hospital was transferred as *Personal Ledger Accounts*, by which the appropriations were possible and director finance could set it according to the requirements of the hospital and for re-appropriation the approval of Secretary Finance must be granted, which took long time. But under these conditions, budget handling was not a serious problem for autonomous hospitals.

But in 2013, Personal Ledger Account was changed into *Special Drawing Accounts*, in which money was directly transferred from Government of the Punjab into hospital heads' accounts. In these conditions, appropriation and re-apparitions both were restricted which further curtailed the financial autonomy of hospitals.

Now in the current fiscal Year 2015-2016, the budget of the autonomous hospitals is *Cost Centered*, means that budget cannot be handled on horizontal level, now it has vertical utility, means if one hospital has five units, every unit can only use its own budget, if other unit needs some finance, then it is not possible to utilize it. In case one unit feels some constrains in budget, other unit cannot help it. What will be happened, at the end of fiscal year some units have no budget to use, and some have budget to no use. It is the bureaucratic style of government in the province.



In all these hurdles, constrains, and hindrances, who will be the ultimate sufferers; definitely doctors, nurses, and para-medical staff are indirectly, and poor patients directly suffered. The *Exhibit 3* clearly defines it. It shows that finance is issued by the approval of health secretary, then sanctioned by Secretary Finance, then given to Principal and the director finance of the autonomous hospital. Chawl and Govindaraj (1996) devised five indicators to measure the hospital autonomy; efficiency, quality of care and public satisfaction, accountability, equity, and resource mobilization. In the study under hand the researcher used only two indicators; efficiency and quality of care and public satisfaction. If there is the constraint in inflow of finance then it can cause dissatisfaction among the patients and hospital employees; Doctors, Nurses, and Para-medical staff. Therefore, in present study to link the constraints in inflow of fiancé and level of dissatisfaction among the directly and indirectly sufferers, surveys were conducted in Allied Hospital

Faisalabad.

Research Methodology and Data

Allied Hospital is selected for present research because of its significance in the whole district of Faisalabad, it is the largest hospital having 1150 beds and it receives the highest number of patients in the district. The hospital has latest medical equipment along with surgical, medical, cardiology, ENT, pediatric, gynecology, obstetrics, labor, radiology, nephrology, dialysis, oncology, urology, plastic surgery, orthopedics, ophthalmology, and neurosurgery units. The hospital also has latest kidney transplant facilities. It also facilitates in postgraduate training in medical and surgical specialties. It also provided amenities of mortuary, and postmortem.

Exhibit 2

Particulars	2013-14	2014-15	2015-16 upto 30 ³ March 2016
Admission	346700	257422	194770
Gynae Major	4872	4931	4386
Gynae Minor	1512	1638	860
Over all Surgical cases	88063	88430	67110
Pneumonia cases	1635	1875	1985

Exhibit 2 shows the statistics of total admissions in hospital during the fiscal year 2013-14, 2014-15, up to March 2015-16 in the categories of Gynae Major, Gynae Minor, Overall Surgical cases and patients of Pneumonia during the time period. There is a gradual increase in the number of patients and surgeries from 2013 to March 2016.

Exhibit 3

Year	Government funds	Hospital's Generated Funds	Amount Rs. (m) ⁴ Total
2013-14	1559.372	118.646	1678.018
2014-15	1648.572	131.321	1779.893
2015-16	1723.966	152.806 (approx.)	1876.772

Exhibit 3 shows the gradual increment in the hospital budget during the period of the fiscal year 2013-14, 2014-15, and 2015-16.

³ Source: Allied Hospital Statistics Department, Faisalabad

⁴ Source: Allied Hospital Finance Department, Faisalabad

Research Results

Exhibit 4

Patients' Satisfaction doctors, nurses, and para-medical staff

	Gender	N	Mean	Std. Deviation	Std. Error
Patient's Satisfaction towards Doctors	Male	196	13.9694	4.45940	.31853
	Female	81	15.2716	6.13598	.68178
Patient's Satisfaction towards Nurses	Male	196	15.0663	3.55047	.25360
	Female	81	15.6667	4.40454	.48939
Patient's Satisfaction towards para-medical Staff	Male	196	19.0816	5.49158	.39226
	Female	81	20.1852	6.08505	.67612

Ten-item scale was constructed to measure the satisfaction level of Patient towards Doctors in Allied Hospital ranging from (very poor=1 ...very good=5), ($N=272$, *Cronbach Alpha*=.847, $M=14.35$, $SD=5.031$) (appendix 1). Then further ten-item scale was created to measure the satisfaction level of Patient towards Nurses in Allied Hospital ranging from (very poor=1 ...very good=5), ($N=272$, *Cronbach Alpha*=.704, $M=15.25$, $SD=3.819$) (appendix 2), whereas, 13-item scale was assembled to measure the satisfaction level of Patient towards Para-medical Staff in Allied Hospital ranging from (Strongly Disagree=1 ...Strongly Agree=5), ($N=272$, *Cronbach Alpha*=.853, $M=19.40$, $SD=5.683$) (appendix 3). The Exhibit 4 reports that female patients have more satisfaction levels towards Doctors, Nurses, and Para-medical Staff. Male patients had least satisfaction levels towards doctors, while female patients have highest levels of satisfaction towards para-medical Staff.

Exhibit 5

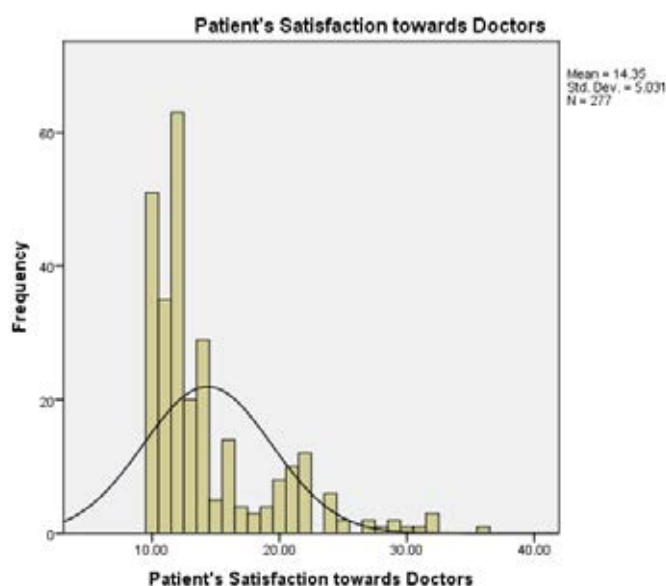


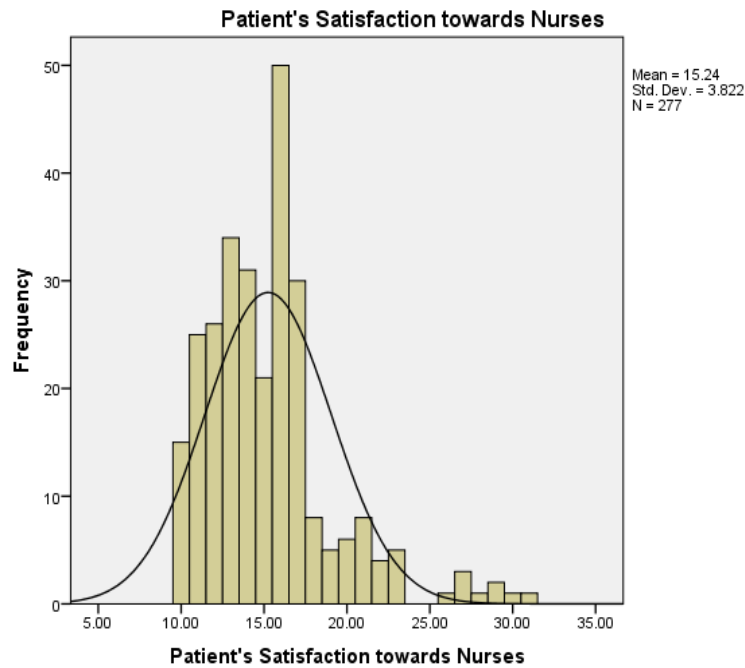
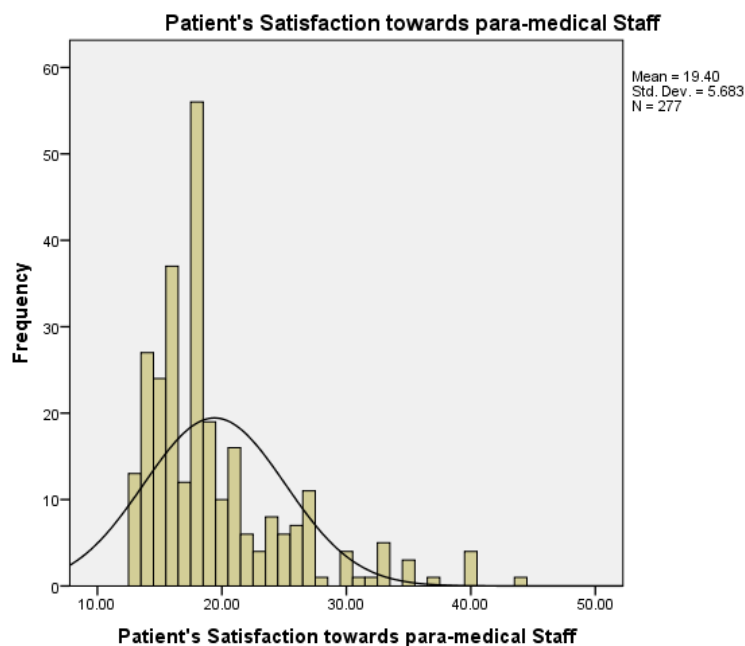
Exhibit 6**Exhibit 7**

Exhibit 5 shows that most of the patients had very poor level of satisfaction towards Doctors, and same trend was observed about Nurses (*Exhibit 6*), and Para-medical Staff (*Exhibit 7*).

Exhibit 8**Surgeons' Level of Satisfaction about Management of the Hospital**

Group Statistics

		Gender	N	Mean	Std. Deviation	Std. Error Mean
Surgeons Level of satisfaction towards Management		Male	34	6.2647	2.20617	.37836
		Female	7	6.7143	1.88982	.71429

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Surgeons Level of satisfaction towards Management	Equal variances assumed	.091	.765	-.501	39	.619	-0.450	0.897	-2.263	1.364
	Equal variances not assumed			-.556	9.700	.591	-0.450	0.808	-2.258	1.359

5-items scale (ranging from Strongly disagree =1, ...Strongly agree=5, Cronbach Alpha= .732, M= 6.34, SD=2.140) was constructed to measure the level of satisfaction among surgeons towards hospital management (appendix 4), Exhibit 8 reports that independent sample t-test shows there was no significant difference of level of satisfaction among male-surgeon and female surgeons toward management of the Allied Hospital. Both male and female surgeons had low levels of satisfaction (*Male*= 6.2647, *Female*=6.7143, $p=.765$).

Exhibit 9**Job Satisfaction levels of Doctors, Nurses and Paramedical Staff at Allied Hospital**

	N	Mean	SD	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Paramedical	14	66.571	18.169	4.856	56.081	77.062	42.00	100.00
Nurse	37	76.487	17.063	2.805	70.797	82.176	42.00	109.00
Doctor	31	87.000	15.595	2.801	81.280	92.720	44.00	109.00
Total	82	78.768	18.069	1.995	74.798	82.738	42.00	109.00

ANOVA					
Total Jobs at Allied					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4375.926	2	2187.963	7.832	.001
Within Groups	22068.672	79	279.350		
Total	26444.598	81			

15-items scale (ranging from *Low* =1-3, *High*=8-10, Cronbach Alpha= .823, M= 28.7333, SD=4.68561) was constructed to measure the levels of satisfaction of doctors, nurses and para-medical staff towards hospital management keeping in view the irregular inflow of finance (appendix 5), *Exhibit 9* reports that independent sample t-test shows there was significant difference of levels of satisfaction among doctors, nurses and para-medical staff toward management of the Allied Hospital. All three had low levels of satisfaction (*Doctor*= 87.0000, *Nurses*=76.4865, *Nurses*=66.5714, $p=.001$). However, paramedical staff had least satisfaction levels as compared to nurses and Doctors.

Conclusion

The present study concludes that the most of the patients had very poor level of satisfaction towards Doctors, Nurses, and Para-medical Staff of Allied Hospital Faisalabad. Male patients expressed least satisfaction levels towards doctors as compared to female patients whereas, female patients have highest levels of satisfaction towards para-medical Staff as compared to male patients. On the other hand, overall doctors showed signs of dissatisfaction; there was no significant difference of level of satisfaction among male-surgeon and female surgeon toward management of the Allied Hospital. The study further concludes that there was significant difference of levels of satisfaction among doctors, nurses and Para-medical staff toward management of the Allied Hospital. Although all three had low levels of satisfaction, however, the doctors had higher satisfaction levels as compared to nurses and paramedical staff.

Recommendations

Due to restraints in financial autonomy of Allied hospital, patient's satisfaction towards doctors, nurses, and paramedical staff is so low, and same trend of low level of satisfaction is observed among the surgeons of the hospital towards management. Majority of the employees feel discomfort due to irregular inflow of funds. Therefore, present study strongly recommends that Government of the Punjab must revise their policies about financial autonomy to improve the functioning of autonomous hospital in the province; otherwise the low level of satisfaction will soon plague the system. As for the policy revision, funds should be transformed into to Personal Ledger Account rather than Cost Centered or Schedule Withdrawing Accounts for smooth and quick improvement in health sector especially in autonomous hospitals.

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Appendix 1

Reliability Statistics	
Cronbach's Alpha	N of Items
.847	10

Item Statistics			
	M	SD	N
Friendliness of the Doctor	1.47	1.020	277
Explanations the Doctor gave you about your problem or condition	1.42	.769	277
Concern the Doctor showed for your questions or worries	1.39	.794	277
Doctor's efforts to include you in decision about your treatment	1.31	.575	277
Information the Doctor gave you about medication (if any)	1.35	.754	277
Instruction the doctor gave you about follow-up care (if any)	1.66	.817	277
Degree to which doctor talked with you using words you could understand	1.62	.769	277
Amount of time the doctor spent with you	1.43	.761	277
Your confidence in the doctor	1.37	.758	277
Likelihood of your recommending this doctor to others	1.34	.671	277

Item-Total Statistics				
	Scale Mean if Item Delete d	Scale Variance if Item Deleted	Corrected Item- Total Correlatio n	Cronbach's Alpha if Item Deleted
Friendliness of the Doctor	12.88	19.105	.580	.832
Explanations the Doctor gave you about your problem or condition	12.94	20.938	.538	.833
Concern the Doctor showed for your questions or worries	12.96	20.198	.629	.825
Doctor's efforts to include you in decision about your treatment	13.04	22.161	.521	.836
Information the Doctor gave you about medication (if any)	13.00	21.870	.408	.844
Instruction the doctor gave you about follow-up care (if any)	12.69	20.438	.569	.830
Degree to which doctor talked with you using words you could understand	12.73	20.763	.565	.831
Amount of time the doctor spent with you	12.92	20.602	.598	.828
Your confidence in the doctor	12.98	20.424	.630	.825
Likelihood of your recommending this doctor to others	13.01	22.047	.448	.841

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
14.35	25.315	5.031	10

Appendix 2

Reliability Statistics	
Cronbach's Alpha	N of Items
.704	10

Item Statistics			
	M	SD	N
Friendliness of the Nurse	1.40	.661	277
Explanations the Nurse gave you about your problem or condition	1.42	.765	277
Concern the Nurse showed for your questions or worries	1.65	.777	277
Nurse's efforts to include you in decision about your treatment	1.65	.689	277
Information the Nurse gave you about medication (if any)	1.40	.773	277
Instruction the Nurse gave you about follow-up care (if any)	1.40	.767	277
Degree to which Nurse talked with you using words you could understand	1.30	.626	277
Amount of time the Nurse spent with you	1.76	.580	277
Your confidence in the Nurse	1.79	.918	277
Likelihood of your recommending this Nurse to others	1.47	.694	277

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Friendliness of the Nurse	13.84	12.190	.424	.673
Explanations the Nurse gave you about your problem or condition	13.82	11.762	.426	.670
Concern the Nurse showed for your questions or worries	13.59	11.547	.461	.664
Nurse's efforts to include you in decision about your treatment	13.60	11.568	.542	.652
Information the Nurse gave you about medication (if any)	13.84	10.765	.636	.629
Instruction the Nurse gave you about follow-up care (if any)	13.84	11.777	.421	.671
Degree to which Nurse talked with you using words you could understand	13.95	12.247	.444	.671
Amount of time the Nurse spent with you	13.49	13.388	.203	.705
Your confidence in the Nurse	13.46	14.546	-.115	.777
Likelihood of your recommending this Nurse to others	13.78	12.225	.387	.678

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
15.25	14.584	3.819	10

Appendix 3**Reliability Statistics**

Cronbach's Alpha	N of Items
.853	13

Item Statistics			
	M	SD	N
There are no enough para-medical staff at the hospital	1.66	.817	277
Para-medical staff listen to patients and converse with them	1.62	.769	277
Para-medical staff approach patients with gentility	1.43	.761	277
Patients requests are promptly attended to para-medical staff	1.37	.758	277
Para-medical staff promptly respond to patients call	1.34	.671	277
Para-medical staff promptly take action during emergency	1.40	.661	277
Para-medical staff controls sources of noise in the unit	1.42	.765	277
Para-medical staff dispose soiled lined promptly	1.65	.777	277
Para-medical staff attend to cleanliness of patients	1.65	.689	277
Para-medical staff attend to patients unable to care for self	1.40	.773	277
Para-medical staff conveniently place patients in bed	1.40	.767	277
Para-medical staff safely lift and move patients	1.30	.626	277
Para-medical staff give adequate explanation about their activities	1.76	.580	277

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item - Total Correlation	Cronbach's Alpha if Item Deleted
There are no enough para-medical staff at the hospital	17.75	26.675	.586	.837
Para-medical staff listen to patients and converse with them	17.78	27.221	.558	.839
Para-medical staff approach patients with gentility	17.97	27.438	.536	.841

Patients requests are promptly attended to para-medical staff	18.04	27.267	.563	.839
Para-medical staff promptly respond to patients call	18.06	27.960	.548	.840
Para-medical staff promptly take action during emergency	18.00	27.837	.576	.839
Para-medical staff controls sources of noise in the unit	17.98	26.706	.632	.834
Para-medical staff dispose soiled lined promptly	17.75	27.151	.560	.839
Para-medical staff attend to cleanliness of patients	17.75	28.526	.447	.846
Para-medical staff attend to patients unable to care for self	18.00	26.362	.672	.831
Para-medical staff conveniently place patients in bed	18.00	28.525	.388	.850
Para-medical staff safely lift and move patients	18.10	28.471	.513	.842
Para-medical staff give adequate explanation about their activities	17.65	31.954	.000	.868

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
19.40	32.292	5.683	13

Appendix 4**Reliability Statistics**

Cronbach's Alpha	N of Items
.732	5

Item Statistics			
	Mean	SD	N
We have ability to add nonselective procedures	1.22	.419	41
We have reliable high quality equipment	1.27	.449	41
Surgeons are on time	1.24	.699	41
Anesthesiologists are on time	1.34	.728	41
We get the required instruments properly cleaned and on time	1.27	.708	41

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
We have ability to add nonselective procedures	5.12	4.110	.174	.775
We have reliable high quality equipment	5.07	4.220	.087	.797
Surgeons are on time	5.10	2.540	.696	.594
Anesthesiologists are on time	5.00	2.400	.731	.574
We get the required instruments properly cleaned and on time	5.07	2.370	.784	.548

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
6.34	4.580	2.140	5

Appendix 5**Reliability Statistics**

Cronbach's Alpha	N of Items
.823	15

Item Statistics			
	M	SD	N
How would you rate your satisfaction with Allied Hospital	1.76	0.59	75
How would you rate the government's understanding of your concerns?	2.16	0.68	75
How would you rate your satisfaction with your job?	1.85	0.67	75
How would you rate your satisfaction with the Hospital's communication?	1.93	0.62	75
How would you rate the effectiveness of Hospital's vision?	1.93	0.62	75
How would you rate your understanding of the Hospital's vision?	2.00	0.40	75
How would you rate your understanding of Government's vision about Hospital?	1.93	0.62	75
How would you rate your current level of enthusiasm?	1.85	0.54	75
How would you rate government's ability to motivate you?	2.09	0.62	75
How would you rate government's understanding of your needs?	2.15	0.67	75
How would you rate your willingness to discuss concerns with your management?	1.76	0.43	75
How would you rate government's commitments to address your concerns?	1.89	0.42	75
How would you rate the level of recognition you receive when you over achieve?	1.87	0.83	75
How would you rate the level of pressure you feel to perform better?	1.85	0.36	75
How would you rate the overall leadership of the Hospital?	1.69	0.46	75

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
How would you rate your satisfaction with Allied Hospital	26.9733	17.756	.776	.789
How would you rate the government's understanding of your concerns?	26.5733	17.329	.737	.789
How would you rate your satisfaction with your job?	26.8800	17.702	.673	.794
How would you rate your satisfaction with the Hospital's communication?	26.8000	18.243	.625	.799
How would you rate the effectiveness of Hospital's vision?	26.8000	17.108	.866	.781
How would you rate your understanding of the Hospital's vision?	26.7333	19.523	.638	.805
How would you rate your understanding of Government's vision about Hospital?	26.8000	18.243	.625	.799
How would you rate your current level of enthusiasm?	26.8800	21.594	.014	.837
How would you rate government's ability to motivate you?	26.6400	18.152	.648	.797
How would you rate government's understanding of your needs?	26.5867	20.300	.199	.831
How would you rate your willingness to discuss concerns with your management?	26.9733	20.648	.287	.821
How would you rate government's commitments to address your concerns?	26.8400	20.406	.360	.817
How would you rate the level of recognition you receive when you over achieve?	26.8667	20.306	.129	.843
How would you rate the level of pressure you feel to perform better?	26.8800	21.107	.220	.823
How would you rate the overall leadership of the Hospital?	27.0400	22.093	-.081	.839

Evaluation of the antioxidant activity and mutagenicity of Brazil nut (*Bertholletia excelsa* Bonpl.).

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Abstract

This study evaluated the antioxidant capacity and the genotoxic and antigenotoxic effects of the fixed oil of B. excelsa Bonpl. in peripheral blood of Swiss mice. For the antioxidant capacity, were used the β -carotene/linoleic acid and DPPH methods. In the genotoxicity assay, were used healthy, 6-7 week old male Swiss mice, and there were six animals per group. For the genotoxic test, animals were treated with different concentrations of B. excelsa (500, 1.000 and 2.000 mg/kg body weight bw) in 0.5 mL orally. For the antigenotoxic test, animals were treated with predetermined concentrations, followed by intraperitoneal injection of doxorubicin (DXR 15 mg/kg bw) in 0.3 ml, in addition to the negative group (water) and dimethylsulfoxide (200 μ L). Peripheral blood samples were collected 24 and 48 hours after the treatments. The frequency of micronucleated polychromatic erythrocytes (MNPCEs) was obtained from

the analysis of 2.000 MNPCs/animal. After data analysis, the conclusion was that the fixed oil of *B. excelsa* showed excellent protective activity by the β -carotene/linoleic acid method, demonstrated absence of genotoxic effect, and significant antigenotoxic effect according to the protocols and treatments performed in this study.

Keywords: Mutagenesis; Micronucleus test; *Bertholletia excelsa*; DPPH; β -carotene/linoleic acid method.

1. INTRODUCTION

The use of bioderivatives started thousands of years ago by populations from several countries in order to treat various diseases. Populations used these substances as an alternative or complementary form to synthetic drugs (Veiga-Junior & Mello, 2008) through popular knowledge transmitted from generation to generation over time.

Brazil is known for its rich biodiversity and for having the largest part of the Amazon rainforest that also includes nine other Latin American countries (Da Silva et al., 2016). The forest has a wide variety of plant species that have not been fully studied yet. Nuts are energy-rich foods, mainly due to their high content of proteins (15%), carbohydrates (9%) and lipids (71%) (Yang, 2009; Da Costa et al., 2010; Stockler-Pinto et al., 2015; Cardoso et al., 2017), and this has attracted researchers' attention regarding their chemical composition and use as functional foods. Among nuts, *Bertholletia excelsa* Bonpl. 1807 is a native Amazonian species of the family Lecythidaceae. It is popularly known as Brazil nut, and distributed geographically in countries such as Venezuela, Bolivia, Peru, Colombia, Guianas and Brazil, in Brazilian states of Maranhão, Mato Grosso, Pará, Acre, Rondônia, Amapá, Roraima and Amazonas (Pacheco and Scussel 2006, 2011; Shepard and Ramirez, 2011; Manfio et al., 2012a, 2012b). Harvest of the Brazil nut is one of the main sources of income for Amazonian riverside families, besides moving the international market with its export (Ribeiro et al., 2014; IndexBox, 2016).

The chemical composition of the Brazil nut includes considerable amounts of fibers, folate, vitamin E, vitamin B6, calcium, iron, potassium, zinc, copper, arginine, flavonoids and minerals that can act as antioxidants (Chunhieng et al., 2004; Kornsteiner et al., 2006; Ros et al., 2010). Selenium is one of its minerals (Se, its safe intake range is 50 to 400 $\mu\text{g/day}$ for adults) (Roman et al., 2014), and it was considered toxic, but is now classified as an essential element by its antioxidant action of preventing the body from diseases related to age, such as cancer and cardiovascular diseases, as well as risk factors related to oxidative stress and diabetes (Risher, 2003; Lopez-Uriarte et al., 2009; Ros, 2015; Stockler-Pinto et al., 2015; Mozaffarian, 2016; Asghari et al., 2017).

Natural products have been in evidence for being a natural source of bioactive molecules. Their broad list of biological properties benefits humans because of their biocompatibility and easy metabolization by the body. However, toxicological studies are needed to support the use of these products, because they are a natural source with excellent preventive activity of oxidative processes in the metabolism. In view of the aforementioned biological properties, the aim of the present study was to evaluate the antioxidant capacity and the genotoxic and antigenotoxic effects of the fixed oil of *Bertholletia excelsa* Bonpl. (Brazil nut).

2. MATERIAL AND METHODS

2.1 Fixed oil of *Bertholletia excelsa*

The fixed oil of *Bertholletia excelsa* was kindly provided by the Laboratory of the Nucleus of Food Science and Technology (Portuguese acronym: NUCTECNAL) of the Institute of Scientific and Technological Research of the State of Amapá (Portuguese acronym: IEPA), where the nuts were manually broken and their exposed almonds were later dehydrated in a laboratory stove (Quimis®) at 50°C for ten hours for processing of the fixed oil. The almonds were pressed to exhaustion in a 72 hours period by using a hydraulic press (Marconi®). The fixed oil was stored in an amber bottle at 4°C for subsequent analyzes.

2.2 Preparation of extracts for antioxidants assays

This method was adapted from the technique described by Larrauri et al., (1997). For preparation of the extracts, were weighed 5g of the oil in a 100 mL beaker, 20 mL of 50% methanol were added, homogenized and allowed to stand for 60 minutes at room temperature. Then, centrifuged at 15.000 rpm for 15 minutes, and the supernatant was transferred to a 50 mL volumetric flask. From the first extraction residue, 20 ml of 70% acetone was added, homogenized and allowed to stand for 60 minutes at room temperature. Centrifuged again at 15.000 rpm for 15 minutes, and the supernatant was transferred to the volumetric flask containing the first supernatant. The volume was completed to 50 mL with distilled water.

2.3 β -carotene/linoleic acid method

The technique used was that described by Rufino et al. (2007a) with modifications. From the extracts obtained, at least three different dilutions in triplicate were prepared in test tubes as follows: 0.4 mL of each dilution of extracts was mixed with 5 mL of the system solution (β -carotene/linoleic acid). A mixture of 0.4 ml of the Trolox solution (synthetic antioxidant) with 5 ml of the system solution was used as control. Test tubes were homogenized on a shaker and kept in water bath at 40°C. Concentrations used in this assay were 10.000 and 15.000 ppm. The first reading was performed (470 nm) after 2 minutes of mixing, and then at 15 minutes intervals until completing 120 minutes. The spectrophotometer was previously calibrated with distilled water.

Results were expressed as percent inhibition of oxidation. The absorbance reduction of the system without antioxidant (Eq. 1) was considered as 100% oxidation.

$$\text{Absorbance reduction} = \text{Abs}_{\text{initial}} - \text{Abs}_{\text{final}} \quad (\text{Eq.1})$$

The decrease of the absorbance reading of the samples is correlated with the system and establishes the oxidation percentage (Eq.2) by subtracting the oxidation percentage of each sample of 100 (Eq.3). The antioxidant action of the sample (*B. excelsa*) was verified by comparing it with the activity of the synthetic antioxidant (Trolox).

$$\% \text{ Oxidation} = \frac{[(\text{Abs reduction})_{\text{sample}} \times 100]}{(\text{Abs reduction})_{\text{system}}} \quad (\text{Eq.2})$$

$$\% \text{ Protection} = 100 - (\% \text{ Oxidation}) \quad (\text{Eq.3})$$

2.4 DPPH method (2,2-diphenyl-1-picrylhydrazyl)

The technique used was that described by Brand-Williams et al., (1995) and Rufino et al., (2007b) with modifications. From extracts obtained, at least three different dilutions in triplicate were prepared in test tubes as follows: in a dark environment, a 0.1 mL aliquot of each extract dilution was transferred into test tubes with 3.9 mL of the DPPH radical (0.06 mM) and homogenized on a tube shaker. A mixture of 0.1 mL of the control solution (methyl alcohol, acetone and water) with 3.9 mL of the DPPH radical was used and homogenized. Three concentrations were used, namely: 50.000, 70.000 and 100.000 ppm, and methyl alcohol was used as blank in order to calibrate the spectrophotometer. The readings (515 nm) were monitored every minute, and absorbance reduction was observed until its stabilization. The final absorbance reading for the calculation of inhibitory concentration 50 (IC₅₀) was performed after absorbance stabilization (IC₅₀ time).

After reading, the value corresponding to half of the initial absorbance of the control was replaced (Eq. 4) by the y of the DPPH curve equation in order to find the DPPH consumption in μM .

Equivalence of control and DPPH:

$$Y = ax - b \quad (\text{Eq.4})$$

Where:

Y = Initial control absorbance/2 (item determining total antioxidant capacity).

x = result in μM DPPH.

Note: convert to g DPPH by transformation: $\text{g DPPH} = (\mu\text{M DPPH}/1.000.000) * 394.3$ (molecular weight of DPPH).

From absorbance values obtained from the different dilutions of extracts, absorbance was plotted on the Y-axis and dilution (mg/L) on the X-axis, and the equation of the line (Eq. 5) was determined. In order to calculate the total antioxidant capacity, the absorbance equivalent to 50% of the DPPH concentration was replaced by y (Eq. 5) and was found the result corresponding to the sample needed to decrease the initial concentration of the DPPH radical (IC₅₀) by 50%.

Calculation of IC₅₀

$$Y = - ax + b \quad (\text{Eq.5})$$

Where:

Y = Initial control absorbance/2 (item determining total antioxidant capacity).

x = IC₅₀ (mg/L).

The result (mg/L) found in equation 5 was divided by 1.000 to find the value in g. Then, it was divided by the value found in g DPPH (Eq. 4) in order to obtain the final result (Eq. 6) that is expressed in g sample/g DPPH.

IC₅₀ expressed in g sample/g DPPH:

$$\text{g sample/g DPPH} = (\text{IC}_{50} (\text{mg/L}) / 1.000 * 1) / \text{g DPPH} (\text{Eq.6})$$

2.5 Chemical agent inducing DNA damage

The chemotherapy medication 50 mg doxorubicin (98% purity) was purchased from Sare Drogarias (DXR, Rubidox®, São Paulo, Brazil). It is used as micronuclei inducer in erythrocyte (positive control). The inducer was dissolved in distilled water and administered once intraperitoneally (0.3 mL/animal). The concentration of DXR (15 mg/kg body weight, bw) was determined according to the literature (Franke et al., 2005; Venkatesh et al., 2007; Carneiro et al., 2017).

2.6 Animals and treatments

For the experiments, were used Swiss male mice aged 6-7 weeks, of approximately 25 g of body weight (bw), from the Biothermum of the Multidisciplinary Center for Biological Research in the Laboratory Animal Science Area (Portuguese acronym: CEMIB) of the University of Campinas (UNICAMP, São Paulo). The study was conducted in accordance with internationally accepted protocols for the use and care of laboratory animals. Animals were kept in polypropylene boxes measuring 37x25x16 cm in an experimental room under controlled conditions of temperature ($22\pm 2^{\circ}\text{C}$), humidity ($50\pm 10\%$), 12 hours of light-dark cycle, ad libitum access to feed and water (15 days before the start of experiment for acclimatization). Treatment protocols performed in this study were submitted to the Ethics Committee on Animal Use (Portuguese acronym: CEUA) of the Federal University of Amapá (UNIFAP), and accepted under protocol number 020/2015 - CEUA/UNIFAP, of October 27, 2015.

2.7 Experimental design

Mice were divided into ten experimental groups containing six animals each. The doses of fixed oil of *B. excelsa* for the micronucleus test in mammalian erythrocytes were (500, 1.000 and 2.000 mg/kg bw) for genotoxicity, and (500 + DXR, 1.000 + DXR, and 2.000 + DXR mg/kg bw) for antigenotoxicity, selected according to Guidelines (MacGregor et al., 1980; ANVISA, 2013; OECD 474, 2016), and administered once. Negative control groups (water), positive control groups (DXR 15 mg/kg bw) and two solvent groups (dimethylsulfoxide; DMSO, Sigma-Aldrich, St Louis, MO, USA; 0.085 g/kg bw) DMSO and DMSO + DXR were also included. The different concentrations of *B. excelsa* were prepared from a stock solution of 300 mg of fixed oil and administered by gavage (0.5 mL/animal). The solvent group was treated by gavage (0.5 mL/animal) at the same DMSO concentration used to dissolve the group treated with 2.000 mg/kg bw of *B. excelsa* (200 μL) and DXR (0.3 mL/animal, intraperitoneally, i.p.). Peripheral blood samples were collected 24 and 48 hours after the treatments to make the smears and perform subsequent analysis of the slides (which were fixed for 5 min in methanol and stained for 20 min with giemsa).

A total of 2.000 polychromatic erythrocytes (PCEs) were analyzed by animal in order to determine the frequency of micronucleated polychromatic erythrocytes (MNPCEs). For calculation of the nuclear division index [NDI, $\text{PCE}/(\text{PCE} + \text{NCE})$ (normochromic erythrocyte)] in order to determine the cytotoxicity of experimental groups, were analyzed 400 erythrocytes per animal (Mersch-Sundermann et al., 2004). The slides were blind-encoded and read using a light microscope in objective (40x) for detection of good quality fields. After the field identification, was performed a reading in immersion objective (100x) for visualization of micronuclei.

For the evaluation of antigenotoxicity, the percentage reduction in MNPCE frequency was calculated according to (Waters et al., 1990; Delmanto et al., 2001) by using the following formula:

$$\%Reduction = \frac{A - B}{A - C} \times 100$$

Where **A** - corresponds to the mean value obtained for the treatment with DXR (positive control), **B** – corresponds to the group treated with *B. excelsa* associated to DXR, and **C** – is the group treated with distilled water (negative control).

Data were analyzed statistically by analysis of variance (ANOVA) for completely randomized experiments with calculation of the F statistic and its respective 'p-value'. In cases where $P < 0.05$, the means of treatment were compared by the Tukey method with calculation of the minimum significant difference for $\alpha = 0.05$.

3. RESULT AND DISCUSSION

Nowadays, emphasis has been given to studies on natural products because their chemical composition is rich in biologically active substances, they play an excellent role as functional products, and are effective in the fight against pathologies, mainly in the prevention of chronic degenerative diseases (Haida et al. 2011; Melo et al. 2011).

Despite the intense consumption of plant species in the most diverse forms of extractive processes, such as teas, bottles, oils or patches, little is still described about the toxicology of some species used (Alonso, 2008; Belcavelo et al., 2012). This fact has drawn attention to toxicological studies with the aim of ensuring the use of these products and proving the absence of harmful effects on exposed organisms.

In order to evaluate the antioxidant activity of phenolic compounds in plants, Melo et al. (2006) have evaluated the antioxidant capacity of fifteen vegetables commercialized in the northeast of Brazil by using the β -carotene/linoleic acid method and the DPPH method. All vegetables analyzed showed antioxidant capacity, and these methodologies were used in the present study. Samples exhibiting protective capacity (oxidation inhibition) above 70% are considered as excellent antioxidants; between 50 and 70% are considered moderate antioxidant action; and below 50% is low protective capacity (De Almeida Melo et al., 2008).

In a study with nuts, Oliveira et al. (2018) used hydroethanolic extracts and fractions rich in flavonoids from leaves of *Anacardium occidentale* linn for the evaluation of the DPPH free radical sequestration activity at the selected concentrations of 50, 150 and 250 $\mu\text{g/mL}$, and *A. occidentale* showed antioxidant capacity of 14, 44 and 72%, respectively. Silva and De Carvalho Melo, (2015) analyzed the same activity, but of a substance present in the cashew nutshell liquid (*A. occidentale*), the epicatechin. The results for concentrations at 1; 5; 10; 25; 50 and 100 $\mu\text{g/mL}$ were 33.43, 32.72, 48.72, 54.74 and 60.41%, respectively. Faria et al., (2016) analyzed the jabuticaba (*Myrciaria jabuticaba*), an Amazonian species known for the already reported high antioxidant rate. Two solutions were used in the study, namely, methanolic and hydroalcoholic, and were found results in percentage of oxidation inhibition of 97 and 95%, respectively. The present study evaluated the oxidation protection/inhibition activity of the fixed oil of *B.*

excelsa by the β -carotene/linoleic acid method. The results obtained were 92 and 87% for concentrations of 10.000 and 15.000 ppm (Table 1), respectively, which is an excellent classification by the method. The Total Antioxidant Capacity (TAC) by capturing DPPH free radical of the extracts obtained from the fixed oil of *B. excelsa* was evaluated at the following three concentrations: 50.000, 70.000, and 100.000 ppm. This way, they could react with the DPPH free radical, and results found were 14.53, 25.57 and 40.33% for sequestration of DPPH (Table 2), respectively. They were classified as having low antioxidant capacity, because it was below the recommended level of 50% decrease of the initial DPPH concentration in the conditions of the present study (Figure 1). This demonstrated a low interaction between extracts obtained from the sample with the free radical by indicating a possible interference in the solubilization of the sample. In another study, were analyzed Brazil nut soluble phenolic extracts and the results of IC_{50} for the three extracts obtained (methanolic, ethanolic and acetonic) were excellent, being 0.921 ± 0.050 ; 0.904 ± 0.072 and 0.919 ± 0.048 mg / mL, respectively (John and Shahidi, 2010). In addition, the antioxidant capacity of a compound is directly related to the present bioactive components, the chemical structure and concentrations of these phytochemicals in the analyzed sample (Magalhães et al., 2008; Barreira et al., 2010).

Table 1: Antioxidant activity of the fixed oil of *Bertholletia excelsa* through the β -carotene/linoleic acid method.

Concentration (ppm)	BE fixed oil (%)
10.000	92.00
15.000	87.00

Table 2: Capture of the free radical of the fixed oil of *Bertholletia excelsa* by the DPPH method.

Concentration (ppm)	BE fixed oil (%)
50.000	14.53
70.000	25.57
100.000	40.33

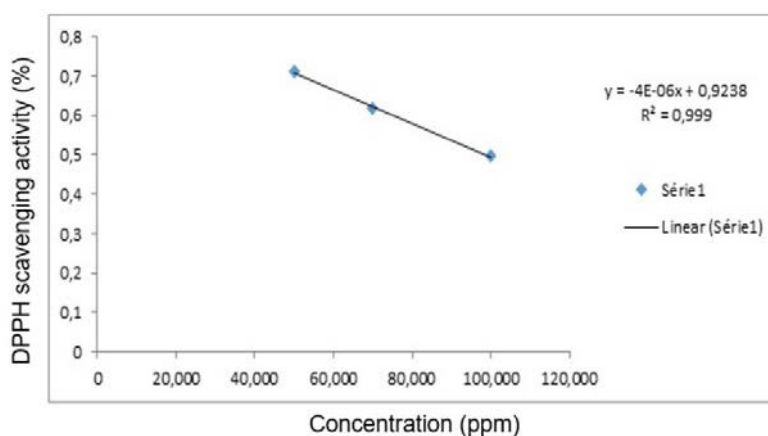


Figure 1: DPPH absorbance at 50.000, 70.000 and 100.000 ppm concentrations.

In the cytogenetic assay, the results obtained for treatments with different concentrations of the fixed oil of *B. excelsa* and/or DXR and their respective controls are shown in Figures 2 and 3. Data showed the differences in the frequencies of MNPCs between the solvent group and the negative control group in peripheral blood samples were not statistically significant. Furthermore, no significant differences were observed in the frequencies of MNPCs between animals treated with the three concentrations of fixed oil *B. excelsa* (500, 1.000 and 2.000 mg/kg bw) compared to the negative control and solvent groups, thus demonstrating the absence of genotoxic effect of *B. excelsa* oil at the concentrations used. As expected, the animals treated with DXR showed high frequency of MNPCs when compared to controls, which is similar to other studies with nuts, such as that of De Araújo et al. (2018). It evaluated the mutagenicity of the *A. occidentale* by using the concentration of 2.000 mg/kg bw of *A. occidentale*, in addition to control groups, negative (deionized water) and positive (cyclophosphamide 50 mg/kg bw). After 24 hours of treatment, peripheral blood was drawn, 2.000 polychromatic erythrocytes were analyzed, and the following results were found: negative control 0.8 ± 0.1 , positive control 9.3 ± 1.4 , and *A. occidentale* 0.8 ± 0.2 , showing no mutagenicity. In a study by Encarnação et al., (2016), were evaluated extracts of *A. occidentale* bark at a concentration of 2.000 mg/kg bw for micronucleus testing. Peripheral blood samples were collected after 48 hours of treatment (negative control, water and positive control cyclophosphamide 50 mg/kg bw), and no genotoxic effect was found.

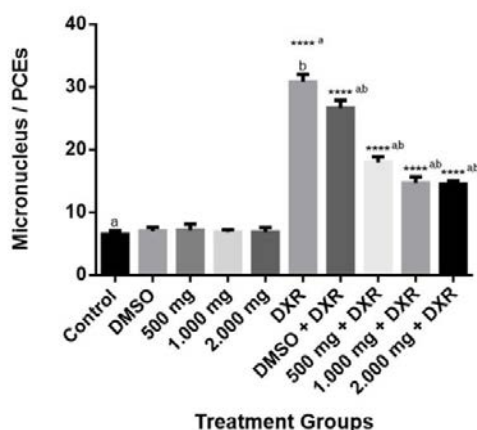


Figure 2: Results of control groups (negative and positive), DMSO and groups treated with different doses of fixed oil of *B. excelsa* after 24h ($P < 0.05$. Groups compared by the Tukey method).

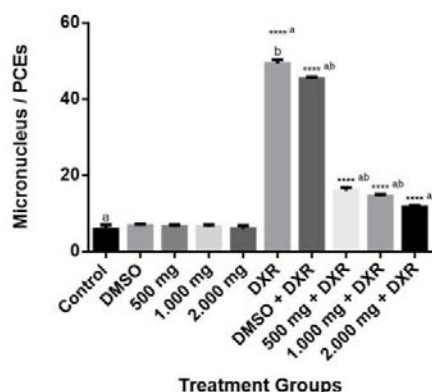


Figure 3: Results of control groups (negative and positive), DMSO and groups treated with different doses of fixed oil of *B. excelsa* after 48h ($P < 0.05$. Groups compared by the Tukey method).

Carvalho et al. (2011) evaluated the genotoxicity of the cashew anacardic acid (*A. occidentale*) by the micronucleus test in bone marrow. Four control groups were used, namely: negative (0.9% saline solution); positive (1 mL/100 g bw of N-methyl-N-nitrosourea, MNU, diluted in 0.9% saline at a concentration of 50 mg/kg bw by intraperitoneal route); test groups with 250 mg/kg bw of anacardic acid dissolved in 100 μ L of cashew nut oil; and the fourth group receiving 100 μ L of cashew nut oil via oral, and no genotoxicity was found in the test groups.

Simultaneous administration of a single oral dose of each concentration of the fixed oil of *B. excelsa* with DXR injection resulted in a significant reduction. The decrease ranged from 52.08 to 67.36% in samples collected after 24h, and from 76.78 to 86.89% in samples collected after 48h (Figures 2 and 3). Tables 3 and 4 show the NDI for all treatment groups at different sampling times. No significant reduction in the percentage of PCEs was observed in relation to the total number of erythrocytes for any of the treatment groups compared to the negative control group, which demonstrates the absence of cytotoxicity in the different treatments in the experimental conditions present in this study. This is in line with the study by De Carvalho Melo-Cavalcante et al., (2011), in which fresh processed cashew juices (*A. occidentale*) were evaluated. The concentration of 0.15 mL/10 g bw was used in the micronucleus test of cashew juice and cajuína (Brazilian beverage made of cashew apples) in Swiss mice. The genotoxicity test showed no genotoxic effect, and a reduction in the micronucleus frequency of 81.81% and 83.11% for cashew juice and cajuína, respectively, when associated with the positive control (50 mg/kg bw cyclophosphamide).

The MNPCE frequency was lower in animals treated with DMSO associated with DXR than in those treated with DXR alone, but there were no statistically significant differences (Tables 3 and 4). The micronucleus test in peripheral blood is satisfactory for the identification of agents capable of inducing or preventing chromosomal damage hence it can be used in mutagenicity and antimutagenicity assays (Grawe, 2005). The results obtained show that fixed oil of *B. excelsa* did not increase the frequency of micronucleated cells (Figure 4). Therefore, the oil of *B. excelsa* did not present genotoxic effect according to the protocols used in the present study.

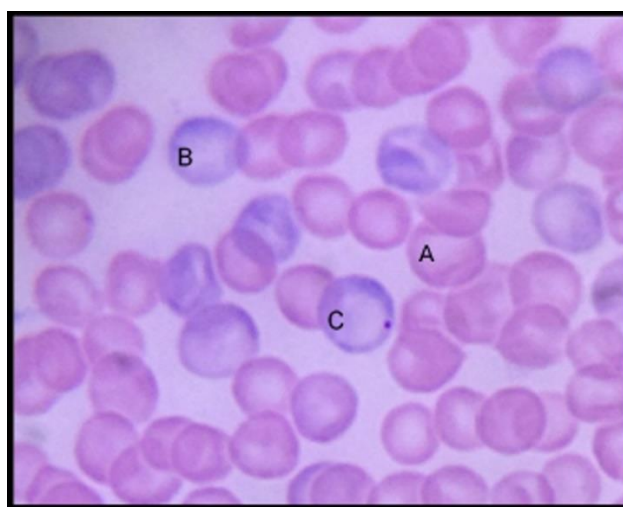


Figure 4: A – Normochromic Erythrocyte (NCE). B – Polychromatic Erythrocyte (PCE).
C – Micronucleated Polychromatic Erythrocyte (MNPCE).

On the other hand, the fixed oil of *B. excelsa* caused a significant reduction in the frequency of DXR-induced MNPCs. The genotoxic activity of the chemotherapeutic agent DXR has been attributed to its ability to produce free radicals (Keizer et al., 1990) that cause different types of cellular damage, including DNA cleavage. The chemical structure of DXR favors the generation of free radicals and the compound can bind to iron and form complexes with DNA, and two-strand breaks are induced (Eliot et al., 1984). The production of free radicals is the main mechanism responsible for their toxicity by resulting in oxidative stress and causing DNA damage, which can be transformed into mutations, and later in the process of carcinogenesis if not repaired (Pan et al., 2008; Monteiro Neto et al., 2011).

The *B. excelsa* oil has a rich chemical composition of lipids, carbohydrates, proteins and selenium. This last compound is found at high levels and responsible for the substance antioxidant activity (Kornsteiner et al., 2006; Santos, 2010), which may have contributed to inhibition of oxidation in the in vivo test. The performance of selenium antioxidant activity is better in association with enzymes such as glutathione peroxidase that is present in the mammalian system (Freitas & Naves, 2010).

Calvo et al. (2002) and Patrick (2004) highlight selenium among the compounds with highest functional recognition. It is considered one of the most important antioxidants, acts on physiological and metabolic changes in the delay or prevention of the organic natural oxidation process. This is corroborated by the study that showed a reduction rate of the micronucleus frequency at the concentrations of the fixed oil of *B. excelsa* used, which were analyzed in 24 and 48 hours (52.08%, 63.88%, 67.36% and 76.78%, 80.46%, 86.89%, respectively). Regarding dose-response, a statistically significant dose-dependent protective effect of the fixed oil of *B. excelsa* administered was observed.

4. CONCLUSION

In conclusion, with use of the β -carotene/linoleic acid method, the fixed oil of *B. excelsa* demonstrated excellent oxidation inhibition activity. For the DPPH method, at the concentrations used, the fixed oil presented below-desirable results that is 50% of DPPH capture, and was classified as having little protective activity.

As for micronucleus testing, the fixed oil of *B. excelsa* did not show a genotoxic effect, but it showed an effective reduction in DXR-induced chromosomal damage in the assay using peripheral blood erythrocytes of Swiss mice. Although the exact mechanism underlying the antigenotoxicity of *B. excelsa* is not fully understood, its oxidation inhibition activity observed in the β -carotene/linoleic acid method may explain its effect on the genotoxicity of DXR. Therefore, the ability of *B. excelsa* for reduction of frequency of DXR-induced MNPCs is an indication of its promising chemopreventive potential.

5. CONFLICT OF INTEREST

The authors state there is no conflict of interest that may be perceived as prejudicial to the impartiality of the reported study.

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Path Planning in Multi-AGVs Using a Modified A-star Algorithm

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Abstract

The problem of path planning is a hot and exclusive research topic on multiple Automatic Guided Vehicles (multi-AGVs) systems. Many research results have been reported, but outrightly solving path planning problem from the perspective of reducing traffic congestion have faced obstacles. A collision-free path planning procedure based on a modified A-star Algorithm for multi-AGVs logistics sorting system is proposed in this paper. AGVs are now a popular way to handle materials in latest smart warehouses. Many researches have been conducted and new technologies are still being developed. There is wide scale research on algorithms to help in scheduling, routing and path planning. Multi-AGVs are used to load goods automatically in a packaging factory. To ensure an effective and safe collision free path planning, this work investigates movement, scheduling and routing, speed manipulation and efficiency of machinery to target positions. The A-star algorithm with grid method to map out a typical warehouse scenario into multiple nodes was used. To have the shortest possible path, for obstacle avoidance, we employed the Braitenberg model. The waiting strategy is used for conflict resolution at intersections.

Key words: AGV, A-star algorithm, collision free, path planning, efficiency, throughput.

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1. Introduction

Automatic Guided Vehicles (AGVs) are effective machines used mainly in factories to run complex transportation of goods. AGVs operate in pathways defined as networks, thus they ensure quick transport of goods around specified confines of the factory. These guided vehicles were introduced in the 1950s for automatic material handling systems. Because they offer material handling, flexibility and efficiency, they have been adopted in many production lines (Gawrilow *et al.* 2008; Henesey *et al.* 2009). To employ their usage, defined routes have to be constructed in the warehouse or factory.

In a packaging factory multi-load AGVs are now increasingly being used so as to minimize human intervention and ensure quick reliable transportation of goods. The use of AGVs greatly reduces cost of production by cutting human labour usually hired for packing and moving of goods. So in line with this, path planning is a great concern, as the goods need to be moved without collision or ineffective use of time.

(Huls *et al.* 2014) described the general system of AGV components consisting of the hardware and software. Functionalities of an AGV system essentially involves task management, measuring, optimization and safety. An abstract interface for the managers and the factory workers which determines how the system should work and what connections there are, complete the system.

Multiple automated guided vehicles are characterized by many objectives and play a major role in the distribution logistics and effective material handling around work stations (Santos *et al.* 2016; Vivaldini *et al.* 2016). A determination of the number of vehicles plays a pivotal role in the management of an AGV system through path planning and constraints monitoring (Ebben, 2001). (Xia and Zheng, 2001) built a new model for an AGV system and studied the minimum number of vehicles approximated by an analytical method based on binary search. Another interesting study was carried out by (Koo *et al.* 2002) to determine AGV fleet size; the waiting time was estimated for various vehicle dispatching nodes to determine the proper AGV fleet size.

1.2 Algorithm Preview

AGVs are intricately integrated systems that require high degree of intelligence to remotely accomplish an entire control of the setup and there still exist various constraints in multi-AGV path planning. Many algorithmic strategies have been developed and implemented in a bid to solve and advance the problems associated path planning and safety in AGV systems. To note, a multi-AGV path planning with double-path constraints by using an improved genetic algorithm was developed by (Han *et al.* 2017) and the acquired results indicated that path distance and the longest single AGV path distance are shortened by using the improved genetic algorithm. (Luo *et al.* 2018) dealt with the problem of collision free path planning using the kinematic model of SIX-DOF serial manipulator constructed by using the Denavit-Hartenberg (D-H) method. The model of obstacles was defined by the axis-aligned boundary box, and the configuration space of harvesting robot was described by combining the obstacle and robot. Their developed approach showed it can effectively plan a collision-free path for the grape harvesting robot in a complex vineyard environment. With the problem of multiple overlapped and adjoining grape clusters, the path planning is still an issue that needs to be solved and requires further research.

(Yuan *et al.* 2016) developed an improved A star algorithm (A*) and yielded encouraging results. This novel method showed improved sorting efficiency of multi-AGVs and relived traffic jam. (Gochev *et al.* 2017) further developed a collision avoidance regime using the A-star algorithm and collision free avoidance method. Each AGV will have its path generated on the factory floor, to the end position the vehicle needs to reach. In the implementation of the A* algorithm, the collision avoidance and obstacles avoidance rules, collisions are restricted. (Yang *et al.* 2016) also used also A* algorithm in conjunction with the unidirectional graph method for path planning of AGV. It effectively solves the problem of conflict of AGV and is highly reliable. But with the use of the unidirectional graph method the operation efficiency of the system is compromised.

In this research work, we seek to investigate a collision free path planning, a very critical aspect in ensuring effective flow of material during production and packaging processes. Three fundamental aspects are involved, i.e., dispatching, scheduling and routing of tasks (simultaneously). We can relate the multi-AGV path planning problem to that of a travelling salesman. It has to locate the shortest time with excessively

large space search. (Smolic- Rocak *et al.* 2010) investigated multi-AGV systems using time windows in vector form to solve the shortest path problem and yielded good results.

However, there still exist various constraints in multi-AGV path planning, that is collision free constraints, time window constraints and time/distance constraints. The optimal path may not be the shortest. But because the A* algorithm is a fast path finder, which can navigate efficaciously in a planar environment, we herein use this algorithm for our investigations in this research paper. To deal effectively with the problem of collision, Braitenberg model and A-star Algorithm have been modelled so that path planning, efficiency and speed become more effective.

2. AGV Efficiency Rules

To plan the path of each AGV in a dynamic environment without properly designed algorithms, collisions, jamming and delays will happen due to the uncoordinated integration of the AGVs working at the same time in a practical operation. Therefore, when designing algorithms, storage environment in relation to its dynamic efficiency should be largely considered (Egbelu, 1984).

2.1 Scheduling

The scheduling of AGVs is to dispatch them to complete a batch of pickup/drop-off jobs to achieve best results (e.g. shortest completion time, minimum AGV idle time, etc.) under given constraints. For instance, one typical scenario is to successfully achieve all the pickup/drop-off jobs under the constraints of priority or deadline. Another typical scenario is to optimize the scheduling so that the total travel time of all vehicles is minimized, or the number of AGVs involved is minimized while the system throughput is as high as possible (Suárez *et al.* 2004). In actual fact, the decision of scheduling might involve selecting a vehicle among several idling vehicles, or selecting one load among all loads to be transported.

2.2 Routing

The aim of routing AGVs is for them to use the shortest possible time path and flexible route for every single job. All routing decisions are divided into three; firstly to detect whether there exists a route which could lead the vehicle from its origin to the destination, secondly the selected route selected must be congestion-free, conflict-free and deadlock-free, thirdly the route must minimize idling runs of vehicles (Weynes, 2005).

2.3 Efficiency

There are two general AGV control systems i.e. centralized and decentralized. The decentralized system gives the AGV system remote assignments which they should accomplish independently using their own communication systems among each other to prevent collisions. Adding more AGVs means overhead communication should also increase. On the other hand, the centralized system gives full control of how the AGV moves, which makes planning and management more easy (Nishi *et al.* 2006). To measure efficiency a lot of information has to be stored, e.g. how much work the AGVs does, in the form of throughput which is the AGV's working time against the time it is stationary. Throughput is the amount of

assignments done by the vehicle in a specified time interval, tracks the metrics related to congestion, notice what causes congestion, frequency, measures how many times an AGV has to wait for another AGV or obstacle (as it is a downside) to the efficiency of the network.

2.4 Collision

Collision is a critical factor to consider when designing an algorithm for an AGV. Normally collisions come when there is no proper laying of routes in a system thereby many accidents maybe seen within a system. To deal with this firstly routes can be divided into zones, allowing one AGV to travel through a zone, which leads to deadlocks and ineffective use of resources. Another solution to prevent collision is to divide the road network into zones (Olmi, 2011). The zone control system allows only one vehicle in a zone at a time. Information is relayed to system before an AGV enters a zone. (Egemin, 2013) created sensors to prevent collision. The first thing is they make the AGV slow down, and if the obstacle hasn't moved the AGV will stop and wait to proceed when the obstacle moves.

3. The Modeling of Warehouse Environment Using Grid Method

The proposed A* algorithm works to find a path from the initial position to the target position in the environment with obstacles. Modelling of the environmental surrounding is the basis of collision-free path planning. In this work, an environmental alert model for AGV work space is established using grid method. Grid environment has the characteristics of good visibility and simple model construction, so the application of this process has reached maturity. The size and quantity of grids are determined by the size of AGV and work space. The grids are demarcated in rectangular coordinate system as shown in Table 1. Grid map method is used for the A* Algorithm. A grid map is a way of environment mapping which is gotten by the discretization of the actual environment (Yang and Wuashan, 2016). In the cell interior, the path is the same, and the path between the adjacent grid and the grid is not continuous.

Table 1. Grid map model of a warehouse set up with 18 Nodes

N14					N5	
N13	N16	N12	N4	N7	N6	
N17			N8	N9	N15	
	N18		N1	N2	N3	
	N10	N11				

Basing on the environmental model, the AGV work process can be given as follows; firstly, the AGV will receive a tasks to carry goods to the allotted sorting area; secondly, goods which had been sorted out are carried to the original location and AGV is allocated another task. However, if there are no other tasks, the AGV will return to the pausing area.

3.1 A-star Algorithm Modification in Path Planning of multi-AGV System

3.1.1 Basic A* Algorithm

An A* algorithm has the capacity to maneuver and calculate the shortest path in real time proficiently and is extensively applicable in practical engineering. The main factors considered for the method to calculate the distance between the current point and the target point includes the actual cost, which is the cost of the path that AGV had taken, and the estimated cost, which is the cost of the path that the AGV will take (Atere and Lehtinen, 2013). The evaluation function form is given as follows:

$$f(n) = g(n) + h(n) \quad (1)$$

where $g(n)$ denotes the actual cost, $h(n)$ is the estimated cost (including empirical data).

The estimated cost is mostly used to explore search direction, which has serious influence on the ultimate search results and efficiency (Guruji *et al.* 2016). The nearer the projected cost is to the actual cost, the faster the convergences speed will be. When the projected cost is below the actual cost, the convergence speed will be slower but the optimal solution can be acquired, on the contrary the convergence speed will be faster but the optimal solution can probably not be obtained.

3.1.2 Modifying the A* Algorithm

The directions of movement for AGVs in a warehouse or factory are due north, due south, due east and due west. We used the Manhattan Distance (MD) to estimate the cost $h(n)$ on the sorting route. Estimating cost according to a given point (x_n, y_n) and the target point (x_{target}, y_{target}) is given as follows:

$$h(n) = |x_n - x_{target}| + |y_n - y_{target}| \quad (2)$$

If the Manhattan Distance is used to estimate cost, the path planning will be limited to a single static AGV (rather than in a dynamic environment), and it can result in traffic jam. To counter this and improve calculation efficiency, at the intersection, re-planning the paths of the AGVs becomes necessary, detecting all feasible paths and adding the penalty value of the paths that AGVs share. The penalty value is dependent on the distance from the AGV and is inversely proportional to the distance. The estimated cost function as follows:

$$h(n) = |x_n - x_{target}| + |y_n - y_{target}| +$$

the other static objects in the environment such as walls, boxes, sensors and conveyor belts. The advantage of the Braitenberg approach is speed is not lost, so the motor speed is modified as in the following equation:

$$V_m = v_m + B_c + \quad (5)$$

where v_m is the motor speed, B_c is the Braitenberg weight coefficient, d is the normalized data from the ultrasonic sensor. The normalization is the function of the minimum safety distance and the maximum detection radius.

3.3 Description of modified A* Algorithm

The A* algorithm is extended from all directions of the starting node. We select the node as $h(n)$ value with respect to the second (target) nodes in all the 18 nodes, and then expand the sequence. The A* algorithm follows path planning with close similarity to reported work (Yang and Cheng, 2016; Yuan *et al.* 2016) which is essentially set up to two lists: one list is called OPEN; the other is closed down list the name being CLOSED. When the node is expanded, the existing obstacles and the existing node direction will not be extended, and stored in the closed list. A modified A* algorithm pseudo code program for computing shortest path and improved AGV throughput is displayed in Fig. 2 below.

Initialize

```
package astaralgorithm;
/**
 *
 * @author munashezhou
 */
import java.util.PriorityQueue;
import java.util.HashSet;
import java.util.Set;
import java.util.List;
import java.util.Comparator;
import java.util.ArrayList;
import java.util.Collections;
public class AStarAlgorithm {
    public static void main(String[] args){
        Node n1 = new Node("Aisle 1",366);
        Node n2 = new Node("Aisle 2",374);
        Node n3 = new Node("Aisle 3",380);
        Node n4 = new Node("Control Room",253);
        Node n5 = new Node("Empty Palletes",390);
        Node n6 = new Node("Store Room 1",193);
        Node n7 = new Node("Store Room 2",198);
        Node n8 = new Node("Aisle 4",340);
```

```

Node n9 = new Node("Aisle 5",320);
Node n10 = new Node("Stuff Offices",240);
Node n11 = new Node("Toilets",232);
Node n12 = new Node("Car Park",160);
Node n13 = new Node("Un/Loading Docks 1",180);
Node n14 = new Node("Dispatch", 200);
Node n15 = new Node("Supervisor Office",328);
Node n16 = new Node("Un/Loading Docks 2",185);
Node n17 = new Node("Lobby 1",170);
Node n18 = new Node("Lobby 2",175);

//initialize the edges
n1.adjacencies = new Edge[]{
    new Edge(n2,75),
    new Edge(n9,140),
    new Edge(n8,118),
    new Edge(n11,115),
};
n2.adjacencies = new Edge[]{
    new Edge(n1,75),
    new Edge(n3,71),
    new Edge(n8,80),
    new Edge(n9,95),
    new Edge(n15,80),
};

```

Fig. 2. Modified A* Algorithm simulation for a typical smart warehouse

3.3.1 Simulation analysis

Table 2. Sorting efficiency between pristine and modified A* algorithm

Run Times (<i>k</i>)	Time (mins)	ASP/s of pristine A* algorithm	ASP/s of modified A* algorithm	% Change
1	60	5.44	5.92	8.82
2	120	5.38	5.76	7.06
3	180	5.32	5.72	7.52
4	240	5.25	5.64	7.43

In the simulation experiment ($k=4$) with the proposed improved A-star algorithm to perform path optimization, the throughput of multi-AGVs path planning is compared to that of the pristine A* algorithm, as shown in Table 2. The average sorting pieces per second (ASP/s) has been provided. The production scene was set with up to 10 AGVs in a predetermined warehouse area, divided into 1×1 grids on an

attained after modification.

4. Conclusion

With smart technology (multi-AGVs) being implemented in factories and warehouses recently, advances in remote intelligence has become a necessary tool to compliment the gap. The traditional algorithm takes more time to fetch all nodes and to calculate the heuristic function values. We present a modified A* algorithmic that plans the AGV network with high safety, built using grid method. The proposed time proficient A* algorithm fetches all nodes but calculates the heuristic function values prior collision, reducing the processing time so that the AGV can perform its work quickly and safely. The paths of AGV are planned from the perspective of relieving traffic jam and avoiding collisions. The Braitenberg model has also been roped into discussion to ensure almost all limitations and hindrances are avoided in the operation of the AGVs in a dynamic environment. The three conflicts that usually arise in the multi-AGV system will be solved by the waiting strategy, the grid method and the Braitenberg model approach.

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Innovation and Staff Turnover in the Food Industry in Sergipe

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Abstract

The high rate of staff turnover has caused concern in the industrial sector, not only for the loss of labor, but also because it directly implies the capacity for innovation, which is essential for the development of companies in a globalized market. Therefore, the objective of this work was to study the relationship between human resource turnover, known as Turnover, and innovation in the Sergipe food industry. A documentary search was carried out in the RAIS, CAGED databases to verify the turnover rate of the industries and a mapping of the patent deposits in the databases of the National Institute of Industrial Property, European Patent Office and World Intellectual Property Organization. When analyzing the average remuneration of the workers, it is noticed that the mineral extractive sector has the highest average remuneration of the state, so it was made the comparison with the food sector, when calculating the turnover rate of both sectors, it was verified that the food industry has a higher than extractive turnover rate. In addition, the Mineral Extractive Industry has a greater number of patent deposits compared to the Food Industry. In this way, it is understood that there is a relation between the turnover rate and the innovation of the sectors, since the Mining Extractive Industry, since it is a sector with higher qualified personnel and with a lower turnover rate, presented a larger quantity of patent deposits in comparison with the Food Industry which presented a higher rate of turnover.

Keywords - Patent Deposits, Innovation, Measurement, Turnover.

1. Introduction

The secondary sector of the economy is formed by companies that are characterized by the intensive use of labor. In these institutions, there has been a growing concern with employee turnover or turnover, since relevant studies on the topic show that high turnover has had an impact on the innovative practices of organizations, directly affecting productivity, profitability and profitability (CHIAVENATO, 2004) .

Employee turnover or turnover, is the phenomenon characterized by the movement in and out of professionals employed in a given period (SILVA, 2006). In the definition of DIEESE (2011, p. 11), “conceptually, turnover represents the replacement of the occupant of a job position by another, that is, dismissal followed by admission, in a specific, individual position, or in several positions , involving several workers ”.

According to one of the main recent studies on the theme - Turnover in the Brazilian labor market - produced by the Inter-Union Department of Statistics and Socioeconomic Studies - DIEESE in partnership

with the Ministry of Labor and Social Security - MTPS, Brazil has high rates of job turnover .

The study points out that in 2014, the global turnover rate of the Brazilian formal labor market, which includes workers in the labor force and statutory workers, was 53.9%. However, if only the employees in the employment category are considered, which is the hiring regime practiced by the private sector, the global turnover rate reaches the rate of 62.8%. The survey also presents a history of the turnover rate in theceletist segment, referring to the years 2003 to 2014, which serves to show that the turnover rate of the Brazilian formal market has always presented high numbers, so that, in this period, an average global turnover found is 59.24% (DIEESE, 2016).

With regard specifically to the manufacturing industry, the area where the present research is located, the study revealed that the global turnover rate is 50.7% (DIEESE, 2016). In the food industry sector, according to data extracted from the Annual List of Social Information - RAIS and in the General Register of Employed and Unemployed - CAGED, the global turnover rate reached, in 2014, the rate of 50.84%, this it is higher than the average rate presented by the sectors that make up the transformation industry (RAIS - CAGED).

To get an idea of the high turnover rate that the numbers of the Brazilian labor market present, a global study carried out by MERCER in 2016, one of the largest and most important Human Resources consulting companies on the planet, pointed out that Europe has an average turnover rate of 7%, the United States 8.1%, Japan 13.23%, India 18.07% and China 19.24% (GUTMANN, 2016).

In the global crisis scenario, between 2011 and 2014, in companies around the world, employee turnover grew significantly or moderately by 38%. In Brazil, in the same period, this phenomenon was observed in 82% of companies, that is, a number almost three times higher than the world average (MELO, 2014).

In this context, Bastos (1993) argues that technological innovations are frustrated or lose their strength if the organization does not have a human capital committed to work and that it finds conditions for self-realization and growth.

Regarding human capital, Bateman and Snell (2009) define it as the knowledge, skills and capacity of employees, which have economic value for the organization. Thus the term human capital, or more broadly intellectual capital, is used to describe the value of the skills and knowledge of employees used for the good of an organization.

Bringing these considerations to the field of innovation, we have, initially, that the Oslo Manual defines innovation as the action of developing new products (goods or services), marketing or organizational processes or methods, as well as promoting significant improvements in products, existing processes or methods, through scientific, technological, organizational, economic-financial and commercial activities (OECD, 2005).

In Brazil, it is important to note that the new regulatory framework for science, technology and innovation (Law 13.243 / 16), enacted on January 11, 2016, conceptualizes innovation as: "introduction of novelty or improvement in the productive and social environment that results in new products , services, processes or that includes the addition of new features or characteristics to an existing product, service or process that can result in improvements and an effective gain in quality or performance ”.

The main database that involves innovation in the country is the Innovation Research (PINTEC), which is carried out by the Brazilian Institute of Geography and Statistics (IBGE), with the support of the Financier

of Studies and Projects - FINEP and the Ministry of Science , Technology, Innovation and Communication. This research, which follows the OECD-predicted innovation references, structures sectoral, national and regional indicators, of innovation activities in companies in the Industry sector, and national indicators of innovation activities in companies in the Electricity and gas and Services, compatible with international recommendations in conceptual and methodological terms (IBGE, 2016).

Within this context, considering that the figures presented by the Ministry of Labor and Employment - MTE indicate that the turnover of employees in the Sergipe food industry reaches high rates. Given this, the present study aims to study the relationship between the turnover of human resources, known as Turnover, and innovation in the food industry in Sergipe.

The high rates of turnover observed in the Sergipe industry and the fact that in Brazil the topic is studied and researched with a greater emphasis on the search for causes and less on the attention dedicated to the knowledge of the repercussions of the phenomenon, justify a thorough study of its consequences. Within the possible consequences, the reflexes provoked in the innovation capacity of organizations, a characteristic considered vital for the survival of companies in an increasingly globalized and competitive world, will be studied.

The increasing numbers of staff turnover have caused concern in organizations, as the loss of qualified labor, in addition to producing high financial costs, considering the dismissal and hiring of a new substitute, has a direct impact on the capacity for innovation (CHIAVENATO, 2004).

Studies on the subject have increasingly shown that innovation is linked to the formation of a common human heritage effectively committed to work, where individuals find conditions for self-realization and growth (BASTOS, 1993). For this reason, good human resources management, which manages to maintain motivation and commitment of employees in organizations, ensures the differentiation and innovation necessary for survival in the competitive world.

Therefore, the relevance of this study is based on the possibility of relating employee turnover to innovative activities developed by companies, in an extremely competitive environment, generating numerous losses, compromising the results of these institutions.

2. Staff Turnover

Initially, it is important to clarify that in the field of human resources science, the word Turnover, has an etymological origin in the combination of the English words "Turn", which means rotation or spin and "over" which means new or beginning. Therefore, in the context of this dissertation, it refers to staff turnover, which will be conceptualized and classified below (MOWDAY; PORTER; STEERS, 2013).

For Anselmi, Anserami and Gomes (1997), turnover of personnel or Turnover is the phenomenon that refers to the entry and exit of personnel in a certain company or sector, that is, the movement that takes place in the labor market, characterized by the entries and exits of individuals from the institution or company that makes up this market.

At this juncture, Chiavenato (2008), when defining and rotating people, adds that this flow refers to the inflows to compensate for the exits of people in the organizations, because, as Silva (2006, apud BEZERRA, 1997) teaches, the rotation is found if closely related to the idea of replacement, replacement

or rotation.

As Ribeiro (2010) prelects, worker turnover only includes movements to replace workers in existing jobs. Thus, analyzing the concepts outlined above, we find in Sarsur; Fleury (2004) the most precise definition on the subject, considering the characteristics of replacement, replacement, rotation and time, the turnover of people is the movement of entry and exit, spontaneous or caused by the company, of its employees, employees, in a certain period .

Chiavenato (1999) draws attention to the fact that staff turnover occurs in two ways: when the decision-making agent is the company, a situation in which its manager makes the decision to dismiss the employee; when the employee leaves the company, he decides to leave the company.

That is why Lucena (1999) classifies staff turnover into two types: the one controlled by the organization and the one controlled by the market.

In the first case, the author explains that the organization is able to retain and motivate the best performing, most qualified professionals with the potential to grow and contribute more effectively to the development of the company. It identifies these employees, monitors their development, gives them career opportunities, with a view to keeping them satisfied, rewarded, recognized, and therefore does not wish to leave the organization. The exits that happen are employees who do not have those characteristics of performance and potential.

Continuing, Lucena (1999) states that the turnover controlled by the market is exactly the opposite: the company loses its best professionals to its competitors and to the market in general, because it does not have policies and criteria to motivate and retain them. Those who do not have the competence to compete in the market remain in the organization.

Morrell, Loan-Clarke and Wilkinson (2001) proposes a classification from the point of view of the object of the study. For him, when the object is the labor market, the research takes place in general in the field of Economic Theory and the causes of Personnel Turnover will be associated with economic and cyclical phenomena.

If the object of study is the individual, this is the field of interest of Psychology, Sociology, Medicine and the causes will be associated with phenomena specifically related to individuals. If the object of study is the organization, it is of particular interest to the Theory of Organizations and the causes will be related to the implementation of policies and administrative models (MORRELL; LOAN-CLARKE; WILKINSON, 2001).

3. Methodology

The highlighted study has a quantitative descriptive research characteristic, since it produced quantitative descriptions about the sectors of the food and beverage and mineral extraction industries in the state of Sergipe.

This research is classified as descriptive, according to Gil (2002), the descriptive research has the objective of describing the characteristics of a given population or phenomenon or establishing relationships between variables.

As far as the research approach is concerned, it is classified as quantitative and Diehl (2004) states that

quantitative research is characterized by the use of quantification, both in the collection and treatment of information, using statistical techniques.

The method of this research was the documentary analysis. The documentary research was carried out on the databases of RAIS, CAGED, National Institute of Industrial Property (INPI) of Brazil, European Patent Office (EPO) and World Intellectual Property Organization (WIPO).

Consultations were carried out in the RAIS database, in order to obtain figures relating to the average remuneration of all economic sectors in the State of Sergipe, relating to the year 2015 and 2016. This search occurred because, the main cause of turnover identified in the market Brazilian workforce is low pay.

From these results, the research was funnelled to the information on the employment stock, average employment stock, education level and average remuneration of employees who perform their activities in the food and beverage sector, which is the main object of analysis of the study, and the mining and quarrying sector, for having presented the highest remuneration average of the economic segments of the State of Sergipe.

To search for job stock data, average remuneration and education level, the RAIS database was used and to consult the average stock the CAGED database was used.

With these numbers in place, the turnover calculation for these sectors for the year 2016 was carried out, using information obtained from the RAIS and CAGED databases, which relate the number of employees admitted and dismissed in 2016 and the employment stock of the employees. years 2015 and 2016, applying the following equation:

$$\text{Equation 02: } \text{TRA} = \text{AD} / \text{MET}$$

Where:

TRA = Annual turnover rate

AD = Minimum number between admitted and dismissed

MET = Average stock of workers up to 12/31 in the current year and the year prior to the reference year

With information on the level of education of employees and the global turnover rate of the sectors of the food and beverage industry, we sought to relate them to innovation, through the criterion of human resources training and the number of patents requested and granted by companies in these sectors.

At this point, a technological mapping of patent deposits was carried out in the databases of the National Institute of Industrial Property (INPI) of Brazil, European Patent Office (EPO) and World Intellectual Property Organization (WIPO) using as search criteria the names of companies in the depositor field. English terms were used in the international databases and Portuguese terms were used in the National database. The research took place from August to January 2018.

Table 1 highlights the mineral extraction industries that have a branch in Sergipe, these were used as a keyword in the depositor field to identify the deposits made by these companies.

Table 1. Search Criteria on the INPI, ESPACENET and WIPO bases for Mineral Extractive Industries.

Keywords	Bases Used		
	INPI	ESPACENET	WIPO
Companhia Vale do Rio Doce	370	519	539
Petrobras	1541	2987	1628
Votorantim	28	19	32
Halliburton	2675	10.000	37.727
Schlumberger	592	10.000	35.811
Fafen e Fabrica and Fertilizantes and Nitrogenados	0	0	0
Nassau e Itaguassu and Agro and Industrial	0	0	0
Indústria Misu	0	0	0

Source: Own authorship (2017)

Table 2 highlights the food and beverage industries that have a branch in Sergipe, these were also used as a keyword in the depositor field to identify the deposits made by these companies.

Table 2. Search criteria in the INPI, ESPACENET and WIPO databases for Industries and Food and Beverage

Keywords	Bases Used		
	INPI	ESPACENET	WIPO
Ambev	8	18	24
Cipa and Industrial	4	4	2
Marata e Jav and Industria and Alimentos	0	0	0
Tropfruit	0	0	0
Laticinio and Santa and Maria	0	0	0
Kapricho and Industria and Alimentos	0	0	0
Sabe and Alimentos	0	0	0
Fabise	0	0	0
Sumo and Industrial	0	0	0

Source: Own authorship (2017)

To interpret the information of interest, an analysis was carried out highlighting the amount of deposits per base analyzed, as well as the temporal evolution of the data found.

4. Results

A survey was carried out in the database of the Ministry of Labor, through the Annual List of Social Information - RAIS, where the stock of jobs, education level and remuneration of the sector of the food and beverage industry and the mineral extraction sector in Sergipe were analyzed. .

The research uses as a starting point the extraction of data that indicate the average remuneration of workers by sector of economic activity in the state of Sergipe, since, for Baltar (1994), studies indicate that the distribution of wages is one of the main causes the turnover of the Brazilian labor market.

In a consultation carried out in the Ministry of Labor's database, through RAIS, the following results were found:

Table 3. Average December Remuneration, in Reais - Sergipe (2015-2016)

Economic Activity Subsector	2015	2016
Mineral Extraction	9.867,64	9.322,89
Non Metallic Mineral Products Industry	1.634,17	1.516,15
Metallurgical Industry	1.687,46	1.814,42
Mechanical Industry	1.822,33	1.423,90
Electrical Equipment And Communications Industry	1.173,00	1.304,89
Transport Material Industry	1.407,05	1.477,41
Wood And Furniture Industry	1.469,88	1.392,09
Paper, Cardboard, Editorial And Graphics Industry	1.670,73	1.598,86
Rubber Industry, Smoke, Leather, Leather, Similar, Various Industries	1.518,50	1.617,08
Pharmaceutical Chemicals, Veterinary Industry	4.212,25	3.643,12
Textile Garment Industry And Fabric Artifacts	1.402,74	1.420,63
Footwear Industry	1.180,08	1.235,27
Food, Beverage And Ethanol Industry	1.541,45	1.556,08
Industrial Public Utility Services	3.574,27	4.495,30
Construction	1.653,14	1.777,67
Retail Business	1.408,26	1.374,38
Wholesale	1.621,74	1.869,95
Credit Institutions, Insurance And Capitalization	5.589,40	5.353,99
Com. And Property Management, Securities	1.626,26	1.654,54
Transport And Communications	1.932,22	1.995,17
Serv. Housing, Food, Repair, Maintenance	1.508,17	1.566,14
Medical, Dental And Veterinary Services	2.132,08	2.559,94
Teaching	3.454,19	3.566,31
Direct And Local Public Administration	3.381,79	3.609,71
Agriculture, Forestry, Livestock	1.132,87	1.111,38
Total	2.361,83	2.458,15

Source: Prepared by the Ministry of Labor database (2017).

In table 3, it can be seen that the average salary of the industrial sector of food products and beverages was,

in the month of December of the years 2015 and 2016, respectively, R\$ 1,541.45 and R\$ 1,556.08, that is, a lowest of all economic sectors in the State of Sergipe. It is important to note that even though it did not show the worst result, its average remuneration was very close to the lowest index presented.

On the other hand, it appears that the highest average remuneration is that of the mining industry, presenting in the month of December of the years 2015 and 2016, respectively, values of R\$ 9,867.64 and R\$ 9,322.89. In view of the initial results presented, the research sought to investigate possible reasons for the discrepancy in the average remuneration of the industrial food sector and the sector that had the best average salary in the State's economic activity, which was that of the mining industry. Afterwards, it was verified whether, in fact, remuneration can influence the rate of labor turnover in these sectors and the repercussion on the level of innovation of these companies.

In Figure 1, the largest number of highly qualified workers are performing work activities in the mineral extraction sector. It is possible to extract from the comparison that, while in the extractive sector there are 1.4% of workers with a Master's degree and 0.2% with a Doctorate, in the food and beverages sector only 0.007% have a Master's degree and there are no employees with the qualification PhD. At the other extreme, it is also found that 1.7% of the total workers in the food sector are illiterate, almost four times the number of illiterates who work in the Mineral Extractive sector, which is 0.5% of the total.

The analysis of the graph shows that the food sector is composed of workers with a low level of education, a finding that is more visible when compared to the analyzed data from the mineral extraction sector, in which professionals with higher qualifications were found, with a low percentage of workers with incomplete elementary school and illiterate.

These data demonstrate the need for companies that make up the food and beverage sector to invest in the qualification of their workers, as the low percentage of qualified people reduces the effective application of investments in R&D and development of new technologies in the sectors.

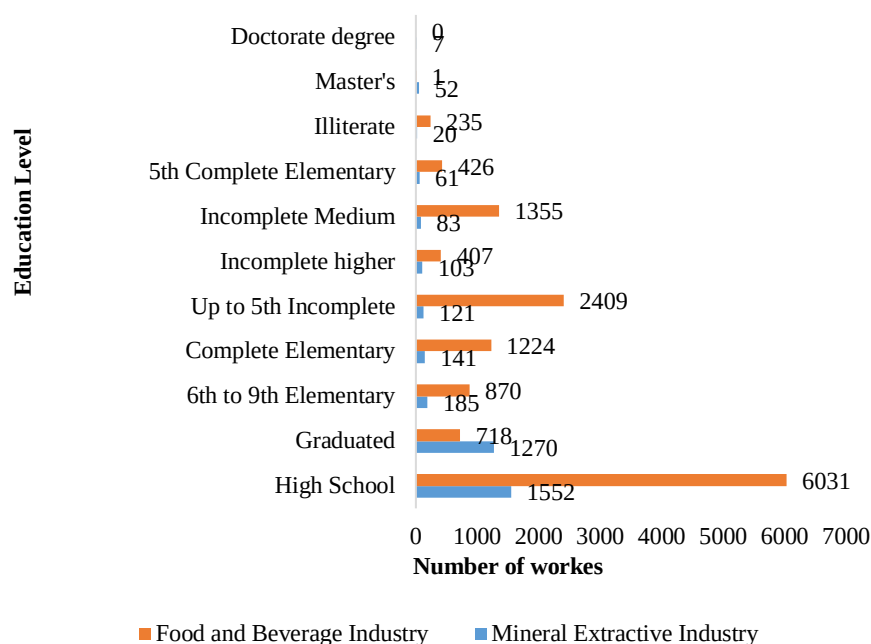


Figure 3. Number of Brazilian technology parks by region.

Source: Adapted from the Ministry of Labor (2017).

Regarding the remuneration of the sectors, it should be noted that the mineral extraction sector presents 15% of the total of its workers with a maximum remuneration range, that is, above 20 minimum wages, whereas in the food sector only 0.1% of its employees receive remuneration at this level. This comparison shows that the mineral extraction sector has a high rate of well-paid professionals, a reality that is very different in the food sector, which has a low percentage of high-paid professionals. This wage inequality indicates repercussions on the qualification of the professionals who work in these sectors, affecting the development of R&D and the production of new technologies in these industries.

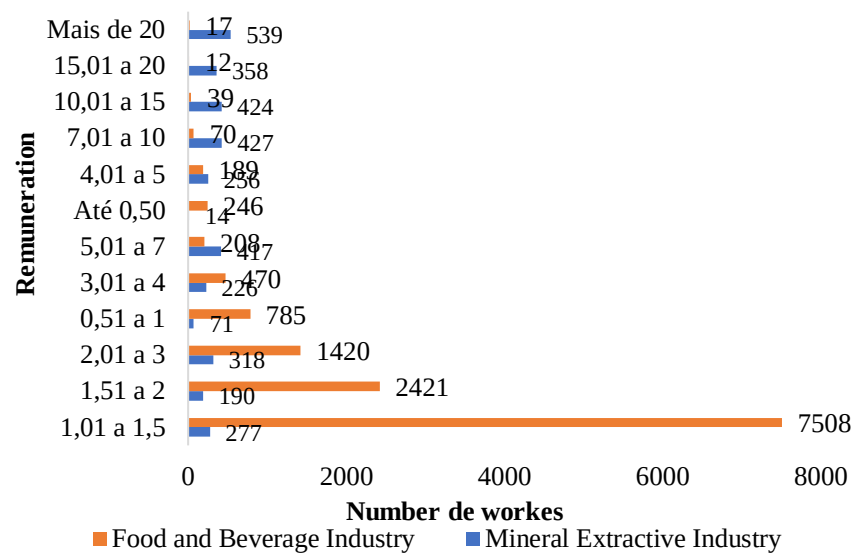


Figure 4. Remuneration of Sectors.

Source: Adapted from the Ministry of Labor (2017).

Thus, the indication that the higher the level of education of workers in the sector, the higher the remuneration average is extracted. These comparative data are important because in future analysis and in conjunction with the global turnover rate, they can indicate the repercussions that are sought in the level of innovation in these sectors.

- Sector Turnover Rate

Being in possession of data that explain the low average remuneration of the sector, it was necessary to verify the repercussion in the labor market turnover rate linked to these sectors.

Thus, from the data collected in RAIS, for calculating the turnover of the year 2016, the number of people admitted to the industrial food sector in 2016 was 6,460 and the number of dismissed workers was 6,908, which can be seen in Table 4.

Table 4. Sector Employment Table - 2016

Sectors	Total admitted	Total Disconnected
Food and Beverage Industry	6.460	6.906
Mineral Extractive Industry	190	312

Source: Own elaboration, based on CAGED data (2017).

For the average stock of the said period, we have that the stock of jobs in 2015 was R \$ 14,054 and in 2016 R \$ 13,676, which can be seen in Table 3.

According to RAIS, in order to calculate the turnover of the mineral extraction sector in 2016, the number of hires in 2016 was 190 and the number of dismissed workers was 312. In order to know the average stock of the said period, we have to the stock of jobs in 2015 was R \$ 4,296 and in 2016, R \$ 3,595.

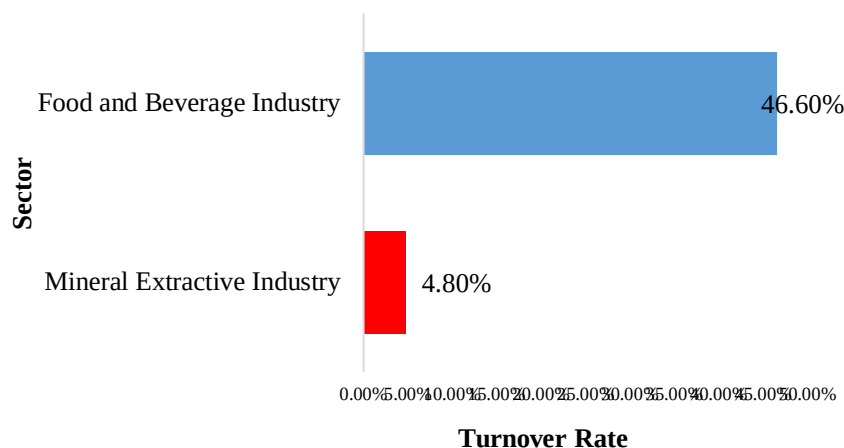
Table 5. Sectors' Employment Stock (2015-2016)

Sectors	2015	2016
Food and Beverage Industry	14.054	13.676
Mineral Extractive Industry	4.296	3.595

Source: Own elaboration, based on CAGED data (2017).

When the data is grouped, the following global turnover figures for these sectors are arrived at, which can be viewed through Figure 3.

Figure 3. Turnover rate by sector - Sergipe (2016)



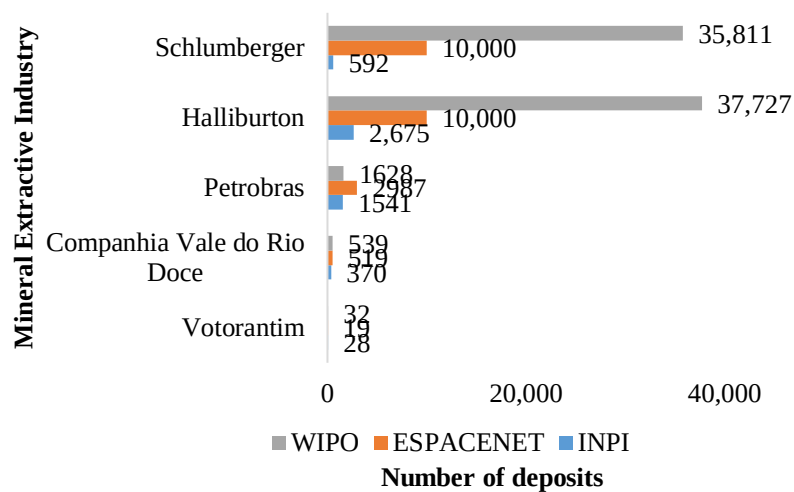
Source: Own elaboration (2017).

It is observed that the global turnover rate presented by the food industry was 46.60%, much higher than the index found in the mining industry, at 4.80%. These figures, when compared to those of countries considered developed or developing, such as Europeans, whose average turnover rate was 7%, the United States 8.1%, Japan 13.23%, India 18.07% and China 19.24%, show that the turnover rate of the food industry under study is very high (GUTMANN, 2016).

- Analysis of data related to INPI, EPO and WIPO databases

After analyzing the data referring to the rate of staff turnover, it was necessary to survey the INPI, EPO and WIPO databases for the number of patent deposits made by the Mining and Food Industries of Sergipe.

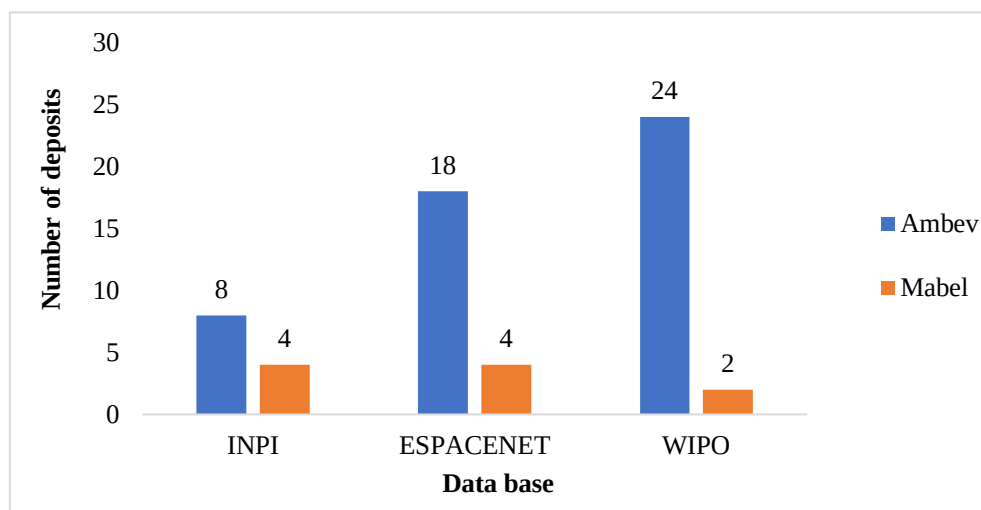
Figure 4. Patent deposits made by Mineral Extractive Industries of Sergipe at INPI, ESPACENET and WIPO bases



Source: Own elaboration (2017).

Figure 4 highlights that Schlumberger and Halliburton had the largest amount of deposits in the analyzed bases, with Halliburton representing 51% of deposits at INPI, 42% at EPO and 50% at WIPO; and Schlumberger represents 30% at INPI, 43% at EPO and 47% at WIPO. The company Votorantim presented the lowest number of patent filings; and the companies Fafen, Itaguassu Agro Industrial and Indústria Misu are not highlighted in this figure since they have not filed any patents, showing that these organizations are not yet seeking the protection of their technologies.

Figure 5. Patent deposits made by Sergipe's Food and Beverage Industries at INPI, ESPACENET and WIPO bases



Source: Own elaboration (2017).

Regarding the deposits made by Food and Beverage Industries, it is observed that Ambev has the largest number of deposits, representing 67% at INPI, 82% at EPO and 92% at WIPO. Mabel represents 33% at INPI, 18% at EPO and 8% at WIPO. However, the companies Marata, Tropfruit, Laticinio Santa Maria,

Kapricho, Sabe Alimentos, Fabise and Sumo Industrial do not appear in Graph 5, as they do not have deposits in the analyzed bases.

5. Conclusion

High staff turnover is a phenomenon that has caused concern in industrial organizations, as, in addition to the loss of qualified labor, it has had a direct impact on the innovation capacity of companies, an essential requirement for the development and survival of these institutions in an increasingly integrated world.

For the present study, it was not enough to just analyze the rate of staff turnover in Sergipe's food industries, it is also necessary to estimate the innovation of these organizations through the analysis of patent filings, as this is one of the most used methods for measuring innovation .

Regarding the average remuneration of workers, a comparison was made between the food and beverage sector, the object of this study, with the mineral extraction sector, as it presented a higher average remuneration in the state of Sergipe. When comparing the data, it was noticed that the mineral extraction sector, in addition to having highly qualified personnel, also has a high number of employees with high salaries, very different from the food sector, which has a large number of people with low qualifications and low wages.

Still, when calculating the turnover rate, it was observed that the Sergipe food sector has a turnover rate approximately ten times higher than the index presented by the mining industry, much higher than the indexes presented by countries considered developed or developing.

In relation to the patent filings made by Indústrias Extrativa Mineral de Sergipe at the bases of INPI, ESPACENET and WIPO, it was noticed that the companies Schlumberger and Halliburton present the highest number of deposits at the bases analyzed, but some companies in Sergipe that operate in the Mineral Extraction sector do not present patent filings. However, it was observed that comparing with the Food and Beverage Industry there are few companies that made deposits, being only Ambev and Mabel, this shows that more investment by these organizations in research and development is still necessary.

Still, it is understood that this differentiation of values in the production of patents is linked to the turnover rate, since when calculating the rate it was realized that the Mineral Extractive Industry has a lower turnover rate and more qualified personnel, consequently implying in the production and patenting of technologies.

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A Study on the Causal Relationship between Spot Price and Futures Price of Crude Oil and Agricultural Products

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Abstract

This paper studies the relationship between the agricultural, energy, and derivatives markets. This study empirically analyzes how the results of previous studies on the Granger causality between oil price and the spot price of agricultural products appear in the futures market by using the Toda and Yamamoto (1995)' causality test. There are two main findings. First, 7 bidirectional causalities and 27 causalities between oil and 6 agricultural products are found, providing strong evidence of a causal relationship. Second, causality is found between oil prices and grain and oilseed type agricultural products, and the spot price of oil has relatively more causalities on agricultural product prices than the futures price of oil. Lastly, testing each period shows that a financial crisis can strengthen the relationship between the agriculture markets and the energy markets

Key words: Granger Causality, Toda-Yamamoto causality test, agricultural derivatives, agricultural products, oil price

1. Introduction

The high-energy consumption of agriculture, and the relationship between agricultural price and energy price since the development of biofuel (Chang and Su, 2010; Zhang et al., 2010) are in the spotlight as important topics in both the agricultural and energy markets. Further, many previous studies have been conducted on agricultural price because of its drastic inflation from 2006 to 2008. Michell (2008) reported that the increase in agricultural production cost caused by the increased production of biofuel, the weakened dollar, and the increased energy price, greatly affected the inflation of agricultural products. Furthermore, Baffes (2007) and Chang and Su (2010) examined the effect of the change in oil price on agricultural price. Some studies support this effect (Busse et al., 2010; Hanson et al., 1993), while others support the neutrality of the agricultural price (Campiche et al., 2007; Nazlioglu and Soytaş, 2011), and no agreement has been reached yet. Accordingly, this study discusses the relationship between agricultural price and oil price as

done by previous studies, but expands the focus on spot price. It examines the relationship between the spot and futures prices of agricultural commodities based on the spot and futures price of oil.

Agricultural products and oil clearly have different regions of production and consumption. The futures market for these commodities has been developed because they are produced in large scale in specific regions. The futures market is one in which profit can be made or hedging can be done by predicting the price of commodities, and price data is the most important part of this market. Despite this, it is surprising that previous studies directly analyzing the results of such relationship are rarely found. Thus, this study empirically analyzes the relationship between the spot and futures prices of several agricultural products and crude oil. The focus of the analysis is testing the causality between the price data of those markets by using the Toda-Yamamoto causality methodology.

This study makes the following contributions by empirically analyzing the relevance of the futures price between oil and agricultural products. First, it expands the scope of previous studies focused on spot price to the futures price. The empirical analysis of the effect of the relevance between agricultural and energy markets (Baffes, 2007; Busse et al., 2010) on futures price can contribute to efficiency of information in the global agricultural futures market. This result can set an important mark on the relationship among the markets, making an academic contribution by expanding the field for future study. Second, the result shows that oil price affects not only spot prices (Harris et al., 2009) but also futures prices of soybean, wheat, sugar, coffee, corn, cotton, and live cattle. This finding supports previous studies by arguing that oil price is related to agricultural price. It also implies that the fluctuation of spot and futures prices of oil can help predict the rate of return for the agricultural futures price. It would contribute to efficiency of information in the futures markets. Third, this result can help the economy of many developing nations where production of agricultural products takes up a large portion of GDP and is the central economic activity. The causality between prices of agricultural products and oil can increase the efficiency of market information and help improve the economic status of developing nations through futures market hedging. Notably, since Korea imports a lot of agricultural products and oil, it needs research to prepare for the price risk.

The primary analysis of this study is about the causality between agricultural and oil futures prices. The Toda-Yamamoto Causality methodology, which supplements the limitations of the Granger Causality, the most widely used method of analyzing causality, is used. The results are as follows. First, bidirectional causality is found between oil spot price and oil futures price. Also, according to AIC and FPE, 7 bidirectional causalities are found, including the spot price of soybean and futures price of oil, the spot prices of soybean and oil, and the spot prices of corn and oil. This is a strong evidence for the relationship between prices of agricultural products and energy. Second, as a result of the Toda-Yamamoto causality test conducted on 72 relationships, oil price has more causalities with grain and oilseed type agricultural products than with food and fiber type agricultural products. Further, spot price of oil is found to have more causalities with agricultural products than futures price of oil does. Lastly, the Toda-Yamamoto causality test is performed on 4 periods: before global financial crisis, during financial crisis, after financial crisis, and during biofuel policy introduction. The largest number of causalities is found during financial crisis, and there is little evidence that the causality between prices of agricultural products and oil is strengthened by the introduction of biofuel policy.

The composition of this paper is as follows. Section 2 (Previous Studies) introduces previous studies on the relationship between agricultural and energy markets, and on detailed price data. Section 3 (Methodology) describes the methodology of Toda and Yamamoto (1995) used for empirical analysis in this study. Section 4 (Empirical Analysis) summarizes the results of the empirical analysis. Lastly, Section 5 (Conclusion) explains the achievements of this study and records its effect on the actual market and on future studies.

2. Previous Studies

Previous studies explain and analyze the relationship between oil price and agricultural price caused by three major factors.

energy or agricultural products. The direction of the two relationships differs according to sub-period. Therefore, the causality between the futures price and spot price of oil and agricultural products cannot be seen as reaching a general agreement, and different results can be obtained from the same samples depending on the period. The results of such previous studies suggest that the causality between the futures price and spot price of agricultural products can be changed by various factors.

3. Methodology

The Granger Causality analysis, created by Granger (1969), is one of the most general methods of testing causality between two variables. However, the Toda-Yamamoto Causality methodology, which follows the procedure used by Alimi and Ofonyelu (2013), has recently been used as a method improved through criticism of previous studies on Granger Causality. Many studies (Baldi et al., 2012; Kwon and Koo, 2009) on agricultural price, including this one, use this methodology.

Granger (1969) created the Granger cause by analyzing causality between two variables. If variable y helps predict another variable x , then y is a Granger cause of x . In his writing, Hamilton (1994) expresses the Granger cause as below:

If Y is not a Granger cause of X ,

(3.1)

This can be expressed by VAR (Vector Auto Regression) as below:

(3.2)

Here, if Y is not a Granger cause of X , all β_{ij} must be 0. In other words, the null hypothesis (H_0) is that all β_{ij} are equal to 0. When H_0 is rejected, Y becomes a Granger cause of X . This means that past values of Y help explain the current value of X , and Y helps predict X . Such a relationship is referred to as a Granger cause. However, the Granger Causality test has been criticized (Christiano and Ljungqvist, 1988; Feige and Pearce, 1979; Stock and Watson, 1990) by methodologies involving past time difference (Gujarati, 1995) and non-stationary time series data (Maddala, 2001) for high sensitivity.

Toda and Yamamoto (1995)'s method can draw a useful prediction value even if the VAR system is not cointegrated. Toda and Yamamoto (1995) proposed an interesting yet simple procedure requiring the estimation of an augmented VAR, which guarantees the asymptotic distribution of the Wald statistic, since the testing procedure is robust to the integration and cointegration properties of the process. (Alimi and Ofonyelu, 2013, pp.131)

The analytical procedure of this paper, based on Alimi and Ofonyelu (2013), is as follows:

) The causality analysis model is formed using the Toda-Yamamoto methodology.

) The order of integration and the optimum time difference are found for the Toda-Yamamoto causality analysis.

) The significance of the Toda-Yamamoto model is verified by the Wald test.

In addition, the primary model used in the empirical analysis of this study is expressed in Eq. (3.3) below, which shows whether individual agricultural futures price at time t can be explained by oil prices before time t . The null hypothesis () is that all $\delta_{i,t}$ are equal to 0, and agricultural futures price at time t cannot be explained by past oil price data. However, if this null hypothesis is rejected, oil price, or oil futures price, can be regarded as a Granger cause of agricultural price samples selected in this study. In order to analyze the model of Eq. (3.3), it is necessary to find the order of integration () and the optimum time difference (m), and the unit root test and information criteria are used to do so. Variables used in (3.3) become the VAR model in vector form.

(3.3)

where X = agriculture commodities price return, c = soybean futures price, soybean spot price, wheat futures price, wheat spot price, sugar futures price, sugar spot price, coffee futures price, coffee spot price, corn futures price, corn spot price, cotton futures price, cotton spot price, live cattle futures price, and live cattle spot price return, w = constant, Y = oil price, j = crude oil spot price return, crude oil futures price return, ϵ_t = error

3.2.1 Stationary test in time series

The causality methodology of Toda-Yamamoto must first determine whether the time series data is stationary in order to avoid the criticism that Ganger Causality is sensitive to the stationarity of time series. When the time series data cannot satisfy stationarity, the order of integration () is used to resolve this problem. Here, refers to the minimum difference required for non-stationary time series data to become stationary.

Many previous studies used the unit test to stationarity, and this study does the same. As done by Alimi and Ofonyelu (2013), Augmented dickey-Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) are used as detailed test methods. ADF tests unit root, and KPSS tests stationary hypothesis. Therefore, if the null hypothesis of ADF is rejected, it means that the unit root of the time series data is larger than 1. This data is statistically non-stationary. On the contrary, if the null hypothesis of KPSS is rejected, the time series data is statistically non-stationary. Alimi and Ofonyelu (2013) introduced this joint test as the “confirmatory analysis.”

If the analysis shows that the time series data is non-stationary with statistical significance, it can be differentiated to find the time difference at which it first becomes stationary. The stationarity of the differentiated time series data is also tested using ADF and KPSS.

3.2.2 Optimum time difference test

The Granger Causality test was criticized (Gujarati, 1995) for its sensitivity to time difference (p) and, using information criteria, Alimi and Ofonyelu (2013) found the optimum time difference () that can

best reflect samples used in the model. This study uses 4 criteria called AIC (Akaike Information Criterion), SC(Schwarz Information Criterion), FPE(Final Prediction Error), and HQ(Hannan-Quinn). There are differences in each information criterion, but no specific one can be regarded as superior to others. All 4 criteria are used in our study. An information criterion based on the information theory is used to find an appropriate model by relatively evaluating statistical models from given data. This study uses the information criterion to find the most appropriate time difference for each commodity group. Models used in this study can have 8 models, as expressed in Eq. (3.3) above, with spot and futures prices of oil, and spot and futures prices of 7 agricultural products. However, since the causality between spot and futures prices of the same commodity is also analyzed, there are 36 models for the relationship between two price data. Since 36 relationships have directions of causality, we try to find 72 causalities. Our study involves causality analysis on the overall period, as well as before global financial crisis, during financial crisis, after financial crisis, and upon biofuel policy introduction. The same Toda-Yamamoto causality test is used for each period. Detailed analysis is provided for the overall period, and only causality results are presented for the sub-periods.

Therefore, 36 relational expressions are observed in this study, and it is necessary to find the most appropriate time difference for data given by each of the 36 models. The model of Eq. (3.3) is tested under AIC, SC, FPE, HQ, and order of integration. And the causality is examined using the Wald test. If the null hypothesis is rejected in the Wald test, and of Eq. (3.3) is found to be not equal to 0 with statistical significance, it can be said that Y is a Granger causality of X, or X is a Granger causality of Y. Thus, the final result of this study seeks to determine whether the relationships show Granger causality.

4. Empirical Analysis

Among various agricultural products, 7 of them are selected as sample products in our study. The samples for our study were selected to include soybean, wheat, sugar, coffee, corn, cotton, and live cattle. Price data consists of the futures price and spot price of oil(OIF, OIS), soybean(SBF, SBS), wheat(WEF, WES), sugar(SGF, SGS), coffee(CFF, CFS), corn(CRF, CRS), cotton(CTF, CTS), and live cattle (CLF, CLS), provided by Bloomberg. Daily closing prices of each commodity, transacted at each exchange from January 2, 2003 to March 10, 2015, are adopted. However, there is a difficulty in historically tracing the futures price of a commodity because there are many futures commodities with different expiration dates for the same commodity. Bloomberg offers generic tickers as a solution to this. Generic tickers combine futures prices that cling according to each monthly expiration date. Crude oil and agricultural futures prices used in this study can cling to different periods because each commodity has a different expiration date, but this does not present a serious problem in the selection of samples, because the aim of our study is to analyze whether there is a causality between changing prices of oil and agricultural products. In addition, dates of different price data do not accurately agree, but omission of less than 50 data for each commodity is not a serious issue since time series data are selected from a long sampling period of over 12 years. Table 1 summarizes basic statistics for each price data.

Table 1. Basic statistics on each commodity price

	Minimum	Maximum	Mean	Standard Deviation	Skewness	Kurtosis
OIF	25.2	145	73.9	24.95	-0.061	-0.749
OIS	24.7	147	74.8	24.79	-0.22	-0.518
SBF	499.5	1771	1017	332.4	0.08	-1.24
SBS	426	3850	1065.9	618.77	1.192	0.779
WEF	275.5	1280	556.48	186.79	0.42	-0.45
WES	1080	2640	1877.6	443.23	0.173	-1.023
SGF	5.36	35.31	15.31	6.56	0.62	-0.33
SGS	2.1	8.97	5.186	1.68	0.201	-1.044
CFF	55.5	304.9	135.7	51.58	0.87	0.5
CFS	40.5	294.75	126.06	51.12	0.907	0.698
CRF	186.25	831.25	418.78	173.83	0.55	-0.87
CRS	1.0	8.0	4.11	1.751	0.44	0.953
CTF	39.14	215.15	72.06	28.17	2.36	6.91
CTS	104.25	401.78	163.1	49.75	2.033	6.124
CLF	44.53	133.88	74.51	16.35	0.86	0.99
CLS	72.84	171.76	99.93	22.73	1.346	0.953

Table 1 summarizes basic statistics for each commodity price, and the price of each commodity refers to the daily closing price announced by each exchange. Moreover, the sampling period is from January 2, 2003 to March 13, 2013. Price data are oil futures price (OIF), oil spot price (OIS), soybean futures price (SBF), soybean spot price (SBS), wheat futures price (WEF), wheat spot price (WES), sugar futures price (SGF), sugar spot price (SGS), coffee futures price (CFF), coffee spot price (CFS), corn futures price (CRF), corn spot price (CRS), cotton futures price (CTF), cotton spot price (CTS), live cattle futures price (CLF), and live cattle spot price (CLS).

The basic statistics for each price data can be found in Table 1. A large difference between the mean spot price and futures price is seen because the basic units of the two prices are different, and the Bloomberg generic tickers for futures prices are provided by combining the various subordinate transactions of a commodity. Moreover, in the standard deviation and absolute values of kurtosis and skewness, the spot price of cotton is highest.

This study aims to empirically analyze whether the spot price and futures price of crude oil have Granger Causality with those of 7 agricultural commodities. Granger (1969) proposed that a variable is a Granger cause of another variable if its change explains the change in the other variable. This relationship is one of the most widely used methodologies to analyze causality among time series data. However, Granger's methodology has been receiving various criticisms, and Toda and Yamamoto (1995) reported that the

problem can be overcome by using order of integration () and optimum time difference (m). Therefore, this study uses the Toda-Yamamoto Granger Causality methodology in order to analyze causality among the commodities of the two markets. This requires order of integration () and optimum time difference (m).

To find order of integration () with the Toda-Yamamoto Granger Causality methodology, Alimi and Ofonyelu (2013) used Augmented Dickey-Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS). These analysis methods test the stationarity of the time series data, which can be found by the minimum difference that satisfies it. The results of this empirical analysis are summarized in Appendix 1. In the results, all daily returns are stationary. Therefore, it is not necessary to find the minimum difference that satisfies stationarity to find the order of integration (). Since all variables satisfy stationarity, the of all variables used in the test becomes 0. The results showing time serial stationarity of daily returns for all samples of our study are excessively good. However, Baldi et al. (2012), who studied the relationship between agricultural spot price and futures price, also analyzed the stationarity of time series using the ADF-GLS and ZA (Zivot and Andrews, 1992) methods. All of their results satisfied stationarity after the first differentiation. Unlike Baldi et al. (2012), rate of return data is used in this study, but the prices of the samples in this paper satisfy stationarity after the first difference when the ADF and KPSS tests are completed. Such time serial characteristics can be another topic of study.

For the Toda-Yamamoto Granger Causality, the optimum time difference (m) needs to be found in addition to , using the information criterion. As done by Alimi and Ofonyelu (2013), this paper uses 4 criteria: AIC, SC, FPE, and HQ. The information criterion based on information theory is used to find the most appropriate model by relatively evaluating statistical models in the given data. Accordingly, time differences of models for each commodity are configured, up to 10, and the most appropriate time difference for the given data is found based on the 4 criteria. The empirical analysis results are presented in Appendix 2. In the test results, the same time difference is shown by AIC and HQ for each relationship. On the contrary, SC and FPE show the same time difference for some relationships, but not for others. The appropriate time difference presented by each test method is used to perform the Granger causality analysis. Therefore, the VAR() model that combines the appropriate time difference for each relationship and order of integration () is shown in Table 2 below.

Table 2. Values of		and	determined for each relationship	
		d_{max}	m	$d_{max} + m$
OIF	OIS	0	10	10
OIF	SBS	0	1,7	1,7
OIF	SBF	0	1,2	1,2
OIF	WES	0	1	1
OIF	WEF	0	1	1
OIF	SGS	0	5,8,10	5,8,10
OIF	SGF	0	1	1

OIF	CFS	0	1,	1,2
OIF	CFF	0	1	1
OIF	CRS	0	1	1
OIF	CRF	0	1	1
OIS	CTS	0	3,6,8	3,6,8
OIS	CTF	0	1	1
OIS	CLS	0	1,7	1,7
OIS	CLF	0	1	1
OIS	SBS	0	1,8	1,8
OIS	SBF	0	1,5,8	1,5,8
OIS	WES	0	1	1
OIS	WEF	0	1,7,9	1,7,9
OIS	SGS	0	6,7,10	6,7,10
OIS	SGF	0	1,6,7	1,6,7
OIS	CFS	0	1,6	1,6
OIS	CFF	0	1,7	1,7
OIS	CRS	0	1,6	1,6
OIS	CRF	0	1,5,7	1,5,7
OIS	CTS	0	3,7,10	3,7,10
OIS	CTF	0	1,9	1,9
OIS	CLS	0	1,4,8	1,4,8
OIS	CLF	0	1,7	1,7
SBS	SBF	0	1	1
WES	WEF	0	1,7	1,7
SGS	SGF	0	5,7,10	5,7,10
CFS	CFF	0	2,3	2,3
CRS	CRF	0	1,3	1,3
CTS	CTF	0	4,8	4,8
CLS	CLF	0	1,6	1,6

Table 2 shows the final time difference needed for the Toda-Yamamoto causality test. Since rates of return for the two products have different time differences, the final time difference is different for each relationship. Moreover, the final time difference represents the sum of the order of integration and optimal

time difference according to the method of Alimi and Ofonyelu(2013).

The results above present and m for the Toda-Yamamoto Granger Causality analysis based on Alimi and Ofonyelu's (2013) procedure. In the table, the final VAR models to be used for oil futures price and oil spot price are VAR(10). Likewise, the VAR models for soybean spot price and soybean futures price are VAR(1) and VAR(7), respectively. The results of this study can become more robust if appropriate time differences under the 4 criteria yield similar analysis results in regards to causality.

In this paper, the Wald test is performed to test the Toda-Yamamoto Granger Causality based on the results above. The results are presented in Table III. From the Wald test, bidirectional causality is found between oil spot price return and oil futures price return at a significance level of 1%. This relationship is also observed between soybean spot price and oil futures price, soybean spot price and oil spot price, soybean futures price and oil spot price, wheat futures price and oil spot price, corn spot price and oil spot price, corn futures price and oil spot price, and cotton futures price and oil futures price, according to the appropriate time difference presented by AIC and HPE. Moreover, the oil price return is verified as a Granger cause of futures price return and of spot price return of agricultural products. The results from the 4 information criteria (AIC, SC, HQ and FPE) are relatively consistent. AIC and FPE show the same results at a 5% significance level, returning 27 causalities, while HQ and SC show 18 and 17 causalities, respectively. The difference becomes smaller at the 10% significance level. The results can be described as below based on AIC, the most widely used method, and FPE, which shows the same results as AIC. Mostly, oil has greater influence on agricultural products than agricultural products do on oil. Among 27 causalities, 18 causalities involve rates of return for oil futures price and spot price. This supports the argument that fluctuation in energy price can explain the price fluctuation of agricultural products. In the detailed results, there is no causality that shows significance at the 5% level among the 10 relationships related to live cattle. Moreover, oil is a much clear causality of agricultural products of grain and oilseed types (soybean, wheat, and corn) compared to food and fiber types (coffee, cotton, and sugar). The overall test results are briefly shown in Figure 4, where the matters described above can be easily observed.

Table 3. Results of Toda-Yamamoto Granger Causality

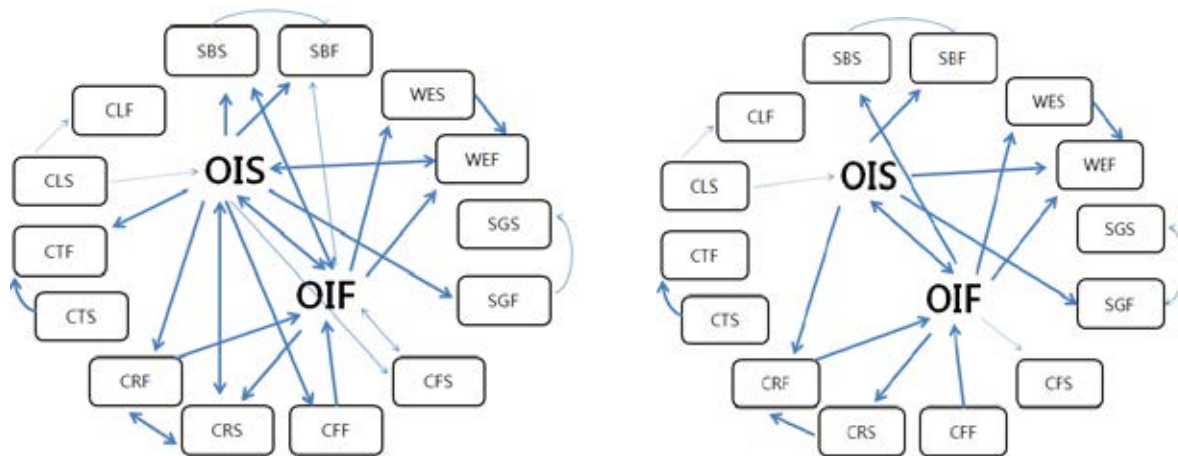
Cause relationship	HQ	AIC, FPE	SC
	1011.7***	1011.7***	1011.7***
	32.0***	32.0***	32.0***
	1.2	20.4***	1.2
	7.7***	17.8***	7.7***
	0.0012	0.73	0.0012
	1.6	5.9**	1.6
	1.2	20.3***	1.2
	7.7***	17.8***	7.7***
	5.3	10.9	0.85
	32.0***	63.5***	0.65

3.7**	3.7**	3.7**
2.2	2.2	2.2
0.029	0.029	0.029
6.3***	6.3***	6.3***
0.026	0.026	0.026
10.8***	10.8***	10.8***
0.57	0.57	0.57
0.18	0.18	0.18
3.5	14.9*	0.031
50.1***	51.3***	0.32
0.33	10.2	0.33
32.9***	41.1***	32.9***
3.7	4.6	1,9
7	7.5	2,7
1.1	1.1	1.1
1.3	1.3	1.3
1.8	3.7	1.4
3.9	8.2	2.2
4.2	5.2	0.021
51.4***	57.2***	3.6*
10.7*	13.1	6.9
16.1**	19.1**	7.8*
3.3	3.2*	3.3
3.6*	4.8**	3.6*
8.5***	8.5***	8.5***
0.0032	0.0032	0.0032
0.59	3.9	0.59
0.016	14.6**	0.016
0.18	4.3	0.18
0.002	32.1***	0.002
2.3	2.3	3.2*
3.9	3.9	4.8**
1.3	1.3	1.3
9.5***	9.5***	9.5***
8.5***	8.5***	8.5***
0.0032	0.0032	0.0032
0.58	18.6***	0.58
0.69	18.5***	0.69
2.6	5.7	0.046
28.4***	65.6***	0.094

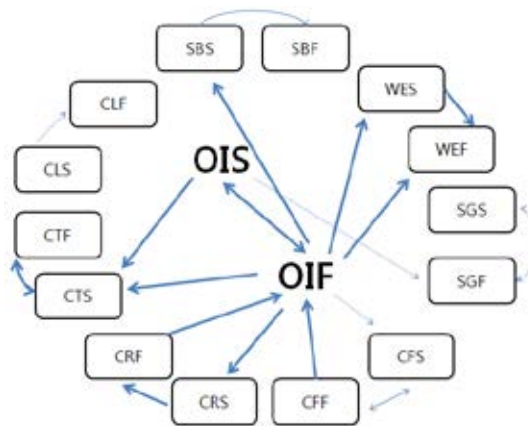
6.4***	6.8**	6.4***
0.12	5.7*	0.12
5.9	6.8	3.8
2.3	3.1	553.3***
1.1	1.1	1.1
1.2	1.2	1.2
1.8	3.3	0.94
4.3	6.2	553.6***
0.12	6.7	0.12
0.65	37.9***	0.65
10.2	10.2	8.5**
36.9***	36.9***	25.6***
0.14	4.8	0.14
0.17	7.8	0.17
0.031	0.87	0.87
0.96	0.97	0.97

Table 3 shows the results of the Wald test on the models used in this paper, and the significance of these results represents Granger causality according to the methodology of Toda-Yamamoto. The numbers below each information criterion refer to chi-squared values and significance levels. Also, AIC and FPE are combined into a single category, as they show the same time difference. All causal relationships are tested. *** means the null hypothesis is rejected at a significance level of 1%, ** at 5%, and * at 10%. The null hypothesis states that fluctuation of the explanatory variable does not explain fluctuation of the dependent variable, and is introduced in Eq. (3.3). In addition, daily return data are indicated as follows: oil futures return (OIF), oil spot return (OIS), soybean futures return(SBF), soybean spot return(SBS), wheat futures return(WEF), wheat spot return(WES), sugar futures return(SGF), sugar spot return(SGS), coffee futures return(CFF), coffee spot return(CFS), corn futures return(CRF), corn spot return(CRS), cotton futures return(CTF), cotton spot return(CTS), live cattle futures return(CLF), and live cattle spot return(CLS).

Figure 1 expresses the results of analyzing Granger causality according to the Toda-Yamamoto methodology. Dark arrows in the figure represent Granger causality, and bidirectional arrows refer to bidirectional Granger causality. Bold arrows show statistical significance at the 1% significance level, thin arrows at 5%, and dotted line arrows at 10%.



[Panel A] Information criterion: AIC, FPE [Panel B] Information criterion: HQ



[Panel C] Information criterion: SC

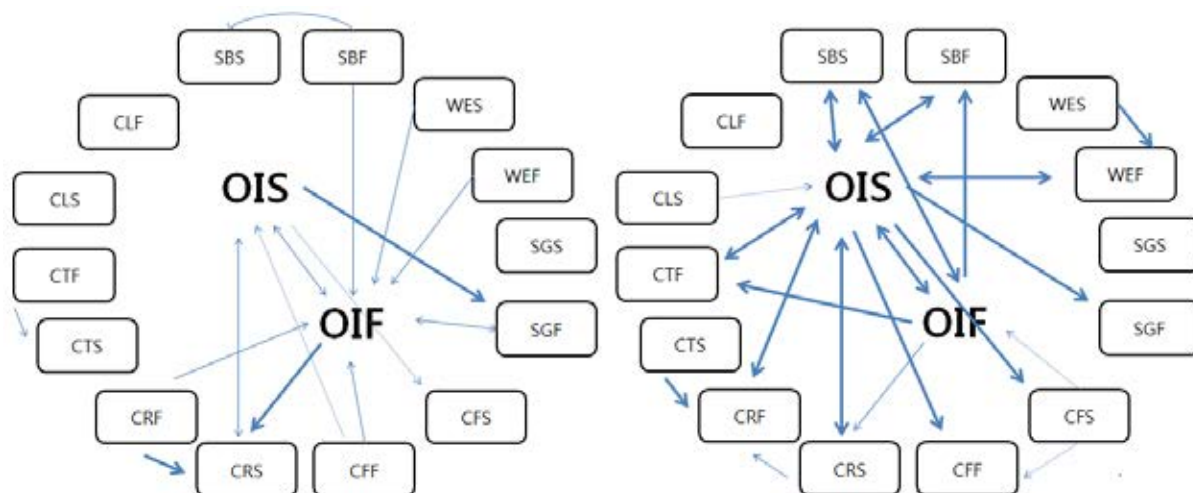
Figure 1. Results of causality test

Figure 1 shows the results of the causality test performed using the Toda-Yamamoto methodology. Based on these results, the spot price and futures price of crude oil show bidirectional Granger causality for all criteria. This means that the two prices cause fluctuation of each other equally. Similarly, soybean and corn spot prices and wheat futures price show bidirectional Granger causality for AIC and FPE criteria. The causality test on futures and spot price returns of agricultural products shows bidirectional causality between futures and spot prices of cotton according to the SC criterion. Based on AIC and FPE, bidirectional causality is shown in corn. None of the criteria shows bidirectional causality between any other agricultural products. In regards to the relationship between spot price and futures price in the agricultural market, Hernandez and Torero (2010) found through the causality test that the change in spot price lead by futures price is stronger than the opposite. On the other hand, Baldi et al. (2012) found that this relationship tends to break when there is an event that affects demand or supply of energy or agricultural product, and the direction of the two relationships differs according to sub-period. Therefore, causality between spot price and futures price of agricultural products cannot be seen as reaching an agreement. Summarizing the results of previous studies and this study, there is no unilateral relationship between spot price and futures price of agricultural products, and the relationship can differ for different commodities. In fact, such discordance also appeared in a study on the oil futures market. Bekiros and Diks (2008) found that the rates of return for spot and futures prices of oil are asymmetric and statistically significant higher

order moment. They argued that the bidirectional relationship of lead and lag could change with time. Except for live cattle, causality between oil and agricultural products is found in almost all relationships, though with different significance. This means that the spot and futures prices of oil affect the spot and futures prices of agricultural products. Moreover, in the significance and causality results of the test on the VAR models for the 4 criteria, both spot and futures price returns of oil show many causalities with spot and futures price returns of grain and oilseed type agricultural products. For food and fiber types, spot price of oil has more causalities. Further, in Panel A of Figure 4, the spot price of oil has many arrows pointed at agricultural products, but the futures price has relatively more arrows pointed from agricultural products to oil. Therefore, it is probable that the prices of agricultural products respond more sensitively to the spot price of oil. This can be further experimented in a future study.

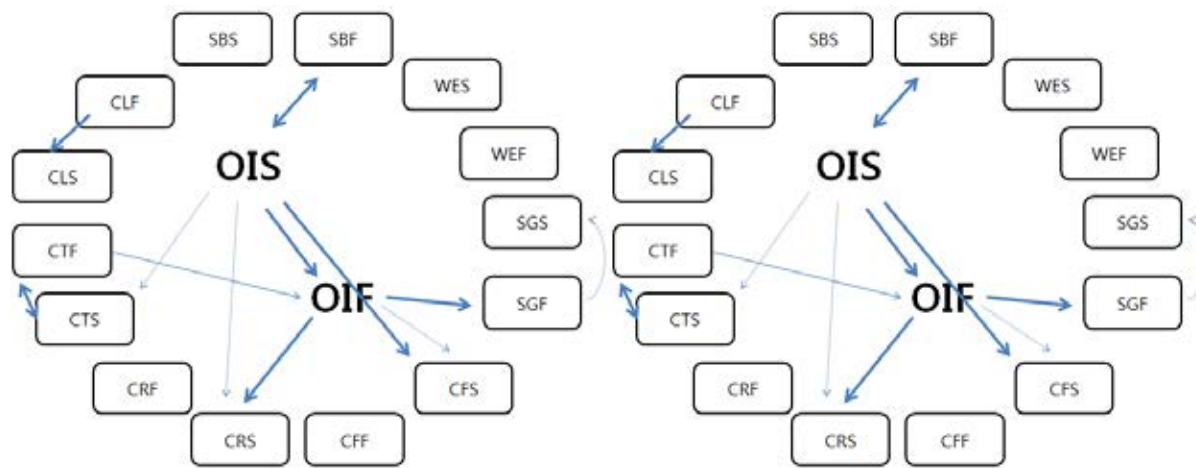
Lastly, causality is analyzed during 4 sub-periods using the Toda-Yamamoto method. Silvennoinen and Thorp(2016) tested conditional correlation during the period in which price levels of agricultural products changed, the period of change in energy policy, and the time of financial crisis. As a result, they reported an increase of correlation according to the energy policy and price level of agricultural products. In our study, sample periods are divided into the following: before financial crisis (2003-2006), during financial crisis (2007-2008), after financial crisis (2009-2015), and during biofuel policy introduction (2005-2007). Figure 2 illustrates the causality relation.

Figure 2 expresses the results of analyzing Granger causality according to the Toda-Yamamoto methodology (for each sub-period). Bold arrows represent Granger causality, and bidirectional arrows refer to bidirectional Granger causality. Bold arrows show statistical significance at the 1% significance level, thin arrows at 5%, and dotted line arrows at 10%.



[Panel A] Before financial crisis(2003-2006)

[Panel B] financial crisis(2007-2008)



[Panel C] After financial crisis(2003-2006) [Panel D] Biofuel policy introduction (2005-2007)

Figure 2. Results of causality test

The Toda-Yamamoto causality test results for each sub-period can be found in Figure 2. Since relationships between different products are described in detail in the section about the overall period, differences between periods can be described as follows. Thirteen causalities are found before the financial crisis, 25 during the financial crisis, 10 after the financial crisis, and 15 during the change of biofuel policy. Thus, the clearest causality between agricultural products and oil is shown during the financial crisis. At 5% significance level, no bidirectional causality is found, except between corn spot price and corn futures price during the change of biofuel policy. However, bidirectional causality is shown during the financial crisis between oil futures price and spot price, soybean spot price and oil futures price, soybean spot price and oil spot price, wheat futures price and oil spot price, corn spot price and oil spot price, corn futures price and oil spot price, and cotton futures price and oil futures price. This means that correlation between agricultural products and oil has been greatly increased. Centered on the financial crisis, causalities are rarely found with a specific period. Likewise for the overall sampling period, the number of causalities is shown in the order of grain and oilseed types, food and fiber types, and live cattle. Soybean and wheat only show relationships before the financial crisis (soybean futures to soybean spot, wheat futures to oil futures, wheat spot to oil futures), and no significance is found afterwards. Contrary to the results of Silvennoinen and Thorp(2016), our results show that the financial crisis stands out in the relationship between agricultural products and oil, compared to the change of biofuel policy. Of course, Silvennoinen and Thorp(2016) only presented a gradual increase of correlation with the change of biofuel policy in 2005-2007, and did not specify the years. Our results show a decrease of causality since 2009, after the financial crisis. Our study is also limited in that it fails to clearly control the inflation period of agricultural products mentioned in many previous studies (2006-2008), the change of biofuel policy (2005 and on) and the financial crisis (2007-2008). Nonetheless, as noted by previous studies, relevant causality between markets increases with increasing market fluctuation. This fact can be easily verified through Figure 2 below.

5. Conclusion

There are three main empirical analysis results of this study. First, bidirectional Granger causality is found

between oil spot price and oil futures price. Based on AIC and FPE criteria, bidirectional causality is also observed between soybean spot price and oil futures price, soybean spot price and oil spot price, soybean futures price and oil spot price, wheat futures price and oil spot price, corn spot price and oil spot price, corn futures price and oil spot price, and cotton futures price and oil futures price. This presents strong evidence about the relationship between prices of agricultural products and energy. In addition, this result is similarly shown for wheat spot price and wheat futures price. Such results imply that, unlike the theory, in reality, futures price can lead or lag spot price, or vice versa. This is the primary topic of studies on spot price and futures price. As argued by Bekiros and Diks (2008), the direction of influence can differ according to time. Next, oil spot price and oil futures price were verified as Granger causes of the futures prices of wheat and soybean. Although many previous studies, like Campiche et al. (2007), reported that agricultural price is not affected by oil price, causality between agricultural and oil prices found in the futures market is evidence that strongly supports the argument that the price fluctuation of agricultural and oil markets can be affected.

Second, the Toda-Yamamoto causality test shows causality in 27 out of 72 relationships tested, or 27 out of 62 relationships, if live cattle is excluded. The oil price return shows causality with agricultural products of grain and oilseed types (soybean, wheat, and corn) in more cases than food and fiber types (sugar, coffee, and cotton). Among oil price returns, spot price shows a greater number of causalities than futures price. Lastly, a causality test is conducted on the 4 sub-periods. As a result, an especially large number of causalities is found during the financial crisis(2007-2008) compared to before and after it. The years 2005-2007, when biofuel policy started to change, are separately analyzed by referring to Silvennoinen and Thorp(2016). No significant difference is shown from other sub-periods, except for the period during financial crisis.

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APPENDIX 1. ADF and KPSS test results

Table 4. ADF and KPSS test results

	ADF	KPSS
	Dickey-Fuller Statistic	KPSS Level
OIS	-13.5941***	0.4372*
OIF	-13.678***	0.3563*
SBS	-12.9148***	0.1179
SBF	-13.6049***	0.1261
WES	-13.5354***	0.1128
WEF	-13.7822***	0.1053
SGS	-9.1213***	0.1766
SGF	-13.5736***	0.1955
CFS	-14.0956***	0.1265
CFF	-13.8463***	0.1379
CRS	-13.355***	0.1594
CRF	-13.4163***	0.1399
CTS	-11.5728***	0.1078
CTF	-14.4827***	0.0962
CLS	-13.3867***	0.0647
CLF	-14.2932***	0.0885

Table 4 summarizes the results of the ADF and KPSS tests on the stationarity of time series data. The null hypothesis (H_0) of the ADF test is that time series data satisfies stationarity, and the null hypothesis (H_0) of KPSS is that time series data does satisfy stationarity. Daily return data are indicated as follows: oil futures return (OIF), oil spot return (OIS), soybean futures return(SBF), soybean spot return(SBS), wheat futures return(WEF), wheat spot return(WES), sugar futures return(SGF), sugar spot return(SGS), coffee futures return(CFF), coffee spot return(CFS), corn futures return(CRF), corn spot return(CRS), cotton futures return(CTF), cotton spot return(CTS), live cattle futures return(CLF), and live cattle spot return(CLS). indicates that the significance level is less than 1%, and results showing only numbers imply that the null hypothesis is not rejected.

APPENDIX 2. Information criterion test results

Table 5. Information criterion test results

		AIC	SC	FPE	HQ
OIF	OIS	10	10	10	10
OIF	SBS	7	1	1	7
OIF	SBF	2	1	1	2
OIF	WES	1	1	1	1
OIF	WEF	1	1	1	1
OIF	SGS	10	8	5	10
OIF	SGF	1	1	1	1
OIF	CFS	2	1	1	2
OIF	CFF	1	1	1	1
OIF	CRS	1	1	1	1
OIF	CRF	1	1	1	1
OIF	CTS	8	6	3	8
OIF	CTF	1	1	1	1
OIF	CLS	7	1	1	7
OIF	CLF	1	1	1	1
OIS	SBS	8	1	1	8
OIS	SBF	8	5	1	8
OIS	WES	1	1	1	1

OIS	WEF	9	7	1	9
OIS	SGS	10	7	6	10
OIS	SGF	7	6	1	7
OIS	CFS	6	1	1	6
OIS	CFF	7	1	1	7
OIS	CRS	6	1	1	6
OIS	CRF	7	5	1	7
OIS	CTS	10	7	3	10
OIS	CTF	9	1	1	9
OIS	CLS	8	4	1	8
OIS	CLF	7	1	1	7
SBS	SBF	1	1	1	1
WES	WEF	7	1	1	7
SGS	SGF	10	7	5	10
CFS	CFF	3	3	2	3
CRS	CRF	3	1	1	3
CTS	CTF	8	8	4	8
CLS	CLF	6	1	1	6

Table 5 summarizes the results of AIC, SC, FPE, and HQ criteria about the 11 relationships tested in this study. The study aims to test 36 causalities formed by relationships among oil futures return (OIF), oil spot return (OIS), soybean futures return(SBF), soybean spot return(SBS), wheat futures return(WEF), wheat spot return (WES), sugar futures return(SGF), sugar spot return(SGS), coffee futures return(CFF), coffee spot return(CFS), corn futures return(CRF), corn spot return(CRS), cotton futures return(CTF), cotton spot return(CTS), live cattle futures return(CLF), and live cattle spot return(CLS), and find the optimum time difference (m) for the 72 causalities. Values in the table represent the optimum time difference for each criterion.

Anxiety disorder and consumption of social media in Brazil

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Abstract

Brazilian population spends a lot of time on social media. The average access from any device is 3 hours and 39 minutes (The Global, 2018). On the other hand, the country leads the numbers of anxiety disorder among the population. According to the World Health Organization, the incidence in the country is 9.3%, while the world average is 3.5%. This number is even higher in big cities, reaching 19.9% in the city of São Paulo (Horta, 2019). Possible causes are economic instability, social changes and violence (Horta, 2019). Add to that the political polarization in recent years and the intensive use of gadgets, private chat applications, such as Whatsapp, and social networks. In this work, we focus on the influence of social networks in the development of Brazilian anxiety. Our hypothesis is that the intensity of use reinforces the existence of other factors of anxiety increase (economy, violence, political division, etc.) through the sharing of news, besides adding others, such as self-display, performativity and the need of always being in evidence in social networks. As a method, we will work with content analysis (news and images) from the main social networking platforms used in Brazil.

Keywords: Brazil; anxiety; social media; technology.

1. Introduction

Brazilian population is among those that most suffers from anxiety and depression in the world. The country, in addition to leading the ranking in anxiety disorder, is in 5th place among the countries whose population most suffers from depression, with 5.8% according to WHO (World Health Organization). Still according to WHO, women in the country suffer more from anxiety: 7.7% are anxious and 5.1%, depressed. Among men, the number is 3.6% in both cases.

The numbers have been growing all over the world, but it is relevant to note why they are the largest in Brazil. Studies putting together all possible factors empirically haven't been published yet. There are only opinions of experts who seek to understand the social complexity of Brazil. For Dan Chisholm, a WHO specialist, for example, "the main risk factors that may weigh in the Brazilian case include the country's economic situation, levels of poverty, inequality, unemployment and recession. In addition, there are environmental factors such as lifestyle in large cities." (Chad and Palhares, 2017).

In this work, we observe these factors present in the socioeconomic condition of Brazil as preponderant elements to understand the global conjuncture in which there are structural forces anchored in post-capitalism and the economic fluidity that puts the country in a particular situation. Among these

factors, we list:

- Economic crisis that has lasted since the year 2014, which has generated, among other things, increased unemployment and underemployment of the population.
- Political and social instability, with the rise of the extreme right to power; increased police violence and carrying of weapons incentive .
- High rates of violence, with increased combat deaths and the number of thefts and robberies.
- Massive use of smartphones and social networks. The country is one of the leaders in the usage time rankings of the internet and smartphones.

Therefore, we will first make a bibliographical review that puts in dialogue several authors who understand the current phase of capitalism as a phase of uncertainties that places economy and labor in conditions more and more volatile, uncertain and precarious. Through global flows of income generation and knowledge, it is possible to note that the country is in a situation that does not put it as a pioneer in the new economy of technology and digital services.

We will start from Paul Mason's (2017) discussion of post-capitalism and then turn to specific questions of this phase from the view of Evgeny Morozov (2018), who discusses the risks of income concentration in Silicon Valley as a function of the existing technology conglomerates. Byung-Chul Han (2015, 2017) talks about the pathologies that current capitalism and technologies promote about the subjects, increasingly directed to construct "self-entrepreneurship" based on their abilities, but also on the degree of visibility and the way they behave socially.

Starting from this more general view, we will point out these factors to make the reading of condition in Brazil, in order to better understand it within a larger conjuncture. We observe how typically Brazilian factors are exacerbated in social networks, in order to reinforce certain narratives that contribute in the levels of anxiety and depression. Public opinion surveys, personal reports and amateur images also contribute to making sense of a networked imaginary about the country's vulnerability in various aspects, such as violence and unemployment. Still, other factors that afflict the world population as a whole should also be considered, such as consumption of perfect images and profile of celebrities that end up interfering in the self-esteem of Instagram users, for example.

2. Threats of post-capitalism

Paul Mason (2015) puts technology at the center of contemporary capitalism as a destabilizing agent of traditional economic forms. This implies a reorganization of the economy, more unstable and based on global capital flows. In addition, it acts strongly on the forms of work, with emphasis on the knowledge economy in detriment to traditional forms of work in industries and commerce. Finally, artificial intelligence already has an impact on jobs, in a wave already started by automation and that now reaches jobs with some level of expertise, such as telemarketing attendants and, soon, consultants and drivers.

The author states that "there is a growing body of evidence that information technology, far from creating a new and stable form of capitalism, is dissolving it: eroding market mechanisms, eroding property rights, and destroying the old wage relationship , work and profit. "(MASON, 2015, p 177).

In the so-called "cognitive capitalism," the main production is linked to knowledge and information, "it is

based on global markets, financialized consumption, immaterial labor, and intangible capital" (Mason, 2015, p. 214). In it, the idea of "class" or "categories" of workers is supplanted, having as main element the figure of the unions.

Investment in education and also in a type of knowledge production that is no longer linked to a company/factory, but to a type of skilled service that can be done from anywhere. The transformation of the self-entrepreneur, an idea presented by Foucault and taken up by Paul Mason and others, directs to self-based efforts on a registered job or through entrepreneurship. This given, the idea of class as representative of a large number of workers is in crisis. With the rise of values aimed at self-investment, success depends on personal effort. In other words, in an economy whose labor power is less dependent on industrial production, the ties and feeling of belonging to certain categories of labor are beginning to be lost. As Morozov puts it, "it is very difficult to preserve values such as solidarity in a technological environment that thrives on personalization and unique and individual experiences" (Morozov, 2018: 47). The "freedom" offered by cognitive capitalism carries with it the insecurities of economic instability as well as greater weight on the paths to be taken. It is necessary that new types of elements arise that meet the need for links between people, albeit in a fictitious way.

Still in relation to cognitive capitalism, Evgeny Morozov (2018) draws attention to the enormous concentration of income driven by the main players in Silicon Valley, technology companies that have dominated the commercial space of the Internet. Among the main ones are Amazon, Google and Facebook. The author shows how the world economy will become increasingly dependent on these companies and, moreover, how it exhibits the imbalance between the northern and southern hemispheres that remain with this new economy. The north being the supplier of knowledge, technology and scientific production. At south, data supplying populations and consumers of new business models globally offered by these companies.

The author also bets that these business models, based on informality, sharing and dispossession of companies such as Airbnb and Uber, also impact on social welfare policies, which are increasingly in charge by the user himself. The author speaks of replacing them with "leaner, faster and more cybernetic alternatives" (Morozov, 2015, p.26) and also in a strong impact on the de-standardization of free circulation of data provided by these companies. This creates control devices that assist in regulating the state when, for example, individuals are encouraged to monitor their physical activity in order to get discounts on their health plans. Or, a proactive vehicle tracking that can act in the pricing of car insurance. Furthermore, data generated by private transport applications can be useful for the reformulation of roads in large urban centers. These are examples of actions of these companies on matters of public order. There is precisely a question of private interference on issues that concerns (or at least should) the State. Such a perspective adds new factors to the role of government and social welfare that, by contract, should be guaranteed to us. In the rearticulation of the place of the state, governability is restricted to a role that acts less and less in the economy, in commerce and now also in social welfare. The problem for the author is that injustices can not be measured by applications, which means that a considerable part of the population's needs are not represented by the data flows offered for "connected" public management. This is, in the author's definition, an "apolitical politics".

3. Brazil and post-capitalism

In a very turbulent pre-election period, Paraná Pesquisas (Brazilian Research Institute) conducted a survey of 2.002 Brazilians nationwide in August 2018 and evaluated what their greatest fears were at that time. Having as aim the gathering of information for the elections, the research, however, revealed the instability present in many themes present in the population's imagination.



Graphic 1. Brazilians greatest fears about the future (Source: Pesquisa, 2018)

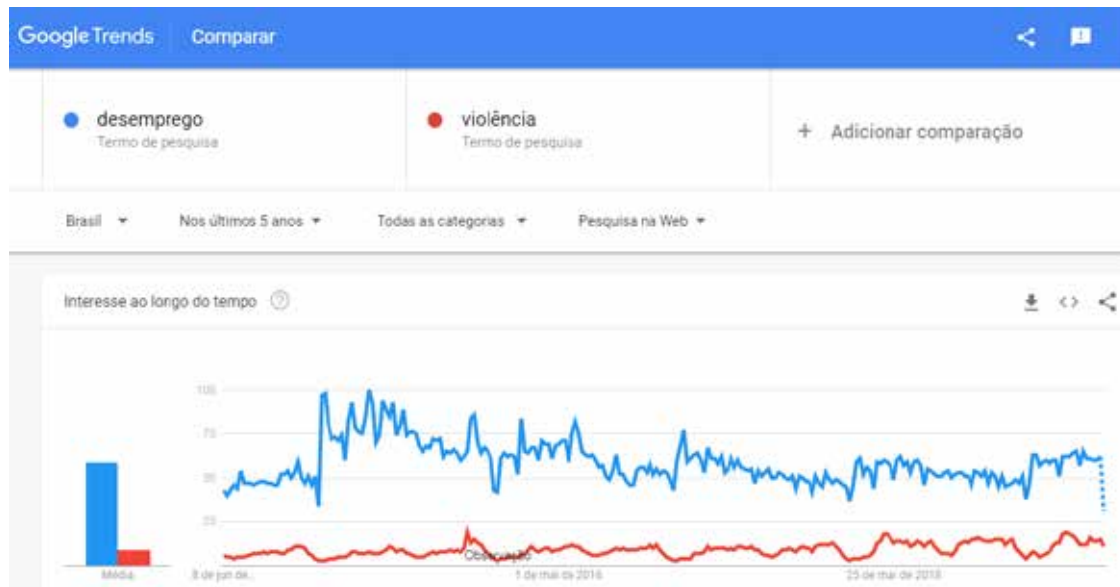
As shown in graphic 1, the greatest fears are the increase in violence and insecurity (27.2%), economic crisis (20.7%), unemployment (19.8%), lack of medical care (17.5%) and increase in corruption (17.5%). The scenario describes a situation of public opinion that shows that the greatest fears of Brazilian citizens are linked to longstanding local problems, but that they have grown in importance in the news and also in the political debates. In a way it also illustrates a panorama that reflects locally economic issues present worldwide. It is a feeling of generalized instability that is directly linked to the present moment of post-capitalism.

Faced with these facts, issues related to social well-being appear as an important part of the population's concerns. With respect to health, the country has its peculiarities, since the SUS (Unified Health System) is considered poor by the population, but three quarters of it depend on this gratuitous system offered by the government. The other 25% have private health plans, of which 62% are corporate, in other words, directly linked to the employment relationship. Losing the job, therefore, means for many to lose private health plan coverage.

Economic crisis and violence are two factors that indicate a fragile state that can not supply its population with basic indices of employability and security.

In a simple research made in Google Trends held in June 2019, we observe the evolution in the search for the terms "violence" and "unemployment" in Brazil in the last five years. As can be seen in the graphic 2 below, while the term "violence" remains within a pattern with little variation in popularity, the term

"unemployment" has increased in demand from the end of 2014, the beginning of a turbulent political-economic phase in the country that coincides with the beginning of the second warrant of the formal president Dilma Rousseff. While the search for "unemployment" has similar distribution across the country, the issue of "violence" is of greater interest in the North and Northeast regions, the two with the highest rates of poverty and social problems.



Graphic 2. Comparison between the terms "unemployment" (in blue) and "violence" (in red) in the last five years (Source: Google Trends)

In the same direction in which concerns about unemployment increase, Brazil has become one of the main markets for Uber. As revealed by the website DriverMachine, based on official data of the company, the country occupies the second world market, losing only to the United States. There are more than 600 thousand drivers partners and more than 22 million users (data from September 2018). São Paulo is the city with the largest number of races in the world (Brazil, 2019).

In the Uber company's own website there are studies that show a relationship between the most vulnerable areas of a city and the adherence of new drivers partners. In the vision offered by the company, it helps to create income for the most needy areas. In the Brazilian case specifically, the staggering economy has pushed a significant number of people to provide this type of service, which makes the country's numbers so significant. Adding to the shortcomings of public transportation and the high dependence on road transport, we have an optimistic scenario for Uber's business.

4. Fatigue, performance and social networks

Self-entrepreneurship brings out a host of symptoms that reflect on people who are always looking for self-improvement. The society of fatigue presented by Byung-Chul Han (2015) is characterized by neuronal diseases such as depression and Burnout Syndrome (SB) and are caused, in the author's view, not by a scenario of pessimism, but by the excess of positivity. Such a scenario is a reflection of the lack

of alterity and strangeness in the contemporary world, where everything is very positive and similar. "Violence of positivity", which "results from overproduction, super-performance or super-communication" (Han, 2015, p.16) is present in this sense.

If in the recent past the disciplinary society kept individuals in control, with the "performance society," control is generated internally by individuals who charge for better results, which ends up overwhelming them. If the negativity of the disciplinary society generated "madmen and delinquents," the positivity of the performance society produces "depressives and failures" (Han, 2015, p.25).

The same author speaks of the transparency to which we are all subjected in the daily delivery that we make of our personal data, in the behavior of navigation and information on purchases, in a process of elimination of private life. This openness to the private world takes away the depth and interest in the mystery of relationships, makes the world pornographic, by opening up and diminishing the distances of one's private life. However, transparency does not give rise to pain, since the space of the exhibition exists only for positivity and happiness, making the places of sharing of pain inaccessible and undervalued. Finally, transparency also contributes to the status quo by depoliticizing the public sphere. For Han:

Coercion by transparency stabilizes the existing system in a very effective way. Transparency itself is positive. Within it is not found any negativity that could call into question the current political-economic system; it is blind to the outer side of the system; simply confirms and optimizes what already exists. (HAN, 2017, 24)

Positivity and transparency are added to an acceleration and an indifference towards a temporality that marks actions in the time and space of individuals. Post-capitalism in its current phase fuses temporalities, in such a way that by being connected it is possible to work, rest, relate and shop all the time, without distinction of time and place. Equality also extends to temporality, which transports the subject to a permanent state of alertness, attention and desire. For Jonathan Crary, "time 24/7 is a time of indifference, to which human fragility is increasingly inadequate, and where sleep is neither necessary nor inevitable" (Crary, 2016, 19).

In consonance with the other authors, Crary also believes that focusing on individual goals also engenders self-centered, self-reliant fatigue, which reflects contemporary values. "24/7 is structured around individual objectives of competitiveness, promotion, acquisition, personal security and comfort at the expense of others" (Crary, 2016, p.50).

The game of positive images to which millions of people who browse websites and social networks is in full dialogue with this scenario. Thus, the landscape of the digital world transposes such values in a positive way, as Han wants, imperceptible, but still rather coercive. In this sense, understanding the implications in the use of smartphones and social networks is the last step to a better understanding of the scenario of neuronal diseases present with high indexes in the case of Brazil.

5. Excesses in social networks and smartphones

If positivity reflects and intensifies in online behavior, it is to be expected that the academy has been concerned about the relationship between the use of social networks with diseases such as anxiety and depression.

The term most commonly used by researchers is "social media fatigue" and defined by Dhir et al (2018: 141) as a situation in which users "suffer from mental exhaustion after experiencing various technological, informative, and communicative overloads through their participation and interactions on the different online social media platforms ". There is a relationship with anxiety and depression, according to a study of young people in India. The same work points to little literature in developing countries, with studies concentrated in West and East Asia. In the vast literature consulted by the authors, there is a relationship between the compulsive use of social media and mental fatigue. Like other types of compulsive behavior, excessive use of the internet and social networks is linked to various physical and mental problems, such as emotional exhaustion and falling incomes at work. In the case of smartphones, compulsive use can generate the fear of running out of the device, a syndrome called nomophobia.

There is also the phenomenon called FoMO (fear of missing out), defined by the authors as "an apprehension or concern of being disconnected, absent or missing an experience which others (i.e., peers, friends, family) might receive or enjoy." (Dhir et al, 2018, p.143). Such feeling is linked to an emotional need that is greater among people with higher anxiety level. Still in the same study, the authors will point out that anxious people tend to use more social media to mitigate their unfavorable emotions, seek attention, support, and sense of belonging. In an Instagram-specific study of 18- to 29-year-olds in the United States, Lup, Trub, and Rosenthal (2015) found that the greater the number of strangers a person follows in this social network, the more likely they are to experience symptoms of depression. In other words, it seems that the choice to follow strangers is also related to this sense of compensation identified by Dhir et al (2018).

Morozov contributes in another way to thinking about the reason why excessive use of social networks generates distraction and fatigue. Apart from common sense that says that such use dulls people, the author states that:

(...) this fatigue can be explained as a natural consequence of the extractive models of data adopted by the platform providers: it is they who designed the systems to distract us to the maximum, because this is how they maximize the number of times we click on the sites - and therefore we provide our data. They continue to dig our psyche just as oil companies dig the ground; and the data keeps spouting from our emotional reservoirs. (MOROZOV, 2018, p.166)

The author, therefore, adds to this context automatic database-based and artificial intelligence mechanisms that will over time better understand users' needs, desires and preconditions, providing distractions that capture attention, encourage navigation, and promotion of clicks, which feeds the network with more data. Along with them, there is also an emotional charge that tends to settle on these mechanisms, in a confluence between expectations of the data market and the users' responses to these

stimuli. The friendly environment of social platforms and networks hides very well-founded strategies of data collection and consumer understanding.

6. Brazilian people and social media

The latest survey released by Hootsuit, a popular social media management platform in 2018, examined data from 239 countries. You can find there results by country. There is great adherence and time spent of Brazilians with digital media. In Brazil, internet penetration is 66%, while the number of social media users on mobile devices is 57% of the population. (The Global, 2018).

The number of hours spent using the internet is also significant. From any device, it is 9h14 a day, on average, which gives the country the third place in the world, behind only Thailand (9h38m) and Philippines (9h29m). Access to social media from any device is also high: 3h39m, the second largest in the world. The country loses only to the Philippines, with 3h57m. At the other end, the Japanese people spend only 48m a day with the same activity.

Several recent phenomena in Brazil have highlighted WhatsApp instant messaging application. According to the site Statista, the country is among the main nations in the penetration of the application's use. Still in 2017, the total population penetration of the country was 56% (Selected, 2019). Among the most recent events involving the application, we highlight the truckers' strike in 2018 and the elections for president, governor, deputies and senators, also in 2018.

The first case was emblematic for the extent of the use of social networks, given a diversified class and apparently little articulated in terms of union representation, which is the class of the truck drivers. This category of workers drew attention to the pricing policies of fossil fuels under the government of Michel Temer, which matched the price of diesel (main fuel of trucks) to the exchange rate of dollar.

The articulation of truck drivers was mainly through Whatsapp application and gained strength by means of the numerous groups that were formed there. The groups were based on the articulation of the strike, but also served as encouragement among the participants, as well as were used as dissemination of diverse political ideas. The movement halted the supply of the country between May 21 and 30, 2018, which caused serious problems that affected public transportation, loss of perishable cargo, as well as harmed the distribution of items in supermarkets, pharmacies and other segments. The testimony of Moisés de Oliveira, one of the truck drivers involved in the strike announced by the BBC at the time, clearly illustrates the dynamics of the application: "We travel all over Brazil and meet other truck drivers, we talk, exchange WhatsApp number. Then, when the strike came, there were already several groups assembled and we distributed the information" (ROSSI, 2018).

Just as the application helped to mobilize the category, it was also responsible for spreading many fake news. In this particular case, news circulated about the takeover of the federal capital by demonstrators, the seizure of power by the military, decontextualized videos that were interpreted as part of the movement, among others.

The same fake news mechanism was also the main reason for building the electoral political scenario that followed that year. The country saw itself in principle with a wide range of options for the post of president. After Dilma Rousseff's impeachment in 2016, the country tried to reorganize itself politically

with new political parties and candidates promising to be a "novelty" for the electoral scenario of that moment. The unfolding of this scenario culminated in the division of the country between right-wing and left-wing voters, with a second round between the formal federal deputy Jair Bolsonaro of the small PSL (Liberal Social Party) and Fernando Haddad, former minister of education of Lula and Dilma's governments and candidate for PT (Workers Party). What followed was a media-driven election within a never-before-seen scenario in the country. The candidatures with longest-running television and larger grants have not taken off, while the internet campaign with low budgets and videos made by lives via streaming put the candidate Jair Bolsonaro at the top of the voting intentions, culminating in his election. As a side effect, the election divided the country between those who support the president-elect and the voters who are against him. A post-election apathy climate is still maintained in 2019, driven by the constant errors given by the lack of experience of a government that suffers from problems in its articulation with the Chamber of Deputies and in the approval of proposals. At the micro-social level, daily life became more difficult, with an economy that does not advance and a scenario of insecurity, with significant setbacks mainly in the area of culture and education.

The high intensity with which Brazilians use social networks and instant messaging applications appears in this case as a propelling agent of the crisis, since it mixes issues of private nature with issues of public interest. The most recent fake news studies, revealed in the significant case of Donald Trump's election in the United States in 2016 and the involvement of Cambridge Analytica, show a correlation between the propensity to believe in newsworthiness based on values and beliefs of who is exposed to certain "news". In the case of Brazil, the electoral scenario was loaded with offensive news, targeting the behavior of candidates and their alleged involvement with controversial topics such as drugs, racism, corruption, among others. The country, once considered as tolerant, social, friendly and open, showed before itself a very different scenario, which still persists after the elections. The division remains and is verified in the streets. Until June 2019, Brazil witnessed four demonstrations at national level. Two in favor of education and against cuts made by the government, a general strike involving several categories that question social security reform, but also a significant pro-government demonstration also at national level.

In sum, the high level of sociability of Brazilians in social networks and message applications has contributed to a multifaceted and dichotomous landscape that has divided the country politically, causing a serious crisis of representativeness and a feeling of insecurity in a substantial part of the population. Adding to this the stagnation of the economy that has not yet responded to the wishes of the new government, we have a delicate and complex scenario, which places in a fragile situation a subject already unstable by the global socio-technical scenarios pointed out throughout this text.

7. Conclusion

The scenario that puts Brazil in front of the numbers of anxiety, depression and consumption of medicines that fight these diseases is complex and multifaceted. Nevertheless, we seek throughout this work to discuss the peculiarities of the country, which make these facts more understandable.

The attempt is also to put the Brazilian condition in a perspective that involves economic, political, cultural and technological factors. When added, these factors can optimize limiting situations that

generate the disorders. In addition, it is important to note the global concerns with the excesses of the exacerbated consumption of smartphones and social media. In the national scenario, where this consumption is already historically high, coupled with the fact that the Brazilian population is still being included in the digital universe, often without a literacy necessary for the good habits of consumption of these media, it is observed high negatives rates linked to the consumption of social media in Brazil, as well as the consequences of this condition, such as problems with self-esteem, self-image, lack of attention and sleep disorders.

The political and economic crisis in which the country now finds itself has structurally strengthened the articulation of ideas that culminated in two great right and left ideological bubbles that grew on the basis of communication networks that were strengthened with social networks and instant messaging applications. Such bubbles have divided the country and now block the power of articulation of the current government, as well as causing crises of citizen's representativeness, their identity as Brazilians, freedom of expression and their security in coming and going.

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Procedural Justice as an Approach to Address Workload among Kindergarten Supervisors, Minia Governorate

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Abstract

The current research aimed at identifying the level of procedural justice and workload among kindergarten supervisors at Minia governorate, and identifying the relationship between procedural justice and workload. For data collection, the researcher applied a questionnaire to a sample of (36) kindergarten supervisors, Minia governorate. Results revealed that there was a statistically significant correlative relationship between the level of procedural justice and workload reflected in the workload of kindergarten supervisors. Therefore, the study recommended providing a suitable climate for practicing procedural justice, paying attention to the professional development of kindergarten supervisors, providing material and moral encouragement for kindergarten technical supervisors, providing means of transportation between kindergartens especially in the countryside, and activating the system of promotions inside kindergartens.

Key Words: procedural justice, workload, kindergarten supervisors

Introduction

Interest in childhood is one of the most important significant criteria for society's progress and development. This interest, in fact, reflects an interest in the nation's future. Consequently, preparing children and caring for all his aspects outlines a kind of preparation for facing the civilizational challenges imposed by development requirements and society rapid changes.

In this context, Samedna,J and Chandan,K (2014) asserted that technical supervision occupies a distinctive position in the kindergarten educational process, as it is the core of the teaching and learning process. Besides, it represents the cornerstone of the educational process, and without qualified technical supervision who is aware of educational process goals and who has enthusiasm towards work in kindergarten institutions, kindergartens cannot success in performing their tasks effectively and implement their goals that have existed for.

In the light of the above, there is a great concern among researchers to develop technical supervision and overcome any difficulties they face as there are many obstacles in their work environment that prevent them from fulfilling their roles. These obstacles include the factors surrounding their work environments

such as the lack of specialized training and qualification programs, absence of clear roles and responsibilities, lack of justice in the distribution of inputs and outputs, the large number of tasks assigned to them, lack of sufficient time to update their knowledge in their work field, and the load of supervision. Consequently, all these factors affect their psychological state which is reflected in their performance level; which in turn, exposes them to the causes of workload (El-Rasbia,Z, 2012; 110).

Hussien, S(2013) concluded that the workload reduces the workers' performance and increases their desire to leave work. This interest in the workload is due to its negative effects, both on the individual or group level, as the sense of workload can affect workers' job satisfaction in particular, and this has a negative impact on the educational process in general.

Research Problem:

In Egypt, there many laws regarding educational supervision as Egypt's Education Law (2007), No.155 and its executive regulations, where the Article No.78 determined the workloads and proportions of guidance deities in the educational field, and the Article No. (6)which illustrated the distribution of technical supervision as follows: one general supervisor from the first distinguished level and the first level, one first supervisor in the directorate of education from the first distinguished level and the first level, one supervisor in each educational administration, and a supervisor in educational administrations from the first, second and third levels, with the rate of one for every 40 teachers. (Executive Regulation of the Education Law, No.155, 2007).

In addition to the above, the educational supervision is assigned to specialized supervisors in return of 5 Egyptian pounds per visit as stated by the Ministerial Decree(208/1989) and publication 5/1-2008, follow up private kindergarten, Ministry of Social Solidarity). Moreover, Directorate of Education, General Administration of Kindergarten (Publication 5/2008/1) asserted that subject teachers are excluded from kindergarten supervision and it should be assigned to specialized supervisors. While the Directorate of Egypt, General Administration of Kindergarten, Bulletin dated 3/1/2002 stated that periodic meetings with teachers are required to explain alternatives to traditional teaching (Ministerial Decision No.330). Besides, Article (17) of Child Law requires integration between kindergarten supervisors and teachers (Cadre Act (105) of 2017). Reviewing Education Law and statistical data for kindergarten supervisors, Minia Governorate, the researcher illustrated that supervisors number are (51) assigned to supervise (2623) female teachers, each supervisor is responsible for (51) kindergarten teachers in separate locations, most of them are in rural areas (Directorate of Education, General Supervision of Kindergarten). Since these kindergartens are located in separate areas in the countryside; this requires effort and hardship to travel from kindergarten supervisors, which represent a load on them.

So, the researcher conducted a survey directed to (28) kindergarten supervisors, aimed at identifying the difficulties they face while performing their work. The researcher found that supervisors suffer from many difficulties that make them unable to perform their work, and these problems were arranged in descending order according to the ratios of agreements as follows: the procedural injustice among them and supervisors in other educational levels with the percentage of (98%), the large number of kindergartens assigned to them to supervise(82%), the kindergarten locations are far from their accommodation, with the difficulty of providing transportation(80%), the large number of teachers they supervise (79%), lack of incentives or

rewards (77%), they are not participating in decisions regarding teachers assignments or transfer(73%), little transfer fee and delay in payment(70%), there are non-specialized kindergarten teachers (68%), school principals are not aware of the nature of kindergarten work (64%), and the weak response of the older teachers to supervisor instructions(60%). These problems and their feelings of workload and injustice of administration decisions, and job dissatisfaction affect their performance because of low performance and therefore this will be reflected in kindergarten teachers' performance. Besides, they are not able to give kindergarten teachers all the guidance and supervision they need and thus will be reflected in the main output quality, which is the child.

In this context, Yar A. M. & Hüseyin S. (2014) indicated that procedural justice and feeling it depends mainly on the degree of adherence or violation of structural rules structural rules constituting procedural justice which are as follows: the rule of appeal that means the existence of opportunities to object the decisions ,review or modify if there is a justification for this action; the ethical rule which reflects distributing resources according to ethical standards; the representation rule that is relating decision-making process to all stakeholders, so that all supervisors can participate in making decisions that relate to their professional lives; the rule of impartiality(objectivity) that means neutrality, moving away from personal interests, and keeping it away from decision making and taking; the accuracy rule that is making decisions based on accurate , comprehensive and confirmed information; the harmony rule that is justice in applying rewards and punishment procedures of all supervisors in all circumstances.

Hence, the issue of procedural justice is one of the important topics in the field of kindergarten administration, because of its great impact on facing workload. It affects kindergarten supervisors feeling of job satisfaction and improves their performance through realizing their feelings, understanding their attitudes and interests, as well as creating a positive atmosphere of work, linking their goals with kindergarten goals, participating them in setting plans and preparing to accept their complaints and suggestions, in addition enhancing their skills and its development. This creates an atmosphere of satisfaction and justice, and this feeling will push them to work using their full energies in order to achieve kindergarten goals as well as their personal goals. Moreover, it enhances the status of belonging, sincerity, and loyalty that kindergarten supervisors feel to achieve a sense of commitment, loyalty, and organizational citizenship among them.

According to what previously presented, the researcher conducted the current research with the aim of identifying the nature of the correlative relationship between procedural justice and workload among kindergarten supervisors, Minia Governorate; especially all previous studies- according to the researcher knowledge- did not address personal justice in the kindergarten stage and did not link it to the workload they have. So, the research problem concentrates on the importance of implementing procedural justice and using it as an approach to address the workload of kindergarten supervisors at El-Minia governorate. This problem stimulating the following questions:

1. What is the level of applying procedural justice among kindergarten supervisors at El-Minia Governorate?
2. What is the level of the workload for kindergarten supervisors in El-Minia Governorate?
3. Is there a statistically significant correlation between the level of procedural justice and the workload of kindergarten supervisors in El-Minia Governorate?

Research Objectives: The current research aimed at:

1. identifying the level of applying procedural justice among kindergarten supervisors at El-Minia Governorate.
2. identifying the level of the workload for kindergarten supervisors in El-Minia Governorate.
3. identifying the nature of the relationship between procedural justice and the workload of kindergarten supervisors in El-Minia Governorate.

Research Significance:

1. This study addresses the issue of procedural justice and its relationship to the workload of kindergarten supervisors as one of the new topics in contemporary administrative thought and it has a great deal of importance.
2. The results of this study open new horizons for other researchers in order to study some other aspects related to the research topic.
3. This study contributes to enriching the educational library, especially with the scarcity of research and studies that dealt with procedural justice and its relationship to the workload of kindergarten supervisors in El-Minia Governorate.

Research Methodology

The current research utilized the descriptive and analytical approach as it is the most suitable to the nature of the study.

Research Tools

For data collection, the researcher utilized the following tools:

- The first tool: a questionnaire to identify the level of procedural justice among kindergarten supervisors in El-Minia Governorate. (Prepared by the researcher)
- The second tool: a questionnaire to identify the level of the workload among kindergarten supervisors in El-Minia Governorate. (prepared by the researcher)

Theoretical Background

Procedural Justice

Abboud, M.(2012:49) indicated that procedural justice reflects the extent to which the supervisors feel the justice of the methods followed in determining the results of their efforts, the integrity of the standards, the integrity of the procedures followed in judging the outputs such as evaluating performance procedures and the criteria used in this, in addition to the accuracy of implementing the evaluation process. Therefore, recognizing the meaning of procedural justice by supervisors is related to many rules that form the conceptual framework for the content of this concept. Moreover, Ravangard, et al. (2013) study aimed to test the effect of the organizational justice components, including procedural justice on the dimensions of organizational commitment, and the study concluded that procedural justice has a positive correlative relationship with the overall organizational commitment.

Consequently, the researcher believes that these dimensions represent a reflection of the supervisors' feeling of procedural justice which utilized in determining rewards are justice procedures, in addition to reflecting the mental perception of procedural justice used in making decisions affecting the individual. This kind of justice is achieved when the supervisors have the opportunity to discuss the principles and the rules on which her performance will be evaluated, and the lack of justice of these outputs leads to creating stress among them, which negatively affects their work performance.

Hassanein,R. (2013: 108-109) indicated that procedural justice can be divided into two types:

Justice Procedures: this relates to justice methods and mechanisms when making a decision, as participation in decision-making, or seeking to adopt new procedures that supervisors are aware of within the limits available to them, or seeking to adopt specific measures to reduce bias and errors in decisions that have been taken.

Injustice Procedures: this relates to injustice methods and mechanisms when making decisions regarding kindergarten supervisors, which creates negative feelings of them, and this leads to a decrease in their job performance. So, in order to achieve objective and justice procedural justice should be characterized by these two conditions:

- The first party that establishes the organizational procedures (administration) agrees with the second party who is affected by those procedures (supervisors) on the merits on which these procedures are formulated.
- The first party (the administration) must provide the second party (supervisors) with sufficient information on how to implement these procedures.

Based on the foregoing, it can be said that the justice of the procedures includes three elements:

- Formal rules and standards for procedures.
- Explaining the procedures and decision-making process.
- The interaction between who applies the rules (the decision maker) and the supervisors who are affected by the decision.

Furthermore, there is a correlation between distributional justice and procedural justice. That kindergarten supervisors' feeling of justice in distribution is closely related to their sense that the distribution decisions were carried out according to fair guidelines and methods, so the justice procedures reflect the supervisors' sense of justice followed in taking decisions related to the distribution regulations. While as, the lack of procedural justice among kindergarten supervisors leads to an inequitable distribution, which causes a sense of workload and as a result their feelings of work stress.

The positive effects of implementing procedural justice in kindergarten:

The concept of procedural justice is of great significance in the performance of kindergarten as it plays a prominent role in the coherence of administrative systems at all levels. It also reflects a beautiful image of kindergarten through highlighting the results of the work, the cohesion of its members and their good communication with each other, and their respect and appreciation for each other and for others. There are many literatures that highlighted the importance of procedural justice for kindergarten in particular, and for

administrative organizations in general. Darawsheh, N. (2017:373) indicated that the concept of procedural justice is an important concept in the literature of modern management because of its role in the following:

- Enhancing the confidence of kindergarten employees in their organization.
- Achieving kindergarten goals and programs with outstanding effectiveness and realism.
- Achieving the employees' satisfaction in kindergarten.
- Noticing the kindergarten competence in accomplishing its tasks and activities.
- Provide the foundations of justice, equality, and impartiality in rights and duties among all, according to laws, regulations, and instructions that express the individual's relationship with the organization.
- Forming the individual's personality, values, motives and attitudes with justice and credibility.
- Modifying the attitudes of kindergarten employees positively, and therefore their performance at work.
- Increasing supervisors' and teachers' motivation towards work.
- Helping in clarifying the reality of the procedural system of salaries and wages.

The negative effects of non-implementing procedural justice in kindergarten:

In the state of non-implementing procedural justice among kindergarten supervisors, this will create negative consequences as indicated by Ahmed, J. (2016:304), which are as follows:

- Decline in job performance in kindergarten.
- Weak organizational loyalty of kindergarten supervisors.
- The supervisors desire to leave work.
- Lack of job satisfaction among kindergarten supervisors.
- Weak organizational trust among kindergarten supervisors.
- The unwillingness of kindergarten supervisors in professional development.
- Weak social relations between directors in kindergarten.

Moreover, Nwosu & Gbadamosi (2011: 206) added to the effects of non-implementing procedural justice:

- Failure to apply justice will be the basis of all organizational harm.
- The basis for the decline of the organization.
- The basis of low quality in performance.

Workload:

Workers are exposed to an increased sense of pressure due to various factors including the increased loads resulting from multiple roles, or multiplicity of responsibilities and personality style, to an increased sense of pressure if compared to people who perform fewer tasks (Youssef, J 2007:23). So, in order for the educational supervisors to use the modern evaluation methods in guiding teachers in schools, attention should be paid to the supervision and its various activities through reducing the workload on the supervisors so as to have enough time to be updated with the most recent supervision styles and selecting them from school principals as well as providing a separate budget for educational guidance as recommended by Eldor's study (2017).

Therefore, studies in this field have sought for identifying the attitudes of kindergarten supervisors, and revealing the effects of those positive and negative feelings on their ability to achieve the goals of the institution in which they work and their attitudes towards their jobs and institutions to raise the quality of the production, and thus illustrates many of undesired reactions and behaviors among kindergarten supervisors such as high rates of absence, frequent complaints; frequent work mistakes; poor performance, and other patterns of behaviors as being related to work stress as a result of workload, or inexperienced leader and others which cause a rapid feeling of pain, frustration, and boredom of work (Tarek,M 2015:246).

The workload is loading the worker with burdens over his capacity and increasing their quantitative burdens which cannot be accomplished on time. It may be in a qualitative form, such as asking the individual to perform actions that do not fit his own preparations and capabilities or charging the individual with less than what is required from works which are considered also a source of pressure because that means underestimating his capabilities and abilities. Nabil, H (2016:239) added some causes of workload as incompatibility of the individual personality with the requirements of the organization, problems of subordination to power, imbalance in labor relations, and competition for resources.

Yasser,M (2015) concluded in his study that educational supervision is an important pillar of the educational organization, as the educational supervisor has many tasks and a great burden in guiding teachers and monitoring them. These workloads and lack of training courses, weakness of school principals' ability to practice educational supervision, curriculum difficulty, student dropout, and lack of commitment to official working hours; leads to accumulations which have turned into bottlenecks that hinder his career.

The researcher believes that such workloads may hinder the supervisors' communication with their heads at work and that the little time the supervisors have as well as the large number of schools that they supervise limit their follow-up to teachers who supervise and hinder presenting effective feedback to them. Moreover, the techniques used by the educational supervisors in communicating with teachers and schools may cause workload if it is a slow and unhelpful routine. In addition, the researcher believes that the teachers' indifference and lack of interest in applying the recommendations of the supervisor or in attending meetings, training courses and workshops may lead to workloads of the supervisors.

Moreover, the researcher administrated that the kindergarten supervisors deal with different categories of teachers and school administrators who have different thinking styles ,different abilities to accept criticism and other opinions, and who are different in the use of methods of dialogues as they have various economic and social conditions. All of these cases, in turn, also generate psychological pressure among the supervisors to give everyone his right in supervision, guidance and advice.

Consequently, the researcher concludes that as a result of workloads that the directors are exposed to in their work in kindergarten and its negative effects on kindergarten and them; kindergartens must seek to find solutions in order to maintain their mental health and stability. That reducing the severity of these loads increases their career satisfaction as a focus of many organizations because of its great importance and prominent role in increasing the output quality.

For these reasons, the studies of Al-Rasbieh,Z,(2012); Rifai,L. (2014); Abdel Majeed,A. (2017); Ashwi,A. (2019) indicated that one of the most significant sources of workloads and educational problems

is weak incentives, lack of promotion opportunities, task pressure, lack of control, poor feedback, work stress, conflict and ambiguity of role, lack of participation in decision-making ,and lack of career development. Therefore, Al-Mushrifi's (2014) study recommended the necessity of reviewing the salaries of managers and heads of departments in a manner that suits their workloads, granting them increments with their current work which are in line with the job description, that the employee should enjoy material and moral advantages that makes him feel more secure and stability.

Research Results:

- Answering the first question: "What is the level of applying procedural justice among kindergarten supervisors at El-Minia Governorate?"

Table (1)

Estimated Degrees and Average of Sample Opinions Response Rates Regarding the Procedural Justice Axis Statements (n=36)

n.	Statements	Response			Estimated Degree	Average of response rates
		Agree	Disagree	To some extent		
1	Make career decisions based on available information and facts.	5	8	23	54	0.50
2	Explain the administrative decisions to the supervisors when they ask about them.	18	12	6	84	0.78
3	Accepting opposite opinions with an open mind.	5	7	24	53	0.49
4	Interest in doing feedback on decisions issued by the administration.	5	9	22	55	0.51
5	Include supervisors in their decisions.	6	7	23	55	0.51
6	Commitment to promotions on time without delay.	6	3	27	51	0.47
Total Axis Degree					352	0.54
Minimum Confidence Interval Level=0.52					Maximum Confidence Interval Level=0.82	

Table (1) indicated the following:

- The average of the research sample response rates in the first axis" procedural justice" ranged from (0.47: 0.78).
- That statement n. (2) ranged between the minimum and maximum confidence interval levels, which indicated that it was achieved with a moderate degree.
- While the statements n.(1,3,4,5,6) came below the minimum confidence interval level, which indicated that they were not achieved and revealing that central administration for kindergarten and basic education is not keen on procedural justice.

- The percentage of the dimension as a whole was (0.54), which ranges between the minimum and the maximum confidence interval levels, which indicates its achievement with a moderate degree, this was due to these reasons: career decisions are taken away from the available information and facts, such as the numbers of supervisors in relation to the numbers of teachers, assigning non-specialized teachers to work in kindergartens, assigned kindergartens are in rural well as urban areas, there is no communication between the central administration and the supervisors in order to appeal the decisions, the implementation of decisions in an obligatory manner and does not accept any change, here is no feedback on the decisions issued by the central administration in order to get identify the impact of these decisions and the results of their application in a way that suits the work needs and the needs of the supervisors, there is also inside the kindergarten ladder promotions, and there are no new appointments to work in kindergarten, but it is possible to assign non-specialized teachers to work in kindergarten to fill the gap. That the teacher remains a teacher and the supervisor remains a supervisor till she returns a gain to be a teacher inside kindergarten.

Answering the Second Question: " What is the level of the workload for kindergarten supervisors in El-Minia Governorate?"

Table (2)

Estimated Degrees and Average of Sample Opinions Response Rates Regarding the Workload Axis Statements (n=36)

n.	Statements	Response			Estimated Degree	Average of response rates
		Agree	Disagree	To some extent		
1	I find difficulty and complexity in the tasks assigned to me.	26	6	6	90	0.83
2	I am assigned workloads of absent supervisors due to small number of supervisors.	27	4	5	94	0.87
3	Increase the financial expenses related to my job as a supervisor.	29	6	1	100	0.93
4	Difficulty moving from one kindergarten to another during work, especially if the places are far away.	29	7	-	101	0.94
Total Axis Degree					385	0.89
Minimum Confidence Interval Level=0.52					Maximum Confidence Interval Level=0.82	

- The average of the research sample response rates in the second axis " The Workloads" ranged from (0.49: 0.78).
 - That the statements n.(1,2,3,4) were achieved below the maximum confidence interval level and this is due to the following reasons: most of the kindergartens are located in rural areas far from each other, so the supervisors find it difficult to move to them and need material expenses, the kindergarten system requires more budget than what is available to as it consists of activities,

and to conduct all these activities the supervisor covers the expenses of them on her personal account. Besides, the supervisors need to honor teachers to encourage them to continue in their distinguished performance which requires high expenses. In addition to the small number of supervisors which overload them with duties exceeds their abilities and capabilities and they also find stress to deal with the unqualified teachers or teachers with the same age.

- The percentage of the dimension as a whole was (0.89), which was above the maximum confidence interval level, indicating that it was achieved significantly. These results is consistent with the results of Tekeste, S. F., & Nekzada, N. I.(2014)and BinDarag,B. (2016) which revealed that the workload is a major cause of work stress due to the employees 'feeling of fatigue, exhaustion and stress, as stress in the workplace can be caused by some factors, the most significant of which are heavy workloads, excessive pressure which can interfere with the productivity and performance of their employees, and can affect their physical and emotional health, their relationships and home life, and can determine success or failure in the job, and which can lead to their feelings of job dissatisfaction.

Answering the Third Question: "Is there a statistically significant correlation between the level of procedural justice and the workload of kindergarten supervisors in El-Minia Governorate?"

Table(3) The Nature of the Relationship between Procedural Justice and the Workload of Kindergarten Supervisors in El-Minia Governorate

Variable	
The Workload	Procedural Justice
** -0.56	

- Analyzing the research results revealed that there was a statistically significant negative relationship between the level of procedural justice and the workload of the kindergarten supervisors in El-Minia Governorate, where the relationship between them was as follows:
- Failure to make decisions by the central administration for basic education and kindergarten based on realistic statistics such as numbers of supervisors, which creates the workload among supervisors. This is confirmed by the study of (Hadjisymeou, G. (2010) which indicated that participation in decision-making is a feasible method to deal with workload. As the abilities and capabilities of supervisors, the number of specialized and non-specialized teachers, the location of kindergarten in rural and urban areas, the ratio of the supervisor to teachers and the budget of kindergarten results in taking decisions under pressure to assign supervisors with a large number of duties.

Recommendations:

In the light of the research results, the researcher recommended the following:

- Provide adequate budget for kindergarten.
- Providing a complete organizational structure for kindergarten work.
- Providing leaders to support procedural justice.

- Providing qualified human resources to work in kindergarten.
- Providing policies that support procedural justice.
- Providing a suitable climate for practicing procedural justice.
- Paying attention to the professional development of kindergarten teachers and supervisors.
- Provide material and moral encouragement for technical supervision in kindergarten.
- Providing means of transportation between the kindergartens especially in rural areas.
- Activating the system of promotions inside kindergarten.
- Make decisions based on realistic statistics.
- Participating supervisors in decisions regarding their work.
- Interest in doing feedback on decisions issued.
- Providing the opportunity for the supervisors to challenge the decisions issued.
- Examine the percentages of supervision jobs in kindergarten periodically.
- Clarify the tasks assigned to the supervisors.

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Difficulties Found by Students in the Disciplines of Post-graduation in Electrical Engineering

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Abstract

In this study, we explore the difficulties of students in the disciplines of post-graduation in electrical engineering. To the extent that the student is able to elucidate his difficulties during the disciplines of the postgraduate course, your research can flow with greater satisfaction and success. Our findings are based on interviews of students with different backgrounds and educational experiences, allowing to capture different difficulties and motivations found in the classroom, which influence the researches of masters and doctoral students. We found that most of the students in the postgraduate course in electrical engineering had background training in distinct areas (73.3%), and that they are generally related area students, such as math, computing, and other areas of engineering. Another aspect is that most interviewees reported that their difficulties were related to the disciplines that addressed the development of algorithms and mathematical calculations (66%), suggesting that this problem was a consequence of insufficient knowledge base for the disciplines. The findings suggest that even with the difficulties encountered in the classroom, the students of the course had no disapproval, because most of the time they sought to discuss their difficulties in groups of studies created by classmates, and thus, elucidating the difficulties faced with colleagues who had different skills.

Keywords: Difficulties; Disciplines; Electrical Engineering; Post-Graduate.

1. Introduction

The first steps of graduate studies in engineering in Brazil were taken in 1961 at the Technological Institute of Aeronautics - ITA, in which it was intended to guide younger teachers, and thus offer ample opportunities to pursue advanced studies in the country and abroad. Since this period, postgraduate courses

in Engineering have evolved considerably in recent years, expanding in several areas of knowledge, with an increase in the number of programs created, in the offer of courses and in the entry of new students each year of selection. However, when compared to other areas of knowledge, it is still evident that there is little representation in a world scenario of technological competition [1-2]. However, it is clear that even with an expansion in this level of education and an increase in the offer of courses in Brazil, there is still a concern related to the deficit in the number of doctors trained in the country [3].

The small number of postgraduates in Brazil often look for alternatives to jobs that are far from classrooms and research. Because, the technological areas guarantee better business working conditions, as well as Engineering, Administration and Medical Clinic, whose main field of work is (public and private) companies [4]. In addition, several factors imply the graduate's decision to enter graduate school, as well as financial issues, the need for immediate employment and quality of life.

However, the student faces several difficulties when arriving at a *stricto sensu* post-graduation, such problems may be related to the lack of depth of knowledge that was sometimes “decorated” during graduation, with this he faces serious dilemmas: “the to study, why to study this (and not that), where to start, who will help him, how much time he will have to complete the work, how he will know that he is ready and what to do to avoid problems in defending the dissertation ”[5] . Another aspect is the frustrations of students who were considered excellent at graduation, but when they entered graduate school, they did not achieve the same performance, facing failures for the first time [6]. All of this can cause an uneasy relationship in the research. Thus, in order to complete the highest degree of research, the student faces an arduous task, in which he requires that both the student and the advisor have good management skills for research projects. However, a delay or failure to complete this higher level can put more pressure on students.

Currently, there are several other difficulties encountered in the post-graduate period (master's and doctorate), in which they may be related to orientation, which includes the lack of communication between the advisor and the student, in addition to the absence of supervisors in institutions and institutions. in research labs (leaving their students alone), as well as supervisors' retirement, sabbaticals and vacation periods. Another factor related to the difficulties encountered in this study period, involves the ego of the supervisors who do not give a chance to hear and accept the opinions of the supervisors, thus causing the change of supervisors during the research and, thus, influencing the loss of motivation during the study. course period.

In addition, problems related to the line of research, such as the choice of the theme and the appropriation of the targeted content, including the subjects taken to complete the required credits, which sometimes are from different areas of the basic training, can contribute to the difficult understanding and course and research. According to Silva [3], “the quality of teaching at the university must result in quality of life, a premise that cannot be ignored”, as the university institution assists in the quality of life of all those involved, directly or not with the university.

Therefore, these notes are currently being discussed a lot, and studies related to postgraduate studies are quite extensive.

However, the greatest concentration of themes is directed to the discussions of public policies of higher education, how the structure of the programs is organized, the creation of new courses, the mapping of

diploma indexes and the evaluation of courses, examples of which are the studies by Cirani, Silva and Campanário [7]; Kornis, Maia and Fortuna [8]; Oliveira e Siqueira [9] and Tourinho e Palha [10]. However, there are still few that address the themes that relate the interest in the development of university careers, covering aspects related to the choice of courses, life projects, academic satisfaction and dropout [11]. In addition, the lack of discussions on the aspects related to the motivation to choose the topic, difficulties faced in the course subjects, student-tutor relationship or colleagues, and other factors that can directly influence the research in the academic life of graduate students graduate programs still need to be discussed with greater vigor.

Therefore, this study sought to investigate the main problems encountered by students when taking courses during the master's and doctorate courses, especially in the electricity engineering course, addressing the main decision-making to stand out from the problem situation.

2. Materials and methods

2.1 Participants and Place of Collection

In this study, we conducted a qualitative research based on information reported by students in the form of a questionnaire. The study was carried out on the main campus of the Federal University of Maranhão - UFMA, city of São Luís, state of Maranhão, Brazil, during the second semester of 2017 and was aimed at masters and doctoral students enrolled in the Postgraduate Course in Electricity Engineering. This Postgraduate Program started officially in 1995, having been recognized by CAPES in master's and doctoral courses in the areas of concentration: Automation and Control, Computer Science and Energy Systems. Up to the date of the research, 45 students were enrolled in the master's course and 35 students in the doctoral course. A total of 15 (18.75%) students participated, of which eight were enrolled in the master's course and seven enrolled in the doctoral course. The survey was conducted in October 2017 at the participants' own University.

2.3 Participants and Place of Collection

An evaluation questionnaire was developed by the research team and administered among the students. The data for this study were collected individually through printed questionnaires. The questionnaire consisted of two scales: (1) a learning competence scale, which comprised 6 items in order to investigate the demographic data and the scientific literacy of the students; and (2) a scale of the difficulties found in the course subjects and self-regulated learning, comprised of 4 questions capable of examining the students' perceptions of preparation, the difficulties faced in the graduate courses and the solutions found to elucidate the difficulties faced.

2.3 Study Procedures

The collected data were obtained in an academic context. All participants were informed of the objectives of the study and that their participation was voluntary, in addition to guaranteed anonymity. All the questionnaires answered by the research participants were followed during the filling out as some guidelines, stimuli and questions asked by the participants in the discursive questions related to the

challenges encountered by the interviewees about the content covered in the discipline and the strategies used to help overcome such difficulties. Then the collected data were analyzed, formatting the results and analyzed using statistical calculations for the questionnaire questions through the interpretation of the answers.

4. Result and Discussion

The categorical characteristics of master's and doctoral students in the electricity engineering course are shown in table 1. Of the 15 students who participated in the survey, 66.7% were male, while 33.3% were female. Regarding the age group, 66.7% were between 24 and 29 years old, another 20% were between 30 and 35 years old, while 13.3% were older. In this way, it is clear that the relationship between men and women when choosing a postgraduate course in the exact field still exists a greater predominance of men, as well as the training public is made up mostly of young people. In this sense, Barbosa et al. [12] highlight that since the year 2000, graduate school has been increasingly attended by young students, indicating a direct transition from undergraduate to graduate school in an increasing way.

In relation to the basic training course, it is observed that only 26.7% of the interviewed students have a degree in the area of the postgraduate course they attend, while 73.3% are from related areas, such as computing, mathematics, physics, chemistry and other engineering, in which the majority (86.7%) studied at public institutions (federal or state). With the expansion of graduate courses in Brazil, Schwartzman [13] informs that it is not easy to know exactly the number of students enrolled in graduate school as a whole in the country, however 54% of students enrolled in the *lato sensu* modality are in private institutions, while *strictu sensu* graduate courses are mostly enrolled in public institutions.

Table 1 . Category of graduate students in electricity engineering (UFMA)

Characteristics	%	Frequency (n = 15)
Sex		
Male	66,7%	10
Female	33,3%	5
Age Range		
24 a 29 years	66,7%	10
30 a 35 years	20,0%	3
36 a 40 years	13,3%	2
Graduation course		
Electrical Engineering	26,7%	4
Mechanical Engineering	13,3%	2
Mechatronic Engineering	6,7%	1
Food Engineering	6,7%	1
Computer Engineering	6,7%	1
Computing	13,3%	2
Physics	6,7%	1

Mathematics	13,3%	2
Chemistry	6,7%	1
Type of Educational Institution		
Public	86,7%	13
Private	13,3%	2
Graduate (current)		
Master	53,3%	8
PhD	46,7%	7
Works		
Yes	33,3%	5
No	66,7%	10

Given the interviewees, 53.3% are studying for a master's degree, while 46.7% are studying for a doctorate in electricity engineering. The majority (60%) of these students say that they are in the course because it is their area of interest, 20% say that the postgraduate course in which they are taking is a personal achievement, another 13% say that there was no other course related to the training area and therefore opted for electricity engineering, while only 7% reported that it is a favorable area for the job market, since there is a narrowing of job opportunities, however, the expansion of schooling "becomes a possible choice among young people who are about to finish their undergraduate courses "[14]. In addition, only 33.33% conciliate work with postgraduate studies, with 66.7% receiving scholarships from an institution that fosters research and scientific development.

Figure 1 shows the list of the main difficulties found in the subjects, reporting the level of learning, the methodologies addressed by the teachers and the main solutions found to elucidate the problems of learning in the classroom.

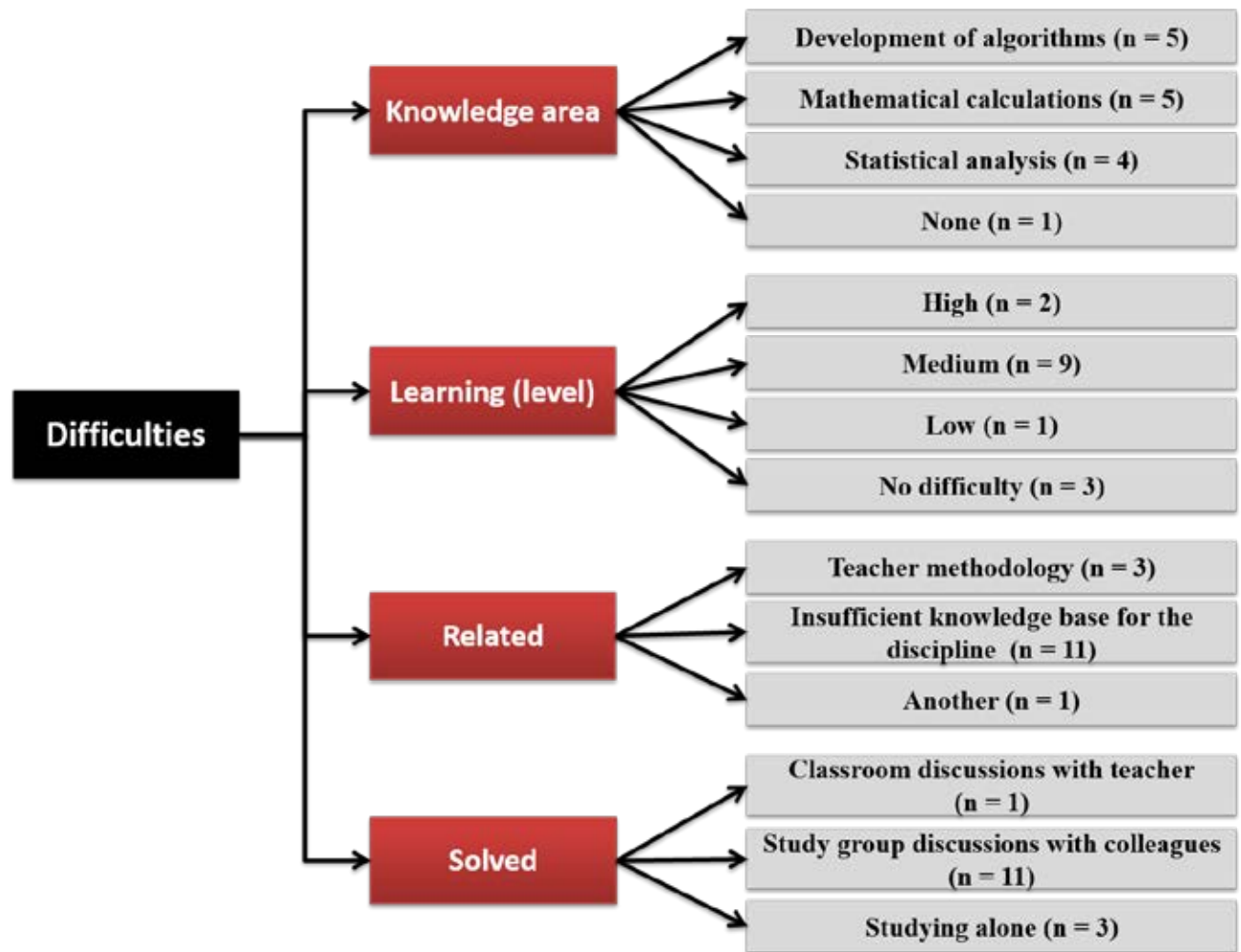


Figure 1 - Scheme of the relationship between the categories of difficulties in the disciplines

When asked about the difficulties found in the subjects studied, 66% reported that the subjects related to the development of algorithms and mathematical calculations have a higher degree of complexity of understanding, and for this reason, they become the subjects with the greatest option of difficulty, another 27% state that the greatest difficulty found is in the disciplines with a statistical analysis approach, while only one student said that there is no difficulty in relation to the disciplines. In this sense, the subjects most mentioned in the research as being the most complex to understand, during the course of the course, were Stochastic Processes and Non-Linear Systems Optimization. In fact, these subjects present an overload of mathematical calculations and complexity of algorithms, normally, the student needs a deep base of statistics and mathematical models, in which, many times, these contents are seen only in engineering courses. However, students who have basic training in another area experience difficulties in understanding in the first contact with the discipline, and normally the teacher leaves the responsibility for the student to seek knowledge alone.

However, with regard to learning difficulties in the subjects, the majority (60%) of the students reported that they are at a level considered satisfactory, in other words, they are at an average level of understanding of the contents, while only 27% reported there is little or no learning difficulty, in which it is observed that these students have training in mathematics or electrical and mechanical engineering courses, these courses

have a very deep curriculum in calculations and statistics, and thus, these students tend to understand better the calculations covered in the disciplines.

Another important aspect to mention is the methodology addressed by the professors, normally the graduate professor only presents the content in class, understanding that master's or doctoral students need to search for their answers alone, in articles, books, internet or journals. The methodology employed prepares the student to be a researcher, and there is not always the need for the teacher to fully untangle the content. In this sense, the students reported in the research that the greatest difficulty found in understanding the disciplines is not related to the teacher's methodology (20%), but to the insufficient knowledge base for the discipline (73%), which may be the reflection of poor training in the undergraduate course or even the lack of time for dedication of studies, linked by external work. Bujdoso [15] pointed out in his work some less pleasurable aspects of master's students in Civil Engineering, Medicine and Law courses, in which they highlighted the disciplines, the qualification exam, the lack of time, the accumulation of tasks, the waivers imposed by the master's and the concern about meeting the deadline as a key factor for the difficulties encountered in graduate school. In addition, it informs that the search for the master's degree is related to the supply of deficiencies detected during graduation.

However, when asked if the subjects taken were directly associated with their research, 33% revealed that there was no association with their research topic and the subjects taken were to fulfill mandatory credits for training in the course, while 27% stated that all disciplines have been or will be used in your research, so they are necessary to complement knowledge in order to develop your work plan. But not all subjects are necessary, according to the reports of 40% of the investigated students, they inform that depending on the research topic, there are often lack of subjects in the postgraduate course in which they are taking and that sometimes it is necessary to seek more knowledge in other postgraduate courses to complement the necessary knowledge. In this sense, 53% of respondents intend to seek other subjects in other graduate programs, while 47% reported that they are satisfied with the subjects taken.

Another important point is the relationship of the research with the basic training of graduate students, 67% of the students questioned affirm that there is no direct relationship with their research to basic training, and being the biggest challenge they found, reporting that the acquisition of the knowledge different from their basic training requires time and a lot of dedication, thus constituting the biggest problem to carry out their research. But this was already expected, since most of the students in this study are from areas other than the electricity engineering course, but related areas. For this reason, there are difficulties in triggering your research or the development of disciplines in the post-graduate course.

To solve the problem situation of the difficulty of understanding the subjects, mainly of students who have training in other areas of knowledge (or similar areas), they proposed discussions in study groups with colleagues (73%), who are usually the same research laboratory, while 20% solved their difficulties by studying alone, and only 7% went to the teacher to answer questions and ask necessary questions about the content covered in the classroom.

The *stricto sensu* postgraduate course is considered a difficult construction, which needs dedication and a basis for the development of knowledge throughout the years of study, this generates anxiety and anguish to develop your research, but which is rewarded by maturity, meetings and positive expectations.

5. Conclusion

Our findings provide some insights into the difficulties faced by graduate students in electricity engineering when taking the program subjects, especially those who have no basic training in electrical engineering, but in related fields. In this way, he was able to observe the influences caused by the difficulties linked by engineering master's and doctorate students to the progress of their research topics, as disciplines unrelated to research, but that needed to be studied in order to comply with the protocol in the post-graduate program. University graduate.

This study was based on a diverse sample of students with different degrees to understand how these difficulties can affect the research of master's and doctoral students in electricity engineering.

It was observed that the greatest difficulty of students is related to disciplines with deep calculations of mathematics and complexity of algorithms, in addition, most students do not complain about their level of learning and report that they have a medium level of knowledge, but that can improve with a little more effort. His biggest concern when attending a postgraduate course was the lack of basic training to attend the disciplines. However, the solution found by the students themselves was to meet in a study group to elucidate the difficulties faced, as the group study strengthens learning with a distribution of knowledge.

As future work, we intend to expand our analysis proposal, interviewing more students and collecting historical data to associate with the identified difficulties. We hope that our results can help teachers to identify the students' learning deficit related to the subjects taken, being able to outline new strategies to elucidate the problems faced by master's and doctoral students, thus reflecting on the development of the researches worked on.

6. Acknowledgement

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Are we teaching patient safety to our academics? The experience of a course in the countryside of São Paulo

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Abstract

Nowadays, one of the biggest concerns in the health care field is centered on patient safety with a primary focus on the errors of the medical team. In 2009, WHO created a guide for universities aimed at patient safety in which it suggests new ways of approaching patients, thus improving the quality of trained professionals and dramatically reducing adverse events. There is a consensus that there is a restructuring of a system that currently presents serious failures that result in permanent harm to the objective of the medical team, which is the well-being of the patient, as well as an efficient inspection of the Decree Number 529/13 in Brazilian universities. It is in this context that the present work proposes to highlight the gap currently existing in Brazilian universities, based on the sampling of one of them, located in the countryside of São Paulo. Prospective intervention study using a quantitative and qualitative methodology, carried out in two stages: analysis of teaching plans and application of the quantitative and qualitative perception instrument to professors. Was not found in the teaching plans of the modules of the medical course at Universidade Brasil the concept of patient safety. Semi-structured questionnaire was answered by 47 teachers, 11 (23.4%) of the basic cycle and 36 (76.6%) of the clinical cycle and internship. Professors at Universidade Brasil consider that the themes are extensively addressed in their classes, although they are not described in most of the modules' teaching plans. Medical education in Brazil needs a qualitative leap, and that leap is certainly in the area of patient safety. In the context of implementation, the multiprofessional edition of the World Health Organization (WHO) patient safety curriculum guide can be used as guidance and a current and very promising development in relation to the acquisition and examination of the skills necessary for safe care for the patient is the establishment of interprofessional training wards. Considering that medical students are the future driving force of change in health care, it is necessary to encourage quality improvement and patient safety education to offer the patient-centered. The graduation, at any time and since day one, is the moment of formation, therefore favorable to the teaching of this topic for students in the health care field, and all teachers should be involved with these contents.

Keywords: Patient safety, Medical education, Curriculum, Undergraduate, Teaching

1. Introduction

1.1 Patient safety historic background

The concept of Patient Safety (PS) has been built throughout history. The literature presents from more remote references such as the philosopher Hippocrates, going through the nineteenth century in the experiences of Florence Nightingale (Carraro, 2013) or the works of Semmelweis, Codman and Donabedian (Trindade & Lage, 2014; Nascimento & Draganov, 2015). However, its peak was in the twentieth century after 1986 with what happened in Chernobyl (Flin et al., 2006; Neto, 2006; Bueno & Fassarella, 2012; Paese & Dal Sasso, 2013; Corona & Peniche, 2015). All these facts have stimulated numerous researches which presented alarming data regarding PS. The reports of the Institute of Medicine (IOM), in the United States, with the publication "To Err is Human", and that of the International Consultative Group on Nuclear Safety (INSAG) were fundamental to create the concept of PS and also to

guarantee worldwide visibility (Neto, 2006; Bates, 2007; Bohomol & Ramos, 2007; Daud-Gallotti et al., 2011; Grigoletto et al., 2011; Rigobello et al., 2012; Paese & Dal Sasso, 2013; Oliveira et al., 2014; Corona & Peniche, 2015) so that in 1980, the Pan American Health Organization (PAHO) instituted measures to improve the assistance provided to patients (Bueno & Fassarella, 2012 ; Corona & Peniche, 2015) and in 2004 the World Health Organization (WHO) created the program The World Alliance for Patient Safety, with the objective to develop global policies to improve patient care (Scott et al., 2003; Neto, 2006; Grigoletto et al., 2011; Rigobello et al., 2012; Corona & Peniche, 2015). Soon after Brazil, founded in 2011, the Brazilian Institute of Patient Safety (IBSP), with the purpose of cultivating this concept, and since then has been developing numerous modifications such as the National Patient Safety Program (Ministério da Saúde, 2013), which in 2013 won the approval of the Patient Safety Protocols, which are being used until now (Miasso et al., 2006; Neto, 2006; Silva et al., 2007; Mendes et al., 2009; Reis et al., 2010; Vituri et al., 2011; Victora et al., 2011; de Faria & Cassiani, 2011; Bueno & Fassarella, 2012; Rigobello et al., 2012; Bathke et al., 2013; Ministério da Saúde, 2014; Nascimento & Draganov, 2015; Corona & Peniche, 2015; Barbosa et al., 2016).

1.2 Patient safety in the context of medical training

Nowadays, one of the biggest concerns in the health care field is centered on patient safety with a primary focus on the errors of the medical team, fundamentally on the figure of the doctor. According to the Code of Medical Ethics (Conselho Federal de Medicina, 2018) the causes of medical errors are based on three classic principles: that of malpractice, negligence and imprudence. However, studies like Cassiani's (2005) demonstrate that the range of errors that lead to impaired patient safety is much greater than imagined, pointing out numerous causes of failures that range from the wrong prescription to the patient's and/or doctor's lack of compliance to the indicated protocol.

Reason's "Swiss cheese" model (2000) discusses how the failure of the entire medical team leads to harm to the patient even though there is a common sense of promoting a cure. Reason's model clearly demonstrates this by making an analogy to Swiss cheese, which when viewed as a whole is smooth and linear, but when sliced it is possible to observe the holes, alluding to the existing failure in the system. These problems, as previously mentioned, are part of a domino effect and include the lack of attention to the patient, excessive workload, lack of communication between the team, problems in the work infrastructure, among others. In this context, Watcher (2013) reaffirms Reason's theory by reflecting on the need for a systematization of the health model, in which each one plays his part and function appropriately, reducing the number of medical errors.

Patient safety is a widely discussed subject and in order to understand how the errors mentioned above occur and what their outcomes are, it is necessary to understand some concepts proposed by WHO, in 2008, and reaffirmed by studies such as Neto's (2006), fundamental in the science of patient safety: incident is the event or circumstance that could have resulted, or did result, in unnecessary harm to the patient; risk is the likelihood of an incident occurring; near accident or near miss is the incident that did not reach the patient; incident without injury is the incident that reached the patient, but did not cause harm; adverse event is the incident that results in harm to the patient.

The patient's lack of security not only reflects harm to him but also to his family, in which two events

can be catastrophic: the psychological trauma of the adverse event and its sequels in that individual's life. Error is an innate characteristic of every human being, so prevention is necessary to reduce the rate of harm to the patient (Vincent, 2002).

In his text, Berwick (2009) questions medical care by giving simple examples of changes in conduct in situations where professional's empathy towards a patient can avoid adverse events. And although it is one of the biggest causes of harm to the patient, the failures of the medical team could be avoided if patient safety protocols were applied and, not less important, these themes were introduced in the universities in health care field courses.

Based on this premise, WHO, in 2009, proposed a guide for universities aiming at patient safety in which it suggests new ways of approaching the patient, thus improving the quality of trained professionals, drastically reducing adverse events. In this guide we find the themes that should be addressed in medical courses and the area of study in which they should be addressed, such as: the concept of patient safety, infection control, medication safety, teamwork and safe surgery, being inserted in areas such as ethics and bioethics, training in clinical skills and procedures, training in communication skills, microbiology, infectious diseases, pharmacology, interprofessional communication skills and urgency and emergency. Walton (2010) makes an excellent analysis of the WHO guide mentioned above, warning about the need for changes in medical education and the importance of having a booklet in which it explains the paths that universities around the world should follow in order to reduce the harm to the patient as much as possible.

In Brazil, in 2013, the federal government Decree Number 529 was established (Brasil, 2013), implementing the National Patient Safety Program, which discusses measures that must be adopted aiming at the well-being and protection of the patient. Among these measures, the implementation of patient safety in the curriculum of academic students in the health care field is included. From this Decree, in 2014, the Reference Document for the National Patient Safety Program of the Ministry of Health originated, containing all epidemiological data as well as protocols and guidelines that must be followed by Brazilian health centers and universities was originated.

The concern on PS also involves the training policy in medical residency. Since 2011, the Accreditation Council for Graduate Medical Education (ACGME) has implemented workload restrictions for residents as it understands the effects of work overload on residents' education, residents' quality of life, cost and, most importantly, on patient safety (Lee, 2015).

Therefore, it is a consensus that there is a restructuring of a system that currently presents serious failures that result in permanent harm to the objective of the medical team, which is the well-being of the patient, as well as an efficient inspection of the Decree Number 529/13 in Brazilian universities. It is in this context that the present work proposes to highlight the gap currently existing in Brazilian universities, based on the sampling of one of them, located in the countryside of São Paulo.

2. Methodology

2.1 Design Study

This is a prospective intervention study using a quantitative and qualitative methodology.

2.2 Data collection and Study participants

Study was carried out in two stages.

2.2.1 Analysis of Teaching Plans

The teaching plans for undergraduate medicine at the Universidade Brasil, Campus Fernandópolis were analyzed, seeking to identify the presence of a module called "Patient Safety". We also sought to find out if the other modules had topics related to patient safety, such as: concept of patient safety, infection control, medication safety, teamwork and safe surgery.

2.2.2 Application of the quantitative and qualitative perception instrument

Semi-structured questionnaire developed by the researchers. applied to 47 of the 82 professors at Universidade Brasil, to assess the presence of patient safety contents taught in class and their absence in the teaching plan and the knowledge about them. The professors were informed about the research objectives and those who agreed, signed the Free and Informed Consent Form.

2.3 Survey instruments

Developed based on the topics that should be addressed in the curriculum of the WHO medical student (2009), with cultural adaptation, involving dimensions (domains) to be investigated, such as: concept of patient safety, infection control, medication safety, teamwork, safe surgery. The instrument was built on the Likert model. The teacher responded to the assertions on a scale that ranged from "strongly agree" to "strongly disagree". In addition to responding to assertions, the teacher could comment if he wanted.

2.4 Data analysis

The exploratory analysis of the data included mean, median, standard deviation and variation for continuous variables and number and proportion for categorical variables. The normal distribution of continuous variables was assessed by asymmetry, kurtosis and the Kolmogorov-Smirnov test. Comparison of the score of statements related to patient safety, on a Likert type scale, between two groups (basic and clinical cycle) was performed using the Mann-Whitney test. Correlation analysis between statements was performed using Spearman's correlation coefficient. Statistical analysis was performed using IBM-SPSS Statistics version 24 (IBM Corporation, NY, USA). All tests were two-tailed and P values <0.05 were considered significant.

2.4 Ethical considerations

Approved by the Research Ethics Committee of the Universidade Brasil (CEP-UB), under CAAE n. 67265717.7.0000.5494.

3. Results

3.1 Analysis of Teaching Plans

The analysis of the teaching plans that make up the curricular matrix of the medical course at Universidade

Brasil revealed the lack of a module entitled “Patient Safety”. 24 teaching plans of the modules that make up the curricular matrix of the medicine course at the Universidade Brasil were analyzed. The topics sought were: concept of patient safety, infection control, medication safety, teamwork and safe surgery. The results found are described in Table 1.

Table 1. Topics on the theme of Patient Safety, found in the teaching plans of the modules that make up the curricular matrix of Universidade Brasil, 2018.

Topics	Subject	Found modules	Semester
Concept of Patient safety	Not found	Not found	Not found
Infection control	- ü Hand Hygiene - ü Equipments for individual safety - ü Asepsis and antisepsis - ü Disinfection - ü Waste management - ü Infection handling	- ü Fundamentals of Nursing I and II - ü Integrated clinical case study I	- ü 1st semester - ü 2nd semester - ü 7th semester
Medication safety	- ü Preparation of medications - ü Administration of medications - ü Abilities to apply medications - ü Safe medication - ü Medication routes	- ü Fundamentals of Nursing II - ü Basis of therapy	- ü 2nd semester - ü 6th semester
Teamwork	Teamwork	Collective Health	4th semester
Safe Surgery	- ü Surgical team - ü Surgical technique - ü Organization of surgical materials - ü Safe surgery	- ü Surgical technique I and II - ü Surgery	- ü 5th semester - ü 6th semester - ü 9th semester - ü 12th semester

Of the five topics described above by the WHO and the Ministry of Health, only one was not found in the teaching plans of the modules of the medical course at Universidade Brasil, which is related to the concept of patient safety. All other topics were found in the teaching plans of the curricular matrix that make up the course sequentially from the first to the last semester. It is worth mentioning that the proposed topics were addressed in a range of subjects as seen in Table 1. The data from the same confirm that even though there

is no module called “Patient safety”, the vast majority of themes were addressed in the classroom and that the number of modules that describe subjects related to the theme of patient safety is still small, which does not mean that they are not addressed, but that the theme is not the main subject of the classes.

3.2 Analysis of the Results of the Perception Instrument Applied to Professors

3.2.2 Quantitative data

Overall, 47 teachers answered the semi-structured questionnaire and were included in the study. Of these, 11 (23.4%) were teachers of the basic cycle and 36 (76.6%) of the clinical cycle and internship. Table 2 shows the demographic data of the included participants.

Table 2. Demographic data of the research participants, Universidade Brasil, 2018.

	N = 47
Age	38.5 (26 – 63)
Gender, n (%)	
Male	32 (68.1)
Female	15 (31.9)
Cycle, n (%)	
Basic	11 (23.4)
Clinical + internship	36 (76.6)

Continuous variables are described in median (variation); categorical variables are described in number (percentage).

The statements regarding patient safety were answered by the professors participating in the study on a Likert-type scale, with the following score: 1 (strongly disagree); 2 (disagree); 3 (neutral); 4 (agree) and 5 (strongly agree). The general results of the 15 statements are shown in Table 3.

Table 3. General results of responses to statements (A) from 1 to 15, on a Likert-type scale. n = 47, Universidade Brasil, 2018.

Assertions	Mean	Median	Standard deviation	Variation
In my classes, I address questions about ...				
A1: ... the concept of patient safety.	4.47	5.0	1.09	1 – 5
A2: ... infection control.	4.53	5.0	0.95	1 – 5
A3: ... medication safety.	4.38	5.0	0.99	1 – 5
A4: ... safe surgery.	3.94	5.0	1.27	1 – 5
A5: ... teamwork.	4.66	5.0	0.73	1 – 5
A6: In my classes, I offer students complementary reference on patient safety.	3.43	4.0	1.25	1 – 5
A7: Patient safety is a difficult theme to address.	2.51	2.0	1.40	1 – 5

A8: Patient safety is a difficult theme for students to accept.	2.49	2.0	1.41	1 – 5
A9: In my evaluations there are subjects related to patient safety.	3.49	4.0	1.38	1 – 5
A10: I should address the theme of patient safety more often in my classes.	3.89	4.0	1.06	1 – 5
A11: I know the WHO guide for health care field academic students on patient safety.	3.02	3.0	1.42	1 – 5
A12: I know the federal government Decree Number 529/13 on the National Patient Safety Program.	2.91	2.0	1.37	1 – 5
A13: It is extremely important for medical students to learn about patient safety.	4.96	5.0	0.20	4 – 5
A14: There is a dearth of literature available in the area of patient safety.	2.83	3.0	1.26	1 – 5
A15: The university should offer me workshops or courses to improve my knowledge about patient safety.	3.53	4.0	1.25	1 – 5

The first five statements of the questionnaire referred to the five themes proposed by the World Health Organization (WHO) on patient safety: concept of patient safety; infection control; medication safety; safe surgery and teamwork. In order to verify the approach of these themes among teachers, the answers were initially grouped into “address” (4 and 5) and “do not address” (1 and 2), excluding neutral responses. Figure 1 demonstrates the teachers' approach to the five themes.

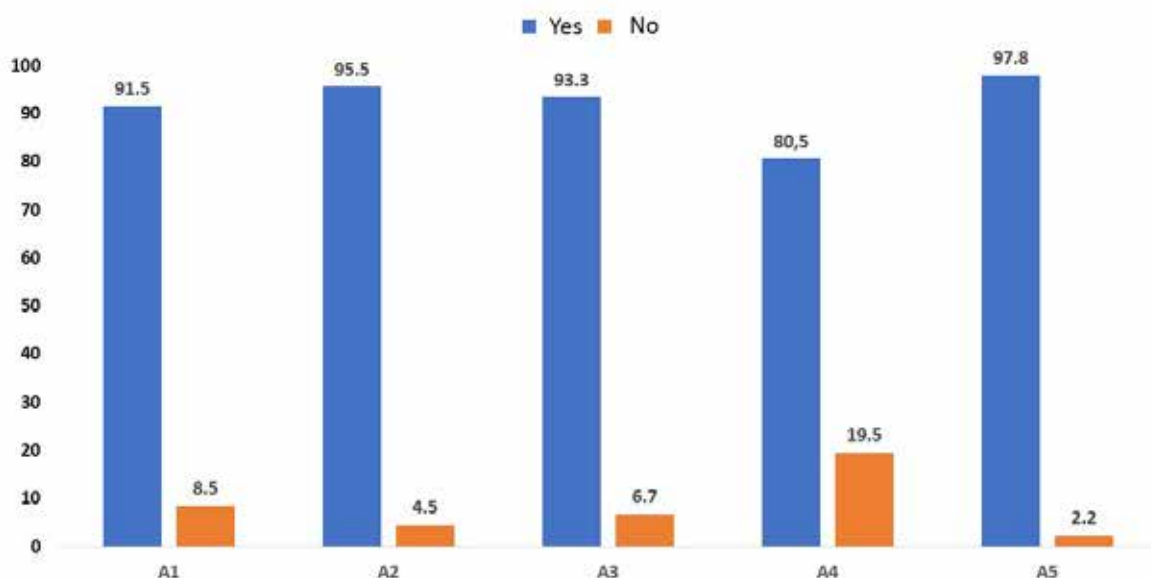


Figure 1. Distribution of the approach to the five themes proposed by WHO on Patient Safety.

WHO, World Health Organization; A1: Concept of patient safety; A2: infection control; A3: medication safety; A4: safe surgery; A5: teamwork

Thus, professors at Universidade Brasil consider that the themes are extensively addressed in their classes, although they are not described in most of the modules' teaching plans.

It was investigated whether the approach to the theme in class (A1) was associated with self-perceived need for a greater approach (A10) and there was no association between the two variables ($p = 0.43$).

Two statements addressed the teacher's degree of knowledge about the WHO guide for academic students in the health care field and about federal government Decree Number 529/13 on the National Patient Safety Program. The answers are shown in Figures 2 and 3.

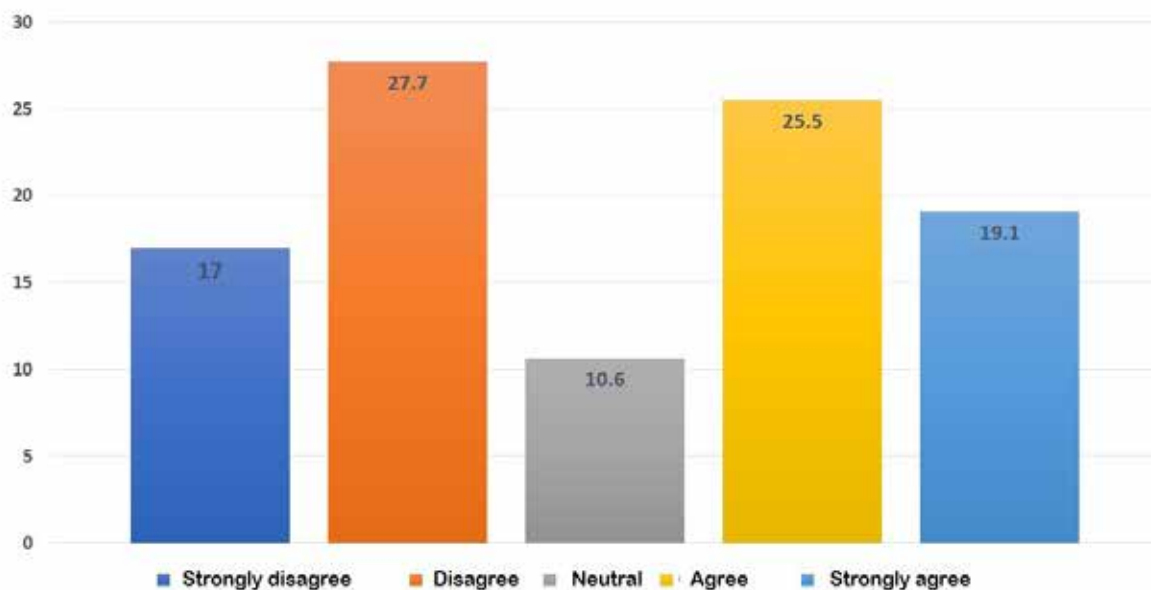


Figure 2. Distribution of responses to the statement related to the teacher's knowledge about the WHO guide for health care field academic students on Patient Safety.

WHO, World Health Organization

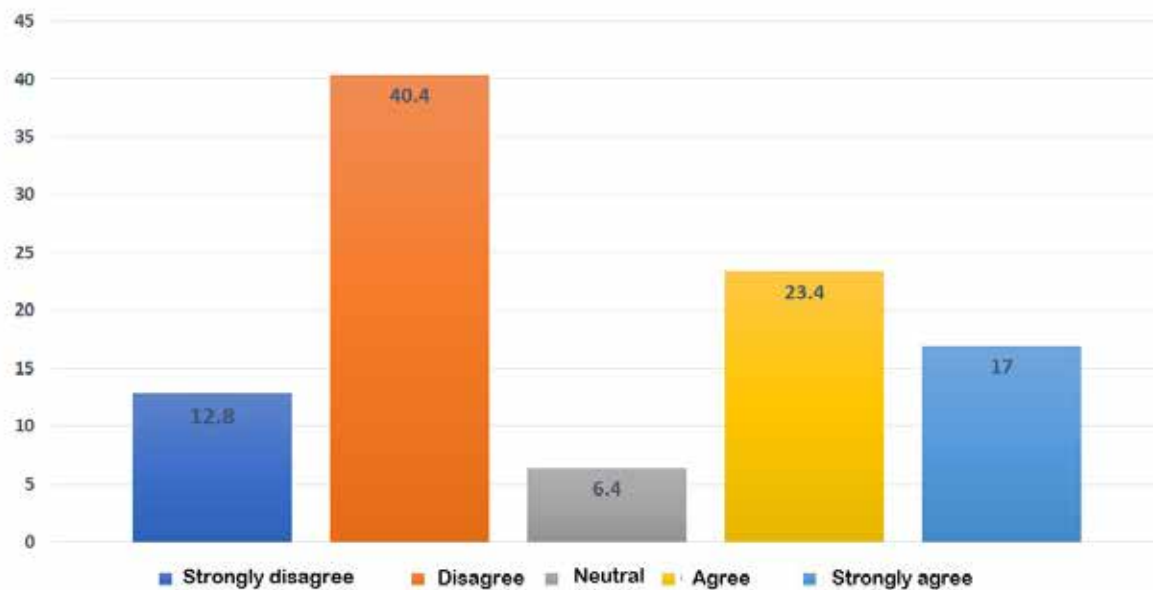


Figure 3. Distribution of responses to the statement related to the teacher's knowledge about federal government Decree Number 529/13 on the National Patient Safety Program.

When investigating a possible correlation between the approach of the theme in classes (A1) and the approach in tests (A9), by the teacher, a positive correlation was found between the two questions. Likewise, a positive correlation was found between the dearth of literature and the need to offer courses at the University on the theme of patient safety (statements 14 and 15), as shown in Table 4.

Table 4. Analysis of correlation of statements related to the dearth of literature and the need for courses to be offered by the University, in the theme of Patient Safety.

	Coefficient ρ [*]	P-value
A1 and A9	0.378	0.009
A14 and A15	0.379	0.009

^{*} Spearman correlation.

Hereafter, the results were compared between professors of the basic and clinical cycle / internship for the five themes proposed by WHO. There was a significant difference in statement 4, obtaining a lower score on the Likert-type scale for professors of the basic cycle, showing more disagreement with the statement “in my classes I address questions about safe surgery” (Table 5).

Table 5. Comparative analysis of responses between professors in the basic and clinical cycle/internship.

	Ciclo		P value
	Basic N = 11	Clinical/Internship N = 36	
A1 (concept of patient safety)	4.27 ± 1.42	4.53 ± 0.97	0.99
A2 (infection control)	4.36 ± 1.29	4.58 ± 0.84	0.91
A3 (medication safety)	4.36 ± 1.02	4.39 ± 0.99	0.95
A4 (safe surgery)	3.09 ± 1.51	4.19 ± 1.24	0.03
A5 (teamwork)	4.82 ± 0.40	4.61 ± 0.80	0.61

Continuous variables are described in mean ± standard deviation.

Items related to the difficulty of approaching by the professor, acceptance by students and the professors' behavior in including subjects of patient safety in the assessments, as well as in providing complementary references in classes (statements 6 to 9) were also evaluated. There was a tendency to perceive that the theme of patient safety is a difficult theme for professors of the basic cycle, although the difference has not reached statistical significance ($p = 0.08$), as well as for the other items.

The last statements in the questionnaire were related to the behavior of the professor in relation to the theme, the relevance of the theme and available literature, as well as the role of the university in providing workshops or courses to professor's improvement in patient safety. The results showed that there was no difference in responses between professors in the basic and clinic/internships.

4. Discussion

The lack of a module entitled "Patient Safety" is no different from most medical courses in Brazil. In a search of 75 resumes available on the internet, in none of them was found a discipline and/or module with that name. This does not mean that the contents are not taught, but that they are not grouped in a single discipline. The results shown in Figure 1 reinforce the great importance that the aforementioned themes have in a medical course and due to the multiprofessional approach in that course, which includes several professionals such as nurses, psychologists, physiotherapists, technicians and nursing assistants, among others. For this reason, a major approach to the subject in medical training is necessary. On the other hand, the theme of safe surgery appears as the least mentioned since it is a more specific area of medicine where only a portion of the modules go deeper.

Although the theme teamwork is the subject most exposed by professors among the topics of patient safety, it does not help much since, despite teaching what a team is, concepts of what successful teams are lacking, since, in medicine, emergency situations are experienced, with a high level of stress and which require good results, where the skills that allow professionals to satisfactorily manage the entire work process, especially the decision-making process, are so that the resulting decisions are appropriate and timely in terms of safety and precision (Vincent & Coulter, 2002).

From the data presented in Figure 3, it is clear that there is a need for greater disclosure of these

regulations to professors. The positive correlation between the dearth of literature and the need for courses offered by the University on the theme of patient safety (Table 4) show that the availability of adequate literature, per se, would already be a great stimulus to professors and one of the ways of training professors to address the themes of patient safety that the university could offer, although most professors agree that there is enough literature, but reiterated that what is missing is a deepening and detailing of professors on the subject. The ability of health professors to design, teach, evaluate and improve relevant curricula is vital for teaching any skill (Ray et al, 2019) and the patient safety policy is no different,

The significant difference between the approach of the theme in classes and in the evaluations (Table 4), raises the question of the role of evaluations as a resource to provide greater dedication of students to the theme. Inadequate feedback and communication about errors and lack of open communication are the main challenges for patient safety in the provision of care and since academic life this has been important in order to meet the need for a modified approach and attention to context, designing interventions aimed at improving the safety culture (Zhong et al., 2019).

Medical education in Brazil needs a qualitative leap, and that leap is certainly in the area of patient safety. In general, in teaching hospitals, where students of different levels and courses are learning, adverse error rates may be higher, but these hospitals play a social role, within the context of education and health care, of inestimable relevance. For this reason, an intensive approach to patient safety themes during graduation is extremely important. In the national literature, of the 1021 articles published in the Brazilian Journal of Medical Education (RBEM) (Scielo, 2019), the most important Brazilian magazine that deals with medical education, divided into 54 editions from 2006 (Volume 30, issue 1) until 2019 (Volume 43, issue 3), none addresses the theme “Patient Safety” in a specific way or as a main theme. We found 5 articles related to patient safety, 4 of which having medical error as the main thematic, however the term “patient safety” is not mentioned in these texts. Only the article “Medical Education in Modern Times” (Lobo, 2015) mentions “patient safety” on one occasion when referring to the hospital as a professional training field also inserted in the context of medical error. In the international scenario, in recent years, teaching initiatives on patient safety have increased significantly, however, they are not yet widely distributed in German-speaking countries or in Europe (Opitz et al., 2020).

In the context of implementation, the multiprofessional edition of the World Health Organization (WHO) patient safety curriculum guide can be used as guidance and a current and very promising development in relation to the acquisition and examination of the skills necessary for safe care for the patient is the establishment of interprofessional training wards. Meanwhile, there are clearly defined strategies for integrating the topic of patient safety in the curricula of health professionals. On the way to a successful restructuring of curricula, including the necessary skills and behavioral changes of students, however, relevant support from the administration of colleges and teaching hospitals is essential.

Considering that medical students are the future driving force of change in health care, it is necessary to encourage quality improvement and patient safety education to offer the patient-centered, safe, evidence-based, and high-value care patients deserve, offering medical students the opportunity to obtain the knowledge and experience necessary to participate meaningfully in this profession, now and throughout their careers (Bartlett & Huerta, 2018).

5. Conclusion

Teaching about patient safety is still given in a fragmented way, valuing the clinical skills such as diagnosis and treatment of the disease, post-treatment, surgical procedures and monitoring. As a recent movement, teaching about patient safety is confronted with training proposals based on traditional structures, centered on disciplines and specific training, and it is still undervalued.

Present studies recommend that teaching on patient safety is included in a transversal axis, allowing an interdisciplinary and transdisciplinary approach, since some successful experiences point to the success in the development of interprofessional skills for students of different undergraduate courses in the health care field, using quality improvement methods to improve patient-centered care (Davis et al., 2020, Sanko et al, 2020).

No distinction should be made in relation to the timing of the course for teaching this subject. For the student just starting a higher education course in the health care field, no specific knowledge of the professional skills that make up the expected profile of this professional is recommended. Thus, graduation, at any time and since day one, is the moment of formation, therefore favorable to the teaching of this topic for students in the health care field, and all teachers should be involved with these contents.

6. Final considerations

It is necessary to invest tirelessly on the undergraduate student, so that, during their training, they acquire competence to perform an expected procedure in their professional practice, but without forgetting the necessary emphasis on the practice of patient safety, promoting a change in teaching: from the action paradigm, which determines to adopt this or that patient safety measure, according to the procedure or diagnosis in question, for the “philosophy of health practices” paradigm, which presupposes the performance of any procedure from the adoption of these measures.

Interprofessional education in systems-level approaches can improve patient safety and curricular efforts in interprofessional education, collaborative practice and patient safety should be guided by these results.

Documentary analysis was the strategy chosen, based on the content written in the formal curriculum, described in the teaching plans, and this presents itself as a limitation, since the real and hidden curricula, also used by teachers, were not studied.

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The Use of Vitamin D in The Infectious Process in The Hospital Period in Childhood Effective?

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ABSTRACT

Goals: To verify whether the use of Vitamin D as parallel therapy to hospital and drug treatment can be effective in the process of infectious reduction in hospitalized children. **Data source:** This study is a systematic review and meta-analysis of randomized controlled trials, published between 2011 and the first quarter of 2019, in the Cochrane Library, Medline, US National Library of Medicine and the National Institute of Health (PubMed), Literature databases. Latin American and Caribbean Health Sciences (Lilacs), Scopus and Web of Science. The studies were scored by the Down and Black scale associated with the quality assessment method according to the Cochrane criteria (RCT). **Summary of the data:** Of the 1475 studies, 09 were included. There is a direct relationship between Vitamin D level and mortality rate in hospitalized children with infections. **Conclusion:** This study highlighted that the vitamin D deficiency in children under serum analysis during hospitalization triggers severe immunological changes.

Keywords: Vitamin D, Deficiency, Supplementation, Pediatrics, Hospitalization.

1. INTRODUCTION

Improvement in survival of hospitalized children and critics infected by viruses or bacteria in the immune system in the hospital care and care process has been focused on the benefit of adjunctive therapies such as Vitamin D [1,2]. It is recognized that Vitamin D deficiency is common in critically ill hospitalized children, especially in intensive care [6,7]. Vitamin D is essential in bone structure and ideal in cardiovascular system and innate immune function [32]. Vitamin D deficiency has been associated in the last decade with an increased risk of progression of infectious diseases in the hospitalization process

[7-11]. Patients with levels of 20 ng/ml are usually categorized as hypovitaminosis D and treatment is started in children to prevent complications such as rickets [14-18]. Vitamin D deficiency is suggested by decreased Vitamin D intake and decreased sun exposure in about 60% of Brazilian children and the Brazilian child population has developed low Vitamin D (25(OH)D (<20 ng) levels/ml)[30,31] characterizing an epidemiological indicator in 15% with Vitamin D deficit in the Brazilian child population[18-21] this percentage increase in Vitamin D insufficiency in children has alarmed Brazilian health professionals even though others have questioned the clinical importance of Vitamin D insufficiency [22].

Increased Vitamin D deficiency has been associated with viral and bacterial respiratory infections and especially sepsis in children [24-26]. Vitamin D supplementation (1200UI) in the winter period has shown a marked decrease in the infectious process of influenza in some countries [27, 42] it has been previously shown that this deficit is related to the metabolism of Vitamin D (25 (OH) D) which produces hCAP-18 catelicidine an antimicrobial peptide [14-37]. Children in the hospitalization process under severe conditions such as sepsis have lower Vitamin D levels and are usually associated with lower catelicidine levels. [34, 37].

Hospitalization has generally been associated with higher levels of severely admitted illness in intensive care units (UTI) [22-38]. Low levels in the Vitamin D pre-hospitalization process and during admission to intensive care units are associated with short- and long-term causes characterized by mortality or bacteremia in children with severe conditions [22-30]. For this reason, this study aimed to verify whether the use of Vitamin D as a preventive therapy can reduce the infectious process in critically ill hospitalized children.

2. METHODS

2.1 PROTOCOL – This review was registered for publication in the International Prospective Register of Systematic Reviews - PROSPERO whose code was: CRD42019121732.

2.2 ELIGIBILITY CRITERIA – Eligible studies were considered randomized controlled trials that compared the use of Vitamin D in the infectious process in children in hospital treatment. The result of interest was the effect on the immune system through the clinical improvement of the child according to the Vitamin D supplementation dosage in the hospitalization process.

2.3 INFORMATION SOURCES – The research was conducted at the Cochrane Library, Medline Library, US National Library of Medicine and the National Health Institute (PubMed), Latin American and Caribbean Health Sciences Literature (Lilacs), Scopus, Web of Science, and Scientific Online Library (SCIELO). The latest survey was conducted in February 2019.

2.4 SEARCHS STRATEGIES – We use the following strategy for US National Library of Medicine and the National Institute of Health (PubMed) "Vitamin D" [MESH] or "Vitamin D Deficiency" AND "Infection" [MESH] AND "Child" OR "Pediatrics" [MESH] OR "Child" AND "Hospitalization" OR "Inpatient" [MESH] OR "Supplementation AND Vitamin D". Variations of these strategies were used according to other sources required on certain platforms.

2.5 STUDY SELECTIONS AND DATA COLLECTION – Five researchers (E.M.R, M.D.d.L, G.G.F, J.E.C.G, C.A.S). Disagreements were resolved by consensus by a third reviewer (V.A.d.N). E.M.R performed data extraction and M.D.d.L confirmed extraction. For duplicate studies only the pre-cross-over result was included to eliminate the risk of biasing the residual effects of the specific methods used. A data extraction protocol was designed to collect relevant information from the studies used in this systematic review and meta-analysis including country, population sampling type, study design, Vitamin D Blood Serum dosage and key results. Some authors had to be contacted in order to obtain relevant information not included in the published studies.

2.6 QUALITY ASSESSEMENTS – This systematic review and meta-analysis included only studies that had comparison groups without systematic differences between the analyzed groups. Dosing in the Vitamin D supplementation process was considered randomized to the method, an indicator of high-quality study. If the groups were formed by other dosing means in Vitamin D supplementation, the baseline dose characteristics (time and dosage) were evaluated to determine if there was selection bias which could favor any group. The study that did not meet quality control according to the established criteria was not included in this systematic review and meta-analysis. A review of the follow-up procedures in the Vitamin D supplementation process was performed at random to assess whether there was any performance bias in the included study. Blinding of participants in the groups was considered for evaluative quality of the studies, as these procedures are viable in experimental research.

2.7 DATA ANALYSIS – The primary outcome was standardization of Vitamin D dose differences in the supplementation process. For a better interpretation of dose-related efficacy in the Vitamin D supplementation process in hospitalized children, odds ratios were used (OR). The meta-analysis was performed by the Mante-Haenszel random effects model for each outcome variable (Vitamin D3 supplementation, clinical improvement (humoral response) and were presented with a 95% confidence interval (95% CI). Results heterogeneity was estimated by I^2 and publication bias risk tests were assessed by inspection of the asymmetric plotting funnel.

Table 01: Main features of the included studies.

Article Identification	Study Identification/ Country Year	Study Design	Population Sampling	Average Levels in Vitamin D Serum	Main Results
A	Rey C et al./Espanha/2015.	Randomized Study (02 weeks)	445 children.	19,2 ng/mL	Respiratory infection rates during hospitalization were less frequent in Vitamin D3, deficient patients, whereas renal infections and metabolic disorders were more frequent in Vitamin D3 deficient patients.

B	Jian Z et al./China/2018.	Randomized Study (16 weeks)	400 children.	20 ng/mL	Vitamin D3 has several immunomodulatory functions, which include up-regulation of antiviral peptides that are part of innate immunity and can inactivate viruses such as influenza.
C	Devi D et al./India/2014.	Randomized Study (01 weeks)	146 children.	20,0 ng/mL	Vitamin D3 level rates were statistically significant in the period of hospitalization; there is an efficiency of Vitamin D3 in the period of hospitalization both in the local and immune system. Hospitalized children show a significant drop in Vitamin D3 levels when hospitalized.
D	Raúl B.B. et al./Chile/2016.	Randomized Study (37 weeks)	90 children.	19,2 ng/mL	Children on admission with Vitamin D3 deficiency showed statistically significant elevation in blood lactate and procalcitonin
E	Spenta K. et al./Canada/2011.	Randomized Study (24 weeks)	97 children.	25 ng/mL	Children in the hospitalization period had elevated serum PTH in individuals with insufficient Vitamin D3. Vitamin D3 supplementation at doses of 800 IU to 1600 IU/day did not show an increase in CD4+ in infected children. Vitamin D3 supplementation at 800 IU/day is inadequate in HIV children.
F	Piyush G. et al./India/2016.	Randomized Study (24 weeks)	324 children.	12 ng/mL	Administration of Vitamin D3 supplementation at a single oral dose of 10.000 units/week showed no recovery from pneumonia, hospitalization duration and fever elimination time.
G	Joanna J. et al./Polônia/2018.	Randomized Study (12 weeks)	50 children.	20 ng/mL	There was a statistically significant change in induction of CD4 +, CD25+, Foxp3+. Vitamin D3 promotes the production of tolerogenic dendritic cells, which

					leads to the introduction of Foxp3+ regulatory cells. Vitamin D3 modulates active T-cell proteins by suppressing Th1 secretion.
H	Duygu O.H. et al./Turquia/2016.	Randomized Study (06 weeks)	74 children.	12 ng/mL	Children with optimal vitamin D3 levels had a medium level catelicidine in their urine. The frequency of Vitamin D3 deficit was significantly higher in cases of urinary tract infection. There is a high dependency ratio between Vitamin D3 deficit and ICU stay. Vitamin D3 has been recognized with effect on the urinary system, with immunomodulatory ability against Escherichia Coli infection. Proper dosage of Vitamin D may benefit the urinary tract during infectious periods by inducing catelicidine expression.
I	Galli E. et al./Itália/2015	Randomized Study (24 weeks)	89 children.	20 ng/mL	The active form of Vitamin D3 induces the expression of antimicrobial peptides that aid in the infectious process of the skin and immunosuppressive properties of the skin.

3. RESULTS

A total of 1475 articles were retrieved and nine articles were included in our review. All studies were randomized and placebo controlled which evaluated including 2693 children. The main features of the studies are shown in Figure 03.

A. STUDY CHARACTERISTICS – 87 studies were removed because they were duplicate, 1388 were recovered. Based on the title and summary these 1388 studies were selected for possible inclusion in the study, 375 were excluded for not reporting the presence of a placebo-controlled control group during the Vitamin D, 450 studies used children and adults in the surveyed sample, 356 studies did not use the dose of vitamin D supplementation in a randomized and informed manner, 188 studies did not

report primary results with the use of vitamin D in the infectious process. Nine articles were included in this systematic review and meta-analysis (TABLE 01).

B. QUALITY ASSESSEMENTS AND SIDE RISK – Quality assessment the result is shown in Table 02. Five articles met the full quality of the evaluation criteria in the inclusion process in this systematic review and meta-analysis (A, B, C, F, I). In all items analyzed, at least 70% of the studies had low risk of bias (FIGURE 01).

TABLE 02 – Quality risk of studies included according to Down and Black associated method according to Cochrane criteria (RCT).

Article Identification	Reporting (0 – 10)	External validity (0 – 03)	Internal validity – bias (0 – 07)	Confusion - bias of selection (0 – 06)	Power (0 – 5)	Total score
A	10	03	04	05	01	23
B	09	02	04	03	02	20
C	10	03	05	05	01	24
D	08	02	04	04	02	20
E	09	03	09	06	01	24
F	10	03	06	05	01	25
G	09	03	05	05	01	23
H	10	03	04	05	02	24
I	10	03	05	06	02	26

SOURCE: SARA, H. D.; BLACK, N. The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care interventions. J Epidemiol CommunityHealth.v.52. p.377–384. 1998.

Figure 01- Bias Risk Graph by type of bias assessed

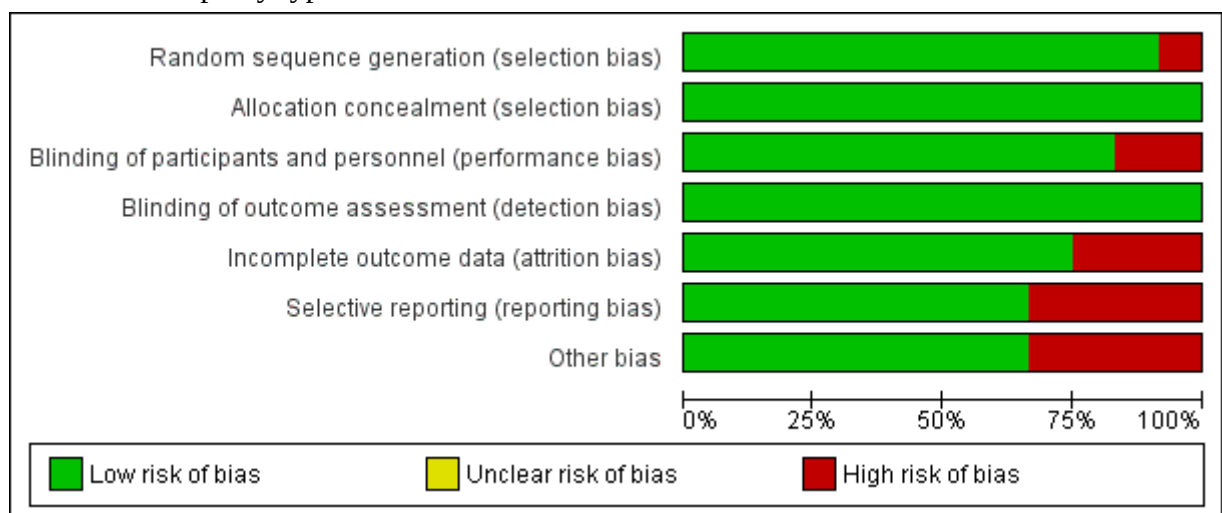


Figure 02 – Funnel graph with prevalence of chronic immunological severity (x-axis) by the standard error of each study (y-axis). Demonstrating heterogeneity between studies analyzed according to the effectiveness of Vitamin D3 and its relationship in the infectious process of hospitalized children.

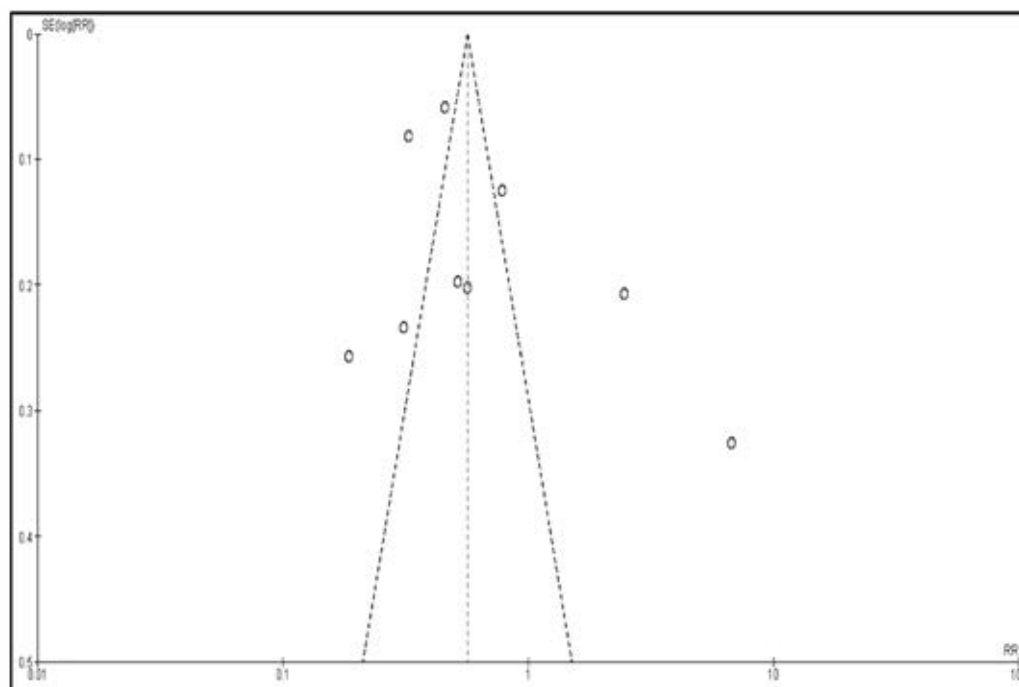
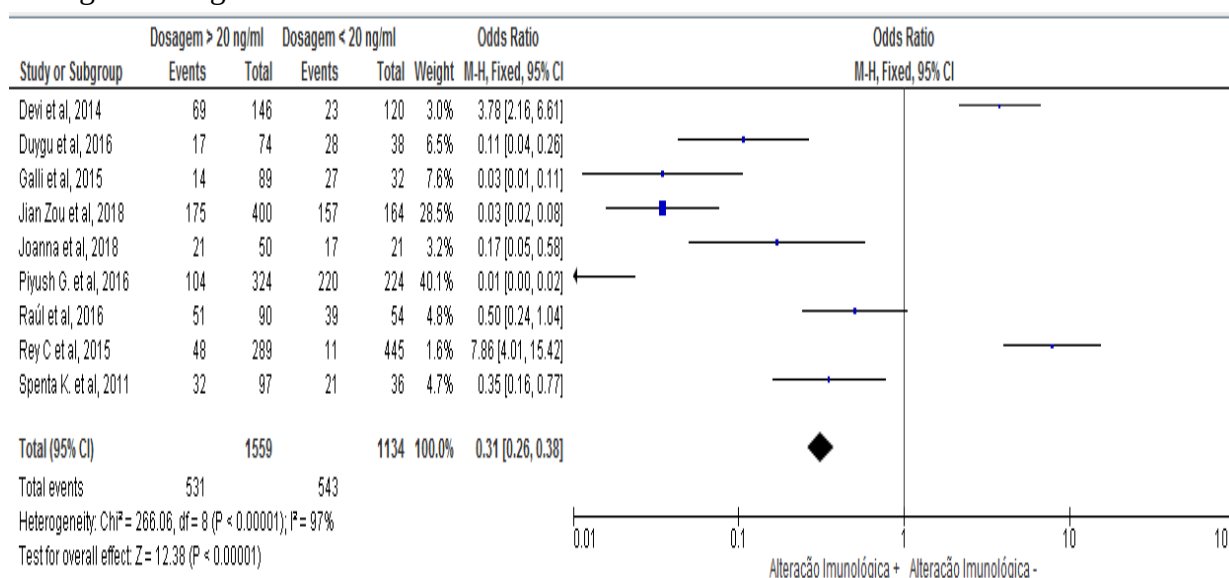


Figure 03 – Efficacy of clustering within confidence interval of risk ratio for Vitamin D3 dosage versus immunological changes in children.



The meta-analysis of the evaluated objectives (infectious process and supplemented dosage of Vitamin D) are show in Figure 3. While the final results and medium term results favored the reduction of

the infectious process with high doses of Vitamin D as shown in Figure 02, the studies analyzed in this systematic review and meta-analysis confirmed that Vitamin D3 supplementation generates an efficient positive immune response in situations of hospitalization process. However, two studies [38-41] of Vitamin D3 supplementation in the present meta-analysis have not shown satisfactory or immunological protection outcomes during hospitalization [39,41].

Still in Figure 02, a total of 07 studies [A, B, D, E, F, G, H] reported a positive effect on immune attenuation after Vitamin D3 supplementation and this sensitivity analysis revealed that five studies were the contributors to these results [A, B, C, F, I] and no limitations in the quality assessment process were found in the studies. Heterogeneity was found in the final analysis results ($I^2 = 97\%$), OR estimates were also statistically significant for incidence of improvement in the infectious process (OR = 0.35; CI = 95%: 0.16-0.77) which indicates improvement in the immune system in the infectious process as increased dosage in the Vitamin D supplementation process in hospitalized children compared to lower doses (OR = 7.86; IC 95%: 4.01-15.42).

Despite the small number of studies included in this meta-analysis to be examined, the assessed asymmetry of the funnel graph showed that there is no risk of publication bias (Figure 02).

4. DISCUSSION

Vitamin D3 supplementation had an effect on the total number of positive changes in immune defense cells (increase) when compared to the control group and the effect was statistically significant ($p < 0.00001$) [32-34]. Thus, the present systematic review and meta-analysis study suggests that Vitamin D3 supplementation has a significant immunomodulatory effect on the production of body defense cells (leukocytes, lymphocytes and plasma neutrophils for example) [34-41].

The articles reviewed in this systematic review and meta-analysis recently highlight that immune system cells express Vitamin D3 receptors and portray intracellular mechanisms capable of converting 25 (OH) D3 into their active formulation, in this case, 1,25 (OH) 2D3, Vitamin D3 has immunomodulatory function [36-42]. It can be seen from Graph 01 that in the studies analyzed in this systematic review and meta-analysis [34-42] Vitamin D3 supplementation was predominantly applied to the treatment groups to compare them with its application in control groups [42], therefore Vitamin D3 played an essential role in adaptive and innate immunity [36-41].

This functionality in the immune system occurs due to Vitamin D3-mediated activation through Toll-like receptors [36-42], where it increases resistance to human cathelicidin antimicrobial peptide, reducing vulnerability to bacterial infections [36]. When comparing the dosage below 20 nmol/L, the selected studies showed an increase in the infectious process of the hospitalization period with an increase in the frequency of death with an infectious process [34,42].

This meta-analysis through Graph 01 shows a significant reduction in infectious process symptoms compared to children who did not supplement Vitamin D (Control Group) [34-42]. Graph 01 shows an increase in cell percentage baseline of CD4+, CD25+, and Foxp3+ during hospitalization in the groups compared to placebo, changes due to Vitamin D3 levels due to Vitamin supplementation D3 [34-42].

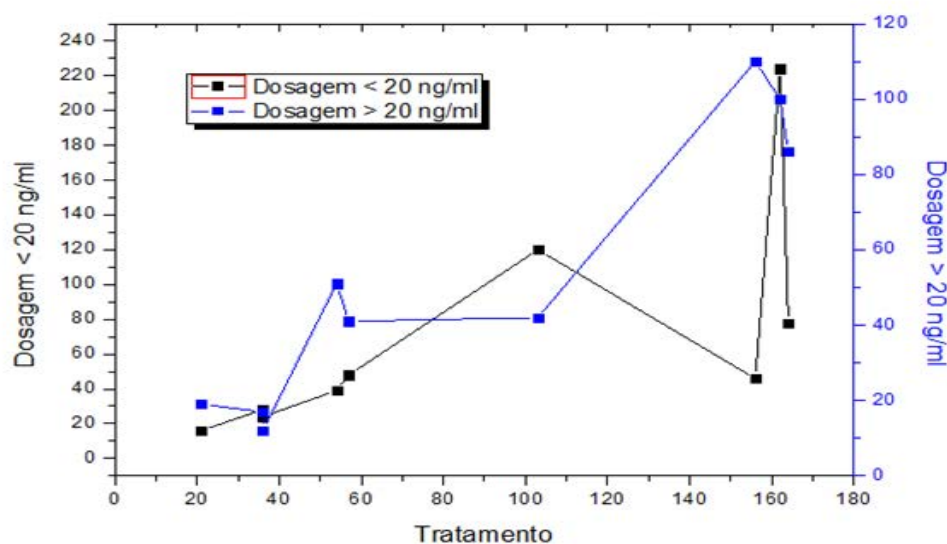
Vitamin D brings immunological improvement in the hospitalized child population by increasing serum IgA and IgG immunoglobulin levels [36-42] with peripheral increase in serum IgM levels in Vitamin D supplemented children. As well as na increase in serum catelicidin [36], an antimicrobial peptide responsible for immune boosting due to Vitamin D3 supplementation and significantly reduced the frequency of hospital complications such as pneumonia, sepsis or other infections [34-42].

In this systematic review and meta-analysis as shown in Figure 02, only a randomized, double-blind, placebo-controlled study used Vitamin D3 supplemented at a weekly oral dose of 100.000 units for children aged 6 months to 5 years.

In cases of respiratory infections and showed an increase in serum IgM levels in children supplemented with Vitamin D3 and serum catelicidine, and due to high Vitamin D3 supplementation there was an increase in na antimicrobial peptide which was responsible for the increase in reinforcement. Immune with Vitamin D Supplementation [36-40].

In this systematic review and meta-analysis study Graph 01 shows a potential beneficial effect of Vitamin D3 on CD4+ count, as the effects of Vitamin D3 include both immunostimulatory and immunosuppressive effects which may raise questions regarding dosage in this case > 1600 IU/ day may have unintended adverse consequences [34-42], so there is a need to continuously monitor active Vitamin D3 serum levels and immune function in hospital-infected patients who are supplemented with Vitamin D [34-40]

Graphic 1 – Monitoring of vitamin D3 serum levels in correlated supplementation in activation and immune function of pediatric patients infected in the hospital process.



This systematic review and meta-analysis study showed that a direct relationship between Vitamin D3 level and mortality, in this case low Vitamin D3 levels at admission, was directly associated with immunological worsening [34-42].

This systematic review and meta-analysis reinforced that patients admitted to intensive care units had a high incidence of hypovitaminosis D in all age groups, however the difference was statistically significant in older age groups, in this case children from 08 years to 13 years [39-42].

This study highlights that Vitamin D supplementation above 50000 IU/week is safe and protective against acute respiratory tract infections [34-42].

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 [42].

5. CONCLUSION

This systematic review and meta-analysis found that the insufficient high prevalence of serum Vitamin D in a hospitalized infant patient triggers severe immune system changes, as well as decreased bacterial defense sequelae and an association with increased length of hospital stay and infectious process and a growing death toll.

However, Vitamin D supplementation shows evidence of improvement in clinical status and immune response, with an increase in serum IgA and IgG Immunoglobulin levels, especially serum catelicidin, reducing hospital complications such as pneumonia, sepsis and other infections.

6. DATA AVAILABILITY

The data used to support the findings of this study are included within the article.

7. CONFLICTS OF INTEREST

The author declares that there are no conflicts of interest regarding the publication of this paper.

8. ACKNOWLEDGMENTS

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International Migrants, Family Literacy and Pact

A Closer Look at a Family Literacy and PACT

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Abstract

The purpose of this study is to examine the components of a family literacy program that brought international migrants into Primary Classrooms in the Rocky Mountain Region in the US. The literacy program included four components: 1) Children's Education of direct child instruction of literacy and language skills; 2) Adult Education of parent instruction of English as Second Language (ESL); 3) Parent Time of parent education and support group; and 4) Parent and Child Together Time (PACTT), where the parents get to be an interactive part of their child's classroom with the teacher present. PACTT is a unique opportunity in facilitating cultural integration and parental engagement, while providing participants opportunity to observe first-hand the reality of education in the United States as well as being active ELLs. Drawing on multiple social and educational theories and research, data from interviews, observation, and focus group yielded data that contributes a more inclusive discourse and new knowledge to the educational community regarding international migrants and their dreams and hopes for the success of their children.

Key Words: family literacy, PACT, international migrants, primary school, student success

Introduction

“Literacy arouses hopes, not only in society as a whole but also in the individual who is striving for fulfillment, happiness and personal benefit by learning how to read and write. Literacy... means far more than learning how to read and write... The aim is to transmit... knowledge and promote social participation.”

- UNESCO Institute for Education, Hamburg, Germany

The involvement of parents in their children's education and literacy development is a strong predictor of students' success in school (American Federation of Teachers [AFT] & Reading Rockets, 2005; Delgado-Gaitán, 2004; Hamilton, Roach, & Riley, 2003). Yet, parental involvement is often a difficult goal to achieve (Ahad, Aliyyah & Meghan Benton, 2018; Ortiz, 2004; Organization for Economic Co-operation and Development (OECD) Report, 2010; Park, Marki, & Margie McHugh, 2014). The issue of parental encounters with their child's schools become even unrealistic and often counter-productive when schools take normalized, traditional approaches instead of culturally and linguistically responsive creative approaches (Samway & McKeon, 2007; Scott, 2004; Williams, 2009). The authors reveal that subscribing to the normalized/traditional lens is not necessarily wrong. However, challenges surface when

families' actions, which are not aligned with the normalized lens, are viewed in a negative, unproductive way.

Differences between the languages, cultures, and expectations of international migrants and local schools are often incongruent, which may hinder effective communication, and prevent schools and parents from developing into successful partnerships (Delgado-Gaitán, 2004; Hamilton et al., 2003; MPI 2016 Report for content and additional sources). One possible way a School District in the Rocky Mountain Region encounters these obstacles is through Linguistically Response Approach of the Family Literacy Programs the District offers at its six of thirteen Title I schools. Four key components of the Family Literacy Program are explored in this article. The Family Literacy Program takes an innovative approach and provides appropriate tool for family involvement that can help introduce international migrants to their children's schools and classrooms, with the goal of equipping parents supporting their children's literacy development.

Literature Review

Who is a migrant?

The UN Migration Agency (IOM) defines a migrant as any person who is moving or has moved across an international border or within a State away from his/her habitual place of residence, regardless of (1) the person's legal status; (2) whether the movement is voluntary or involuntary; (3) what the causes for the movement are; or (4) what the length of the stay is. The United Nations' recommendations on migration statistics define an international migrant as 'any person who changes his or her country of usual residence,' (Carling, 2015). Understood in this way, migrants are people who move under different circumstances and for a variety of reasons—including fear of persecution. Participants will be called "mothers," when indicating the gender of the role and gender of the respondents is necessary, and otherwise they are addressed as "international migrants," or "participants," as contextually needed.

Parental School Involvement and Barriers

Although international migrants bring a plethora of cultural and linguistic resources as well as a wealth of knowledge, skills, and talents with them, they often face significant barriers in the United States education systems. Despite their endeavors to engage with their children's early educational experiences, they face restricted access to many resources due to limited English proficiency and functional literacy (Park, Marki, and Margie McHugh, 2014). The authors report that parental engagement is critical for young children's early cognitive and socioemotional development, and for their participation in programs that are designed to support early learning. School efforts to engage international migrants to be full partners in programs seeking to support their young children's healthy cognitive and socioemotional development, kindergarten readiness, and future school success are imperative (Park, Marki, and Margie McHugh as well as Mainstreaming 2.0: How the USA's Education Systems Can Boost Migrant Inclusion). This is a holistic approach of expanding parent education, literacy, and English language programs; strengthening incentives and accountability for existing program funds; and leveraging State policy-making and capacity.

Looking at the barriers international migrants face in European education systems, Ahad, Aliyyah and Meghan Benton, (2018) summarize that children who are either migrants themselves or have immigrant parents face a number of barriers in European education systems. These can include a lack of proficiency in the language of mainstream instruction, limited or interrupted prior formal education, or patchy institutional knowledge among migrant-background students and parents about how schools and systems work in the country. The authors report that the 2015–16 European migration crisis exacerbated many of these existing challenges, bringing more than 750,000 children who need to be integrated into EU Member State education systems and considerable diversity in the types and intensity of their academic, psychosocial, and other needs.

Review of current literature reveals that international migrant students often face tougher challenges than others in achieving good education outcomes and they have unique needs because of their unique situation (Ahad & Benton, 2018). The authors highlight education and integration policy deliberations more broadly that would benefit from a focus on creating the conditions that will nurture and strengthen these capabilities in pupils, both now and for the future. Performance gaps between international migrants' children and native students are largely explained by language barriers and socioeconomic differences (Organization for Economic Co-operation and Development (OECD) Report, 2010). According to the report, migrant education policy involves complex interactions of discrete policy tools that need to be well coordinated.

Framework

Multiple social and educational theories inform this study: 1) A symbolic interactionism theoretical perspective (Blumer, 1969; 1986) wherein learning as interpretative meanings of the participants' interactions, actions, as well as their experiences in context or community. 2) Sociohistorical theory (Vygotsky, 1978; Wertsch, 1985) wherein learning is seen as social, as well as individual, with more competent or more experienced significant others supporting the learning of the skills and knowledge considered important in that particular context or community (Rogoff, 2003). This theory highlights the differences in the ways individual communities model socialization and appropriate social and learning behaviors for younger members. For instance, Clay (1993) revealed that the values ascribed to literacy, its functions and purposes, and how it is learned and taught differ considerably from one sociocultural context to the next. 3) A theory of social capital (Bourdieu & Passeron, 1990,) "cultural disposition, aptitudes, preferences, and behaviors/practices...are sent unconsciously and internalized through family socialization processes" (Symeou, 2007, p. 474) further informs this study. Laureau, for example, explains that, "schools utilize particular linguistic structures, authority patterns, and types of curricula; children from higher social locations enter schools already familiar with these social arrangements" (1987, p. 74). Many children of international migrants and children from working class and nonmainstream homes come to school not possessing this social capital and therefore cannot access the codes of power (Delpit, 2006) that enable them to succeed at school.

Drawing on these theoretical frameworks, as well as social constructivism theory that focuses on an individual's learning that takes place because of his or her interactions in a group (Crotty, 1998), I was particularly interested in understanding how international migrant parents perceived their roles in

supporting their primary school children's learning, the learning activities and information in the program they valued, and how their understanding of the literacy programs and the way they were delivered influenced (or not) their participation in the program was the goal of this study.

Context

This study was conducted in Bobne Primary School (all names are pseudonyms), of a school district located in the Rocky Mountain Region in the US. The racially and ethnically diverse student population of the school is roughly 40%, many of whom are from international migrant backgrounds of English Language Learners (ELLs). Based on the National Center for Family Literacy Model and under the direction and support of the district languages support services, the school offers four components of family literacy project for the families of ELL students: 1) direct adult instruction of English as Second Language (ESL), 2) direct child instruction (Literacy and Language skills), 3) Parent and Child Together Time (PACTT), and 4) parent education and support group. The PACTT was a context in child's classroom in which the parents' ESL (English as a Second Language) instructor and the child's teacher(s) collaborate to provide opportunities for interacting with positive role models and providing structured situations for positive parent/child interaction.

Family Literacy Programs

The Family Literacy Program of the focus of this study is a parent/child education program designed to help parents of school-aged children become more actively involved in their children's education in a traditional elementary school setting. The approach to this is providing parents with educational instruction in reading, writing, and speaking English in the schools their children attend based on the four components for Family Literacy Program stated above. Parents help their children in their classroom weekly, and are guided to ensure they have the skills they will need to do classroom activities successfully socially, emotionally, and cognitively.

The Family Literacy Program is a unique approach to literacy focusing on parents as their child's first and most valuable teacher. Family literacy and second language literacy research reveals that the collaboration between teachers and families is the most vital one because these two parties are the ones that have one-to-one interaction with children

Method

Overture

Toline (a pseudonym), the District Spanish interpreter, was both familiar with Bobne Primary School and the District, having worked for the District as a Cultural Liaison for over a decade. She is familiar with the family literacy program and the families attending the program very well. She provided Spanish linguistic and cultural support for the study and worked with me throughout data collection and analyses at Bobne Primary School's Family Literacy Program Center, which was the research site. Although she was supporting by interpreting interviews from Spanish to English and translating transcripts of Spanish language into English as well as facilitating contact with the parents, she was not involved in the study as a participant or as a co-investigator.

My Stance

I had already worked for four years for the District in my role and I was familiar with Bobne Primary School and its Family Literacy Program. I was intentionally reflexive of self as a researcher in the coding process of reviewing notes and discovering common "themes," by taking notes to document my curiosities, biases, and doubts that I referred to during the research process. I am aware that reflexivity, which is the process of reflecting critically on the self as a researcher, the "human as instrument" is important in qualitative data collection and analysis process to enhance the quality of its findings (Lincoln & Guba, 1985). Lincoln and Guba emphasize examining what the self as the researcher brings to the field; what the self as the researcher situationally creates in the research process; and how those selves come into play in the research setting and consequently the distinctive voice the researcher brings to the research. I have embraced this interesting topic and according to my description within the paper of my voice, as well as my own lived experience as an international migrant, it is clear that I have a deep interest in the interactions of international migrant parents with local schools.

Participants

Five families participated in the study representing a total of five adults and thirteen children, a convenience sample based on inclusion criteria of six months to one-year attendance of the Family Literacy Program. All five families qualify for the District's a low-income free and reduced lunch program for their children. Two of the participants self-identified as African Immigrants and three of them as Mexicans. The children ranged from kindergarten through ninth grades and attended neighborhood primary, middle, or high schools designated as Title I schools, indicating 40% or more of the population qualified for free or reduced lunch.

Table 1 shows participant demographics, including their countries of origin, education level, number of schoolchildren, and the duration of family literacy attended to give context for the study.

Table 1

Participants of the Study

Pseudonym	Country of Origin	Grades Completed	Number of School Children	Months/Years attended Family Literacy
Fatima	Kenya	3rd	4	6 months
Lydia	Ethiopia	12+1	2	1 year
Lupe	Mexico	12	2	7 months
Maria	Mexico	12	3	1 year
Rosa	Mexico		2	9 months

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Design of the Study

A basic qualitative research design based on the theoretical framework discussed in the preceding section was employed to understand the perspectives of one Ethiopian mother, one Kenyan mother, and three Mexican mothers regarding their reactions, perceptions, and feelings of a Family Literacy Program at large and the PACTT component specifically as they each experienced. Learning from the participants' learning was the goal of this study, and generalizing from the participants respective racial groups is not the primary concern. The research questions were (1) what have the international migrants experienced with PACTT. In addition (2), what situations have typically influenced their school engagement experiences with their children's teachers?

Data Collection and Analysis

The data were collected based on the research questions and pertinent follow-up prompts and emerging data that arose in the interviews, classroom observations, and focus group settings. Focus group was useful to corroborate the data gained through interviews and classroom observations and to seek any emerging data. Participants were contacted three times at the school site over a period of six months to share their responses back to researcher for the purpose of verifying data and checking the data for accuracy. This process also helped to get detail insight of the subject and to validate the preceding responses (Creswell 2007), while looking for new emergent meanings. A Spanish interpreter was helpful in transcribing Spanish audio data and translating transcripts to English text for analysis. Non-Spanish speaker participants used English and the researcher asked questions when clarification of concepts were needed.

The data consisted of three audio recorded interviews, two audio-recorded focus groups, and field notes. The research situation as well as data was interpreted according to the thoughts and feelings that arose in context during the actual setting of the interviews, the focus groups, and observations. Therefore, readers should not assume an objective reality, and they are encouraged to relate to the data with their own

interpretations. Horizontalization (Creswell, 2007), which is a strategy of building on the data from the first and second research questions, data analysis going through the data, such as interview transcriptions were then used in the data analysis process.

Results

The findings in a basic qualitative research study typically involves the themes that emerged from all the data reported with illustrative quotations and possibly the data that answers the research questions. It was necessary that the information gathered in this study be reflective of the participants' voices. The theme sections include a general description, a summary of the relevant comments, and examples of participants' comments and essences.

The analysis of the data revealed the following five significant quotes that yielded three major themes that describe the responses: 1) "I appreciate the open door policy the school offered me and the readiness and willingness of the teachers as well as the administrators to closely work with me. This is new experience for me." Lupe; 2) "The privilege of parents and teachers deserving respect has been taken away here in the United States of America. No consequences that is strong enough to stop this. Back home country, in Mexico, teachers are regarded as "parents" and are very much respected by young kids and adults." Maria; 3) "With the skills and knowledge I gained from the ESL and PACTT programs, I gave a lot of support for my children and it improved my literacy skills. I believe the program is very helpful for most parents." Fatima; 4) "Given its importance and benefit, enough time was not given for both ESL and PACTT sessions." Lydia; 5) "I understand that my children live in two cultures. However, they need to keep their heritage culture while being open to other cultures as well." Rosa.

The analysis of the quotes and the data revealed the following three major themes that describe the responses: 1) Bring more intention to the classroom to identify and to address individual needs while fostering communication, respect, and understanding in the diverse classroom; 2) Model skills and knowledge for parents so that they can support their children's education in school and beyond; 3) Give more time for ESL and PACTT sessions so that participating parents will get more chance to practice with their children during PACT and to learn from their teachers and classmates, as well as hone their speaking skills in ESL classes.

This study was not a program evaluation, but I feel it is important that these significant themes give voice to these concerns as expressed by participants. The themes included a summary of the relevant comments, quotes, and examples of participants' essence of the experience around their perceptions of the subject. Additionally, the themes highlighted the participants' expectations, values, and goals for their children's learning and school engagement. Furthermore, the themes shade light on the parents' perceptions of their children's behavior and attitudes, as well as teacher's management of the classroom.

Brining More Intention to the Classroom to Identify and Address Individual Needs

Bring more intention to the classroom to identify and address individual needs while fostering communication, respect, and understanding in the diverse classroom.

Central to this theme were comments regarding why students are not generally respectful to their teachers and parents as well as to one another. Some participants voiced concerns about lack of

respect and appropriate mannerisms from students. The participants unanimously commented that students should be respectful to teachers, parents and their fellow students and to the school community in general. Regarding respect, a parent's statement stood out in the following quote:

I have experienced children give more respect to teachers and parents in Mexico than in the United States. A teacher is regarded as the other "parent" in Mexico. This privilege of parents and teachers has been taken away here in the United States. No consequences that is strong enough to stop children disrespecting parents and teachers as well as others in schools and outside.

Strategies a Mexican parent mentioned to help her children with behavioral and social issues begins with teaching them to respect themselves first and then to respect others. This strategy is supported by a quote from an Ethiopian parent in Oromo language ("Afan Oromo") "*marcuma ulfinaa abbaatu of-jala baata*," which basically means that one should first respect oneself or model respect so that others will respect. The participants' intention was that even though they live in the United States, it is important for them to keep their culture of respect and continue with a portion of who they are and the legacy of respecting oneself and all others has to stay with them. One participant pointed out that she intentionally teaches her children to behave and to respect all others. Another parent mentioned that, "*In general, teachers are doing a great job, but the suggestion I have is that there should be respect among students, teachers and parents as well as among students themselves.*" All of the participants highlighted the word "respect" and it often came up throughout the interviews and the focus groups. The related comment given by yet another participant was that the school community should continue modeling a sense of respect and responsibility for students. All children need to grow up being respectful, responsible, and as caring citizens who respect themselves and others.

A participant's comment for teachers to be a bit more serious about students' unacceptable behaviors in the classroom was captured in this quote. The participant's quote, "*Teachers should have a more disciplined classroom than I actually observed during the PACTT sessions,*" elaborates the preceding comment about teacher management of classroom discipline. Most participants pointed out those classrooms were noisy to the extent it interfered with teaching/learning process. The participants believed that the classrooms tend to be noisy because they come from different cultures and what works well for one may not do so for another. Therefore, participants state that teachers need to be intentional about understanding each child while identifying the reason(s) behind the behavior the child exhibits in the classroom. Another participant's comment was about the need for parent-teacher collaboration as this may lessen the burden of teachers' jobs and responsibilities. Under this theme, all participants unanimously agreed to the importance of teachers and parents modeling appropriate behavior for children. Regarding this, one participant's quote goes: *Understand the family background to be connected to students: parents' experiences, expectations, beliefs, values, cultures, goals, and languages influence the classroom learning and teaching.* The point is that it takes a joint effort to model appropriate behavior for students, which in turn promote learning and student success.

Within this theme, participants suggested teachers should identify and foster each child's potential through working with their parents. A parent's quote illuminates the point in case. "*I like that, as a parent, I have opportunity to work with school as I am interested in my child.*" The parent reported the importance of attending PACTT sessions in her child's classroom. A participant described how PACTT

gave her opportunity to work with her child's teacher in the classroom. In her words, *"PACTT helped me bridge the learning gap. For example, at times, when my child does not get what the lesson is about, I will explain in my own way and sometimes I use illustrations from our culture/tradition to make my point clear."* This quote was based on a parent's observation of her child's classroom and the content-related discussion that took place after. Based on the classroom insight the parent gained during the PACTT, she could have some conversation with her child in her native language and she used some examples from their background knowledge rooted in their culture to illustrate the discussion point, which was awesome.

This theme represents the participants' desires for teachers as well as school administrators to have an understanding of parents' expectations, cultures and language background that may improve or impede their endeavor to be school allies for their children's education. The participants understand that they should work with schools to support their children's academic, social, and behavioral development. All the participants reported that the knowledge and skills they gained from the ESL and the PACTT programs made them feel more confident and comfortable to work with their children at home and with teachers in school setting. Regarding her experience in school involvement in the United States, a participant has illuminated the importance of home and school interdependence in her quote as follow:

I am interested in my child, and a label on my shirt says so. In a school, it is very important that parents and their children closely work with teachers, administrators, and the general staff as a community, one as an extension of another, assuming responsibility for one another.

The parent was wearing a shirt labeled *"I am interested in my child"*, and she used the it as an example to affirm how much she is interested in her child. All the participants, as ESL and PACTT team, had shirts with *"I am interested in my child"* printed on them. The essence of the metaphorical expression I captured in the interview was that the parents care too much about their children and they wanted to be partners with teachers.

All the participants embraced the concept of school partnership to address the need of their children's academic, social, and behavioral development. They noted the importance of parents working with their children's teachers while developing mutual trust through the open-door policy, which they used to express the access they have to the school. In their words, they explained the meaning of open-door policy as teachers and administrators as well as all school staff willing to have them in school and work with them. They emphasized the need to portray their heritage culture in the school by using it as a resource. Participants also indicated that they are open to others' cultures and languages without losing their ground (heritage culture and language). A participant pointed out that both worlds (theirs and others) unite at some point, and they have to keep the balance between the two. By both worlds uniting at some point, the participant means that there should be a common understanding between the two worlds while maintaining the heritage culture and language.

Additionally, the participants called for teachers to understand each child's specific needs and offer a variety of learning experiences accordingly. A participant's quote illuminates the point in case as follow:

I expect teachers to bring more intention to the classroom to empower and model each student who struggles in his/her learning and behavior. Immigrant students generally used to think they sink or swim when they come to class. Now there are more bonds between parents and teachers and there are improvements in general.

The participants appreciate the readiness and willingness of the school staff to closely work with immigrant parents. All the participants mentioned that they feel more comfortable during the PACTT sessions because they do hands on activities and they get a sense of classroom environment as an insider while working with their children and teachers.

Model Skills and Knowledge for Parents

Model skills and knowledge parents need to help their children and collaborate with school.

The participants stressed the need for effective partnership between parents and schools. Central to this theme is that parents have their own way of communicating with their children at home. Parents also need to demonstrate support for teachers at home and they need the skills and knowledge to work with teachers and their children effectively. Teachers, students, administrators, and parents all want to know how to collaborate in positive ways with one another (Epstein, 2009; National Center for Family Literacy, 2013). For some parents, language poses a barrier to their involvement. The participants strove to learn English as well as academic, behavioral and social skills to take active roles in their children's learning. Given the right kind of environment, immigrant parents of English Language Learners (ELL) can take active roles in public schools, and they can become administrators' and teachers' best allies in providing the support that their children need at home (Hamayan & Freeman, 2006). Families can more successfully address barriers to learning by working in partnership with schools and the community (Adelman & Taylor, 2002). Adelman and Taylor also indicate that immigrant families do not always understand how schools work and emphasize the need for the necessary support to access to information and local resources to be better schools allies.

Although it can take significant effort to establish a strong link, it is well worth the effort. A participant reported that when she picks up her child from school, she asks him about his day and school experience. The parent gave a few examples of what she learned from the informal conversation with her child while going home as follow:

One day, my child asked me if I knew that H2O stands for on the way home. Another day, on the way to school, there was heavy rain and he told me 'when it rains, it pours,' and asked me if I knew the meaning of "pouring." It was pouring at the time. I use the time we come to school and go home as moments of learning and fun with my child.

I learned from the participant that the great communication the parent has with their child while commuting to and from school, and that they are resourceful with time in terms of communication and having learning opportunities. The participant brought up her way of parental support for her child's learning as related to her sense of her role and her self-efficacy that had a positive impact on her child's academic and behavioral improvement. All the parents reported that skills and knowledge they gained from the ESL and PACTT helped them to feel comfortable to take risks, believe in themselves, make goals and have the confidence and persistence they need to effectively advocate for their children's education.

Give More Time for ESL and PACTT Sessions

Given the importance of ESL and PACTT classes in terms of child instruction and parent education and support, comments related to concerns of time constraints in both ESL and PACTT sessions. All

participants expressed the importance of a bit longer amount of time to gain more skills and knowledge they need and to have “enough” time to practice and complete the classroom activities. The participants highlighted the importance of coming to their children’s classroom during PACTT sessions to gain a sense of their children’s classroom learning experiences rather than coming to school just for parent teacher conferences or when issues arise. However, all the participants expressed their concerns of time limit in ESL and PACTT classes and suggested for a bit longer time for a meaningful work in a classroom.

Summary of Findings

The purpose of this study was to explore the unusual aspects of the family literacy program such as PACTT and the parent education and support group at a primary school in the Rocky Mountain Region. The findings, which are the essences of the participants’ experiences, illuminate the openings and obstacles the parents experienced in their efforts to take active roles in their children’s education. This confirms barriers international migrants face in fully supporting their schoolchildren in the United States and Europe, where English is native and primary language at home and outside in schools, work, etc. (Ahad, Aliyyah and Meghan Benton, 2018; Park, Marki, and Margie McHugh, 2014). Family literacy program and its PACT component at Bobne Primary School was instrumental in serving as a gateway to their children’s classrooms for international migrant parents and in building meaningful relationships between the parents, teachers, and school staff.

The participants expressed their aspiration to become more active partners in the education of their children and to have meaningful relationships with the teachers in order to integrate into the web of the school community buoyed by a common purpose, the education of their children. Yet, many children of international migrants and children from working class and non-mainstream homes come to school not possessing the social capital and therefore cannot access the codes of power (Delpit, 2006) that enable them to succeed at school. A Family Literacy Program examined in this study was instrumental to empowering such parents by giving them access points to literacy, information, and resources they need to empower their children.

Given the importance of collaboration with parents, schools must be equipped to help students and parents overcome barriers that may impede full participation by fostering meaningful home-school interactions and by other viable and creative means such as family literacy program and PACT component. Additionally, school districts must ascertain that programs like adult ESL and PACTT are designed and implemented in schools as needed to ensure the effective participation of intended parents. International migrants are learning English and the host country’s cultures and adjusting with new life, but also they bring assets that schools and community need to recognize and utilize as assets. While avoiding generalizations and dichotomies, educators must view diversity that international migrants bring with them as a source of strength, innovation, and creativity. Such positive and asset-based approach aligns with what Ahad, Aliyyah and Meghan Benton, (2018) suggest—instead of thinking about international migrants as pupils with special needs and challenges, the most promising approaches examine the demands future citizens will face through a skills and strengths lens rather than a solely needs-focused lens. Such an asset-based and positive approach makes them productive in their effort to design innovative and realistic

strategies to support primary school's children's success in literacy and in their partnership efforts with international migrants to support their children's literacy at school and at home.

Limitations

Limitations to the study are as follows: (1) I was partially dependent on an interpreter for Spanish language to elicit information from the Mexican participants. However, the interpreter was qualified for interpreting the language and I had worked with the interpreter for several years as the district cultural liaison that facilitated communication and mutual understanding with the interpreter. Such dependence may affect the essence of the participants' experiences for the interpreter mediated the meaning. However, I was vigilant of the participants' "non-verbal" and "body language" cues during the interviews and the focus groups, follow up interviews with participants as well as discussions and chats were used as means to confirm the accuracy of the data. Thus, such limitation is refuted.

Additionally, my familiarity with the participants and the interpreter created a friendly atmosphere and trust to gain an in-depth data. This research only addressed the parents' experiences with their children's teachers, and did not include the teachers' perspectives. One may argue that an inclusive research of both the parents' and teachers' experiences with each other may yield comprehensive data that enhance our understanding of the point in case. However, the present study aimed at learning from the experiences of the immigrant parents, and it was not the goal of the study to gain a comprehensive data from both parents and teachers. Therefore, such argument is refuted.

Discussion and Implications for Future Practice

The goal of this study was to learn from the international migrant parents about their experience of family literacy and student success, and generalizing from the participants respective racial groups was not the primary concern. Sites where parents network, exchanging information and knowledge about children, learning, and schooling benefits positively impact student success (Lareau, 1987). Family literacy program is where families learn literacy, make friends, and connect and network with fellow parents. This confirms and further suggests the importance of welcoming international migrants into the classroom using PACT, working with them to develop an understanding of curriculum and pedagogy, and supporting them in developing relationships, the family literacy program served to support these international migrant parents.

In conclusion, the unusual aspects of the family literacy program such as PACTT is instrumental for parent education and support group to support student learning. I am particularly fascinated by the PACTT component where the parents get to be an interactive part of their child's classroom with the teacher present. This is a unique opportunity for international migrant parents to observe first-hand the reality of education in the United States as well as being active English Language Learners (ELLs). With the flow of international migrants, schools are increasingly growing diverse in terms of language, culture, and race/ethnicity among all others, and the diversity is good since it is a source of diversity of ideas, creativity, and innovation.

Comparative focus groups between international migrants in the same school community that do not have access to the program might yield significant insights as to how immigrant parents without these

supports have different attitudes about their child's teachers and school. In addition, international migrant fathers' voice may add a unique perspective on the subject of the study and worth pursuing it in future research. The "family, home, and community are the true drivers of a child's education" (National Center for Family Literacy, 2013, para. 3) and families are indeed their child's first and most important teacher, it appears imperative that opportunities be included for them to provide feedback about their experiences in family literacy programs. Further study about how schoolchildren of international migrants, who are also English Language Learners (ELLs), adapt themselves to the new and overlapping linguistic and socio-cultural spaces. Such a study can be an opportunity to learn and inform theory and best practices as well as practices to avoid in the endeavor to effectively educate children of international migrants, while forging positive relationships between home and school.

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Promotion of Vocational Education and Training Career Pathways in the Australian Construction Industry

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Abstract

This discussion paper considers the benefits of promotion of qualification pathways related to individual career pathways for new entrants and current workers in the Australian construction industry. Benefits are considered from an individual, organisational and social view accounting for licencing and health and safety obligations in the industry. The paper condones the promotion of training pathway programs, particularly those that increase in level and stimulate upskilling. Increases in uptake of pathways programs linked to career objectives can have a positive impact on recognised skill shortage occupations and enhance skills in younger workers in an industry subject to an aging workforce.

Registered Training Organisations and government agencies are encouraged to develop innovative ways to increase the uptake of pathways and to ensure retention through the range of qualifications completed.

Keywords: learning pathways, vocational education and training, construction industry training, learning programs

1. Discussion

1.1 A framework for pathways

The Australian Industry and Skills Committee (2020) outlines the construction industry is focused on a range of activities that include construction, demolition, renovation, maintenance or repair of building and infrastructure. The illuminate that it covers a wide range of services, from planning and surveying to structural construction to finishing services such as painting and decorating (Australian Industry and Skills Committee, 2020). Artibus Innovation (2019) reports that the construction sector produces around 9% of Australia's Gross Domestic Product, as it generates \$367.2 billion in revenue and is projected to grow at an annual rate of 2.4% in the next five years (2019-2024). Most businesses in this industry are either sole traders or very small, employing less than 20 people (Australian Industry and Skills Committee, 2020). Given the majority businesses in this industry are either sole traders or very small, these businesses benefit from multiskilled operators that are able to perform a range of roles. Individuals who have completed a range of qualifications are able to contribute to these small businesses at a higher level.

Construction and Property Services Industry Skills Council (2015) notes that the Australian Qualifications Framework (AQF) forms a basis for Australian Vocational Education and Training (VET) and provides a comprehensive and nationally consistent framework for qualifications in compulsory post-education and

training in Australia. The framework enables learners to have flexible pathways than can cover more than one training provider. Pathways can be horizontal (across AQF qualifications at the same level) and vertical (between qualifications at different levels), and are designed to eliminate unnecessary and unfair barriers to AQF qualifications (Artibus Innovation, 2018).

1.2 Qualifications and Licencing

Builders licencing is required for those undertaking construction activities. In Australia, each state or territory has different requirements for builders seeking licencing. These can range from education and experience to a number of references and financial resources.

In Victoria, for example, for domestic building work, practitioners must be registered as a building practitioner with the VBA to (Victorian Building Authority, 2020):

- perform domestic building work that costs more than \$10,000 (including labour and materials)
- provide more than one type of building work (such as plastering and painting) that costs more than \$10,000 (including labour and materials).

There are a number of different types of builders' registration in Victoria, with the most common types including Domestic Builder (Limited), Domestic Builder (Unlimited), Domestic Builder (Manager), Commercial Builder (Limited) and Commercial Builder (Unlimited) (Open Colleges, 2019). There are a number of limited registrations available such as Domestic Builder – Limited to Painting and Decorating. The VBA Experience Statement suggests that completion of CPC30611 Certificate III in Painting and Decorating satisfies some of the technical knowledge required for Painting and Decorating work.

In NSW, requirements include have at least 2 years' relevant construction industry experience working in a wide range of building construction work. In addition to the 2 years' experience, applicants for the licence will also need to gain a Certificate IV in Building and Construction and a Diploma of Building and Construction (Building) and one of the following (Open Colleges, 2019):

- A current Carpentry or Bricklaying Contractor Licence or Supervisor Certificate, or an approved qualification that would allow the issue of such a licence
- CPC50210 Diploma of Building and Construction (Building) (Western Australia)
- CPC50210 Diploma of Building and Construction (Building)
- Bachelor of Housing from an Australian University or a Degree in Civil Engineering, Structural Engineering, Architecture, Housing, Construction, Construction Management, Construction Economics, Applied Science (Building), Quantity Surveying
- Degree in Building, Construction, Construction Management, Construction Economics, Applied Science (Building), or Quantity Surveying

The 2 years' experience can be gained as an employee under the supervision of a licensed builder, as a sub-contractor who is appointed the supervisor of a (company or partnership class) Contractor Licence or as a sub-contractor who holds an Endorsed (individual class) Contractor Licence (Open Colleges, 2019).

Completing a Certificate III level qualification allows the person seeking licencing to build their experience as a trades person in a specific trade and following the completion of the Certificate IV in Building and Construction and a Diploma of Building and Construction (Building), meeting the academic requirements for licencing.

There are a large number of Certificate III level qualifications available within the Vocational Education and Training sector (Australian Government, 2020c), including but not limited to, for example, Certificate III in Fire Protection Certificate III in Construction Waterproofing, Certificate III in Painting and Decorating, Certificate III in Shopfitting, Certificate III in Wall and Ceiling Lining, Certificate III in Plumbing (Mechanical Services) , Certificate III in Roof Tiling, Certificate III in Wall and Floor Tiling, Certificate III in Concreting , Certificate III in Gas Fitting, Certificate III in Carpentry and Certificate III in Bricklaying/Blocklaying.

Queensland offers number of builders' licences to choose from. Generally, applicants need between 2 and 4 years' experience and formal qualifications specifically related to the class of licence amongst other requirements (Open Colleges, 2019). The Department of Housing and Public Works. (2019) outlines, for example, a Builder—low rise licence requires Certificate IV in Building and Construction (Building).

The discussion above highlights the extent to which licence classes are aligned to qualifications available from the Construction, Plumbing and Services Training Package. The qualifications allow construction industry practitioners through transition vertically through the levels to apply for higher level licences and progress in the industry. The qualifications are designed for pathways and, in turn, transition of a building practitioner through to unrestricted level licences. The structure allows individuals to undertake qualifications commencing at Certificate II level and work their way through to a licenced builder with development of vocational trade skills through the journey.

Availability of pathways further allows those undertaking programs to qualify for licencing in a number of states and therefore allows for mobility which is one of the fundamental tenements of Australian vocational education and training, as based on a national competency based system. Austin, Mellow, Rosin and Seltzer (2012) reinforce this concept with the notion that many people advocate taking strong action that will result in development of career and educational career pathways that will provide the people most at risk to obtain and build upon credentials. They speak of three important aspects to qualifications, namely that they are credentials that are portable, stackable and part of a career pathways system. Construction industry qualifications have been developed in this way.

Vocational Education and Training Construction Industry Qualifications are developed within the Australian Quality Framework using a national system and are therefore portable throughout Australia. They are stackable in that learners are able to earn shorter-term credentials with clear labour market value, such as a Certificate III level qualification, and then build on them to access more advanced jobs and higher wages, such as Certificate IV or diploma level qualifications. Austin *et al.* highlight that stackable postsecondary certificates and credentials offer an accelerated entrance to the job market. The notion of

qualifications being part of a career pathways system, is one that utilises clear education, training strategies, mechanisms, and supports for movement from the acquisition of core skills and credentials for job entry on through to increasingly higher levels of relevant skills and credentials and thus advancement to higher levels of employment. The training package derived qualifications are reflective of this approach, such as is evidenced through the industry licencing system.

1.3 Health and Safety Duties

SafeWork NSW (2019) outline that the nature of construction work means there are various businesses or undertakings with duties relating to the same construction work. It can involve Persons Conducting a Business or Undertaking (PCBUs) who:

- carry out construction work
- design the building or structure
- commission the construction work (except for a home-owner where they are not a PCBU)
- are principal contractors
- have management or control of a workplace at which construction work is carried out, or
- carry out high risk construction work.

There are also other duty holders who have responsibilities under the WHS Act and WHS Regulation (as relevant to the particular state) and these may include officers (for example, company directors), workers and other persons (such as, for example, visitors to construction sites).

SafeWork NSW (2019) further recognise that it is common in the construction industry for a person to fall into more than one duty holder category. As an example of this scenario, SafeWork NSW (2019) offers that a principal contractor will have the duties of a principal contractor as well as other duties of a PCBU. Further, a subcontractor is a PCBU and can also be a worker when working at a construction workplace. Given the obligation to multiple duties and registration processes, it is more than reasonable that an individual completes a trade qualification and building licence qualification as they may perform multiple roles in the building industry and resulting in multiple duties under WHS legislative requirements.

As an illustration, where an individual has completed both a Certificate III in Plumbing and CPC40110 – Certificate IV in Building and Construction (Building), the qualification description (Australian Government, 2020a) for CPC32413 – Certificate III in Plumbing (Release 2), states:

“This qualification provides a trade outcome in plumbing”.

The qualification description (Australian Government, 2020b) for CPC40110 – Certificate IV in Building and Construction (Building), states:

“This qualification is designed to meet the needs of builders and managers of small to medium-sized building businesses.

The builder may also be the appropriately licensed person with responsibility under the relevant building licensing authority in the State or Territory. Builder licensing varies across States and Territories and additional requirements to attainment of this qualification may be required”.

A licenced builder in this context, could be undertaking construction work in the capacity of a licenced trades person or a Domestic Builder or both depending on the context of the work. Similar arrangements can exist for a person, for example who has completed a Certificate III in Painting and Decorating and Diploma of Building and Construction (Building) and is engaged as the registered builder on a medium rise project and for the project working as a commercial painter. These cases are examples of vertical pathways and an effective use of the qualifications in a manner that they are intended.

By means of an example of horizontal pathway use, an individual who has completed a Certificate III in Plumbing may subsequently complete a Certificate III in Gas Fitting to extend their career opportunities and service offerings.

All variations of packaging for pathways are valid, whether vertically or horizontally as they are linked to career pathways.

1.4 Skills shortages

Aritbus Innovation (2019) advises that the Australian Government Department of Jobs and Small Business researches and compiles a list of skills shortages in the labour market and this list captures shortages in skilled occupations using the Survey of Employers who have Recently Advertised (SERA). The following occupations have been identified and listed as experiencing either a national or state-based skills shortage in 2017-2018: Building Associate (site supervisor); Construction Project Manager; Bricklayer and Stonemason; Carpenter and Joiner; Fibrous Plasterer; Plumber; Wall and Floor Tiler; Painting Trades Worker; Fibrous Plasterer; and Roof Tiler (Aritbus Innovation, 2019).

Some of these skills shortages can be addressed through delivery of pathway programs by vertical pathways that allow for a trade qualification, such Carpenter or Painter, followed by a higher level qualification, such as a Certificate IV or Diploma, to allow the individual to participate in the role of Site Supervisor.

The skills shortages are compounded by an aging workforce in the Construction Industry. Aritbus Innovation (2019) outlines that vital skills are at risk of being lost, resulting from an aging workforce, as proportionally fewer younger workers are replacing retiring workers. This then drives the need to retrain and upskill current workers. Pathways programs spanning qualification levels for both current workers and new entrants will provide to contribute to the reduction of the skills shortage. The Australian Industry and Skills Committee (2020) summarises that employment in the construction industry reached nearly 1,118,000 in 2018 and is projected to exceed 1,300,000 by 2023. The most common identified vocational education and training related occupation in this industry is Carpenters and Joiners, at 9.5% of the total workforce. This is a very large cohort many of which may be interested in upskilling, presenting an opportunity for both the Vocational Education and Training sector and construction industry.

The benefit of pathways training is available to all student cohorts, including Apprentices, domestic student cohorts and international students. All benefit from the additional higher level skills attained and all

provide advantage to their current or prospective employers.

2. Conclusion

There is a solid opportunity for the promotion of training pathways to potential entrants to the construction industry through Vocational Education and Training. Increased uptake of a group of qualifications to achieve higher level skills will help the industry to meet current employment demands and to address legislative requirements on the industry. The qualifications specified in the Construction, Plumbing and Services Training Package are designed in such a manner that they suit a career progression from trades person through to construction management and given the structure of the industry in Australia, these are often the same sole trader. Subsequent research is required to determine the best approaches to further promote uptake of pathways by Registered Training Organisations and Government Agencies. Likewise, research should also focus on innovative methods to maintain retention through the pathway.

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Biomass Yield, Nitrogen Content and Uptake, And Nutritive Value of Alfalfa Co-Inoculated with Plant-Growth Promoting Bacteria

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Abstract

Alfalfa (Medicago sativa L.) has high forage yield potential, protein quality, palatability, and digestibility, and low seasonality. The aim of this study was to evaluate the effects of strains of Sinorhizobium meliloti and Azospirillum brasilense on the nutritive content, bromatological composition (crude protein [CP], neutral detergent fiber [NDF], acid detergent fiber [ADF], and in vitro digestibility of dry weight [IVDDW]), and shoot dry weight (SDW), relative chlorophyll index (RCI), number of tillers (NT), plant height (PH), and root dry weight (RDW) and volume (RV), of alfalfa grown in a Typic Ultisol. The experiment consisted of eight combinations of plant-growth promoting bacteria (PGPB). The treatments were as follows: T₁: non-inoculated control without N-fertilizer (NI); T₂: NI + N-fertilizer, and inoculated with T₃: Sinorhizobium (=Ensifer) meliloti SEMIA 116 + N-fertilizer; T₄: S. meliloti SEMIA 116 + A. brasilense Ab-V5 + Ab-V6 + N-fertilizer; T₅: S. meliloti SEMIA 134 + N-fertilizer; T₆: S. meliloti SEMIA 134 + co-inoculation + N-fertilizer; T₇: S. meliloti SEMIA 135 + N-fertilizer; and T₈: S. meliloti SEMIA 135 + co-inoculation + N-fertilizer. S. meliloti strains are used in commercial inoculants for the alfalfa, and A. brasilense for several non-legumes and legumes in Brazil. The experiment was performed for three successive cuts under greenhouse conditions. Application of N-fertilization increases the production cost, making alfalfa cultivation unviable. Inoculation with three strains of Sinorhizobium meliloti highly promoted alfalfa growth, considering several parameters, including PH, RCI, NT, SDW and RDW, nutritive value, and with an emphasis on RV, and total N content and total N accumulated in shoots and roots. No further increases were observed with the co-inoculation with the PGPB A. brasilense. Studies in field and greenhouse conditions are necessary to verify the benefits of the use of PGPB in the cultivation of alfalfa.

Keywords: *Medicago sativa*, biological nitrogen fixation, diazotrophic bacteria, N-total

1. INTRODUCTION

Alfalfa (*Medicago sativa* L.) has cosmopolitan importance, either based on the scope of the area explored, or because of its important properties such as high yield potential, protein quality, high palatability and digestibility, capacity for biological N₂ fixation (BNF), and low seasonality in forage yield;

additionally, it can be used directly as pasture or conserved as silage or hay [1]; [2]. It is one of the most important pastures used for feeding specialized dairy herds and animals, and can also be used in human diet, cosmetics, and the pharmaceutical industry [3].

Among the limiting factors in alfalfa production, the reduction in N availability is considered the most relevant factor, resulting in less shoot dry weight (SDW) and protein content in forage [4]. Alfalfa is able to symbiotically associate with bacteria known as rhizobia, establishing the process of BNF, which can reach up to 470 kg ha⁻¹ of N in temperate conditions [5]. and twice as much in tropical and subtropical conditions, where the frequency of annual is higher [4]. The main nitrogen-fixing symbionts of alfalfa belong to the species *Sinorhizobium meliloti* (= *Ensifer meliloti*) [6].

In addition to rhizobia, other PGPB, with an emphasis on the genus *Azospirillum*, (BPGPs), can be beneficial to increases biomass production and grain yield in a variety of non-legume and legume species [7]; [8]; [9]. BPGPs are believed to benefit plant growth through an array of mechanisms that can act simultaneously or in continuous reaction [10]; [11]; [12]. For example, this positive effect of PGPB has been verified in *Prosopis juliflora* (Sw.) DC. [13], in maize (*Zea mays* L.) and wheat (*Triticum aestivum* L.) [7], in brachiarias (*Urochloa* spp.) [9], and in co-inoculation with rhizobia of soybean (*Glycine max* (L.) Merr.) and common bean (*Phaseolus vulgaris* L.) [8]. The inoculation of forage species with *Azospirillum brasilense* can increase the SDW and tillering, as well as the uptake of N of phosphorus (P) from the soil [14]; [15]; [16]; [17].

Considering the potential interactions of BNF with the soil chemical attributes and the benefits attributed to different cultures by inoculation with *A. brasilense*, one can deduce that co-inoculation can improve alfalfa yield. However, although there are studies that report the benefits of co-inoculation of rhizobia and *Azospirillum* (e.g. [8]), there are still no reports on the performance of alfalfa in the tropics. Therefore, the objective of this study was to evaluate the agronomic efficiency of strains of *Sinorhizobium meliloti* and *Azospirillum brasilense* on shoot and root growth, nutritive value, and nutritional status of alfalfa grown in a Typic Ultisol.

2. MATERIALS AND METHODS

Strains characterization and growth, alfalfa cultivar and establishment and conduction of the experiment

Strains

The rhizobial strains used as inoculants are authorized for the production of commercial inoculants for alfalfa in Brazil [18]. There are three strains authorized for the pasture in Brazil: SEMIA 116 (=USDA 1088, =3DOi4, =CNPSo 933), SEMIA 134 (=CNPSo 934), and SEMIA 135 (=CNPSo 935) [18]. Despite been used in commercial inoculants, the precise origin and characterization of the rhizobial strains were not clear. According to a record of 1995, SEMIA 116 has been received from the USDA collection, while strains SEMIA 134 and SEMIA 135 were isolated from alfalfa nodules grown in the state of Rio Grande do Sul, Brazil; the three strains were evaluated and indicated for the use in commercial inoculants by the institutions Fepagro (State Agricultural Research Foundation)/UFRGS (Federal University of Rio Grande do Sul) [19]; [18]. The *Azospirillum brasilense* strains Ab-V5 (=CNPSo 2083) and Ab-V6 (=CNPSo 2084)

have been selected in Brazil and used in commercial inoculants as a PGPB for both non-legumes, including brachiarias [9] and legumes as co-inoculant with rhizobia [8]. The strains are deposited at the “Diazotrophic and Plant Growth Promoting Bacteria Culture Collection of Embrapa Soja” (WFCC Collection # 1213, WDCM Collection # 1054), in Londrina, State of Paraná, Brazil.

The three rhizobial strains have been previously classified as *Sinorhizobium* (= *Ensifer*) *meliloti* based on the sequencing of the 16S rRNA gene [18]. As the information based only on the 16S rRNA is not precise to define species, the DNAs of the three strains were extracted using the DNeasy Blood & Tissue kit (Quiagen, Hilden, Germany), according to the manufacturer's instructions, aiming at the amplification with three housekeeping genes, *glnB* and *gyrB*, with the primers and amplification conditions described by [20] and *rpoB*, with the primers and amplification conditions described by [21]. Genes sequencing were carried out according to the conditions described by [22] on the ABI 3500XL sequencer (Applied Biosystems). The sequences were submitted to the NCBI bank database and received the accession numbers that are included in Figure 1. The sequences obtained were aligned using the MUSCLE algorithm [23] and phylogenetic analyzes were performed using the MEGA software version 6 (Molecular Evolutionary Genetics Analysis), using the maximum likelihood algorithm (ML) [24], with a bootstrap value of 1,000 replicates [25]. For the Multilocus Sequencing Analysis (MLSA) the sequences of *glnB*, *gyrB* and *rpoB* genes were concatenated using the SeaView software [26] and the phylogenetic tree was built with the General Time Reversible model, with gamma-distributed sites.

To verify the genetic profile of each of the three rhizobial strains, DNA analysis was performed by BOX-PCR, as described by [27]. The genetic profiles were analyzed using the Bionumerics software (Applied Mathematics, Kortrijk, Belgium, v.7.6), through the construction of a dendrogram of similarity, using the UPGMA (Unweighted Pair-Group Method with Arithmetic mean) algorithm [28] and the Jaccard coefficient [29], with a 3% of tolerance.

For the experiments the inoculants were produced at the Biotechnology Laboratory of Embrapa Soybean and Center, in modified yeast-extract mannitol medium for rhizobia [30] and DYGS medium for *Azospirillum* [31].

Experiment establishing and conduction, harvests and analyses

The experiment was conducted under greenhouse conditions at the São Paulo State University (UNESP), Campus of Araçatuba, São Paulo State, Brazil with an average daytime temperature of 26 to 36 °C and night mean time temperature of 20 °C, 415 m altitude. The soil used was characterized as a Typic Ultisol with the following chemical attributes at the 0 to 20 cm layer [32]: pH in CaCl₂ = 5.2 (1:2.5 soil/solution), soil organic matter (SOM) = 26 g kg⁻¹, phosphorus (P - resin) = 23.0 mg kg⁻¹, sulfur (S) = 19.0 mg kg⁻¹, potassium (K⁺) = 2.9 mmolc kg⁻¹, calcium (Ca²⁺) = 25.0 mmolc kg⁻¹, magnesium (Mg²⁺) = 17 mmolc kg⁻¹, aluminum (Al³⁺) = 28.0 mmolc kg⁻¹, potential acidity (H+Al) = 44.9 mmolc kg⁻¹, cation exchange capacity (CEC) = 72.9 mmolc kg⁻¹, boron (B) = 0.6 mg kg⁻¹, copper (Cu) = 1.2 mg kg⁻¹, iron (Fe) = 111.0 mg kg⁻¹, manganese (Mn) = 9.9 mg kg⁻¹, zinc (Zn) = 3.5 mg kg⁻¹, clay = 155 g kg⁻¹, and sand = 735 g kg⁻¹. Before sowing, base saturation was increased to 80% [33]; [6] with CaCO₃ and MgCO₃ application in a 3:1 ratio, and the soil was incubated for 30 days, keeping the humidity close to 80% of field capacity (FC).

The experiment was performed in plastic pots containing 5.0 kg of soil. After the incubation period, basic fertilization was performed according to [34], with the application of 200 mg kg⁻¹ of P [Ca(H₂PO₄)₂], 150 mg kg⁻¹ of K, 61.5 mg kg⁻¹ of S (K₂SO₄), 0.5 mg kg⁻¹ of B (H₃BO₃), 1.0 mg kg⁻¹ of Cu (CuSO₄), 0.1 mg kg⁻¹ of Mo (H₂MoO₄), 3.0 mg kg⁻¹ of Mn (MnSO₄), and 2.0 mg kg⁻¹ of Zn (ZnSO₄). NH₄NO₃ (50.0 mg kg⁻¹ of N) 14 days after emergence.

The population of rhizobia symbionts of alfalfa was evaluated by the method of the most probable number (MPN) in alfalfa plants of cultivar “Crioula”, while the population of diazotrophic microorganisms in soils was evaluated by the MPN method in semi-solid NFb medium, [35]. The soil populations were estimated at 1.4×10^2 cells of rhizobia g⁻¹ and 1.2×10^4 cells of diazotrophic bacteria g⁻¹ of soil.

The experiment was performed with a completely randomized block design with eight treatments and five replicates with repeated measures over the time. The treatments were as follows: T₁: non-inoculated control without N-fertilizer (NI); T₂: NI + N-fertilizer, and inoculated with T₃: *Sinorhizobium* (= *Ensifer*) *meliloti* SEMIA 116 + N-fertilizer; T₄: *S. meliloti* SEMIA 116 + *A. brasilense* Ab-V5 + Ab-V6 + N-fertilizer; T₅: *S. meliloti* SEMIA 134 + N-fertilizer; T₆: *S. meliloti* SEMIA 134 + co-inoculation + N-fertilizer; T₇: *S. meliloti* SEMIA 135 + N-fertilizer; and T₈: *S. meliloti* SEMIA 135 + co-inoculation + N-fertilizer. The bacterial concentration of the inoculants was adjusted to 2×10^9 cells per mL for rhizobia and 2×10^8 cells per mL for *Azospirillum*. The inoculant dose of 15 mL kg⁻¹ of seed was used. Fifteen seeds were sown, and after thinning, five uniform plants remained per pot.

Three cuts at 10 cm above the ground were made when the plants had an onset of 10% flowering to evaluate plant height (PH), number of tillers (NT), relative chlorophyll index (RCI), and shoot dry weight (SDW). The chlorophyll content was determined indirectly before collection using the SPAD-502 Plus Chlorophyll Meter (SPAD - Soil and Plant Analysis Development) in the average third of five plants per pot. After each cut, the material was dried in an oven with forced air circulation at a temperature of 65 °C for 72 h. Subsequently, the material was weighed and ground for chemical analysis. The neutral detergent fiber (NDF), acid detergent fiber (ADF) as described by [36], N content (NC) in shoot and root and *in vitro* digestibility of dry weight (IVDDW), were determined as described by [37]. The crude protein (CP) concentration was calculated by multiplying the NC by a factor of 6.25. The total N accumulation was calculated by multiplying the NC by SDW. At the end of the experiment, root dry weight yield (RDW) and root volume (RV) of alfalfa were determined.

Statistical analysis

Data were tested for error normality and homogeneity of variances and PH, NT, RCI, SDW, RDW, RV, and chemical composition (NDF, ADF, NC and IVDDW) were evaluated statistically. The results were assessed using analysis of variance (ANOVA), F test ($p \leq 0.05$) and compared using the t test (LSD) with a 5% probability using SAS (Statistical Analysis System, version 8.2) [38].

3. RESULTS AND DISCUSSION

Strains characterization

The analysis of the 16S rRNA represents the backbone of the taxonomy of prokaryotes; however,

nowadays, the great majority of the data has shown that this single analysis is not capable of distinguishing species, only genus. The analysis of other housekeeping genes, in the MLSA (multilocus sequencing analysis) has been used as a much more powerful technique for species classification (e.g. [20]; [30]; [21]). The phylogenetic trees obtained for each single gene (data not shown), as well as the tree obtained when the three housekeeping genes — *glnB*, *gyrB*, *rpoB* — were concatenated and analysed (Figure 1) confirmed the results obtained with the 16S ribosomal gene [18], indicating that the three rhizobial strains used in commercial inoculants in Brazil, SEMIA 116 (=USDA 1088, =CNPSO 933), SEMIA 134 (=CNPSO 934), and SEMIA 135 (=CNPSO 935) belong to the species *Sinorhizobium* (= *Ensifer*) *meliloti*.

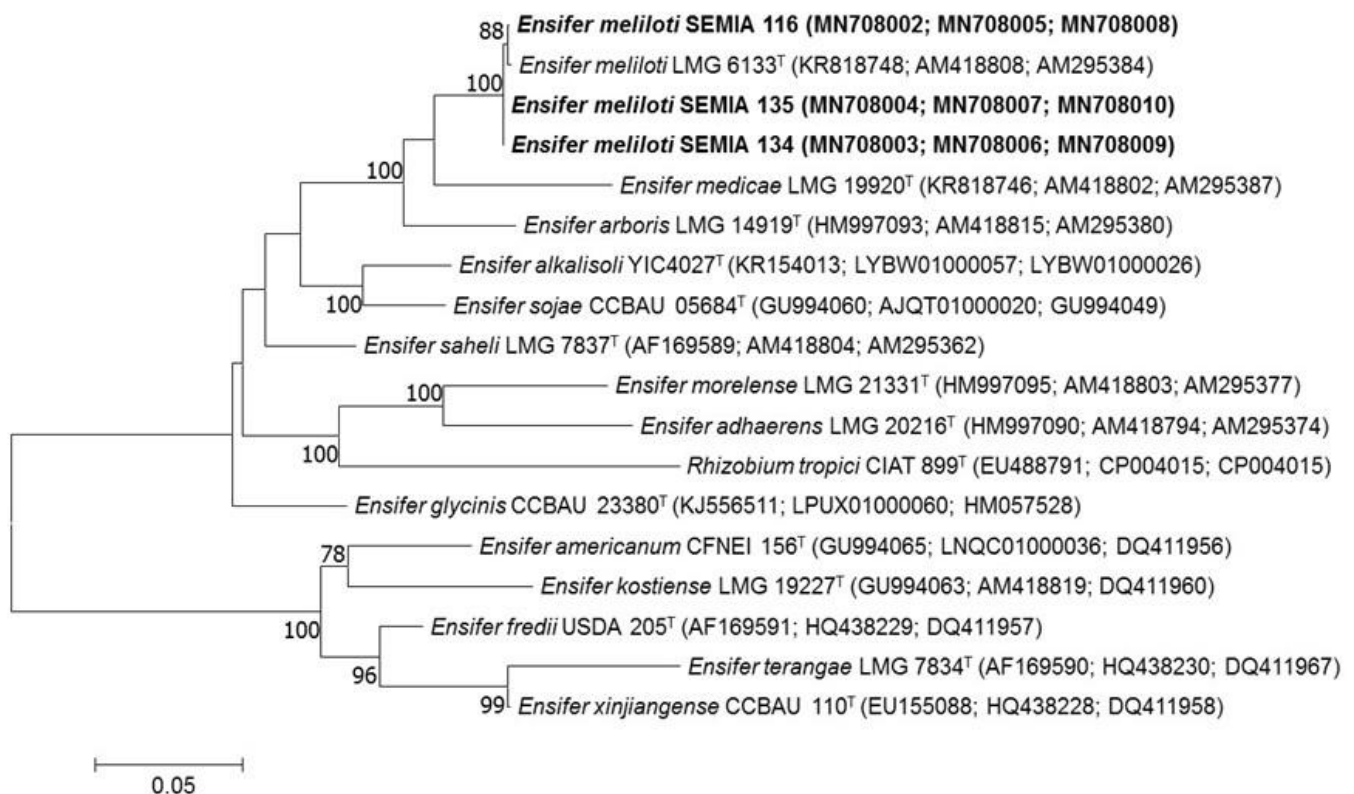


Figure 1. Maximum likelihood phylogeny based on the concatenated gene sequences of *glnB* + *gyrB* + *rpoB* of *Sinorhizobium* (= *Ensifer*) species. Bootstrap values >70 % are indicated at the nodes. The model used was the General Time Reversible, with gamma-distributed sites (G). Bar indicates five substitutions per 100 nucleotide positions.

Previously, strains were isolated from effective nodules, as it was the case of SEMIA 134 and SEMIA 135, but there were no techniques available to distinguish, what has changed with the molecular biology. The DNA profile obtained by the BOX-PCR technique has proven to be a reliable technique to distinguish strains [40], such that it has been included as the official method for confirming the identity of strains in Brazilian inoculants [41]. Interestingly, the analysis of the DNA profile by BOX-PCR indicated identical profiles for the strains SEMIA 135 and SEMIA 136 (Figure 2), indicating that they could be the same strains. As these two strains were isolated from efficient alfalfa nodules in Rio Grande do Sul soil, they can indicate an efficient strain adapted to the region's edaphoclimatic conditions, which stood out in the selection process. As the genetic characterization of the strains was not carried out at the time of selection,

it was not possible to identify that they were the same strain. The profiles of SEMIA 135 and SEMIA 136 were distinct from the North American strain SEMIA 116, with less than 60% of similarity (Figure 2), indicating that SEMIA 135 and SEMIA 136 may be indigenous strains, of some native legume, which have adapted to the alfalfa growing in southern Brazil.

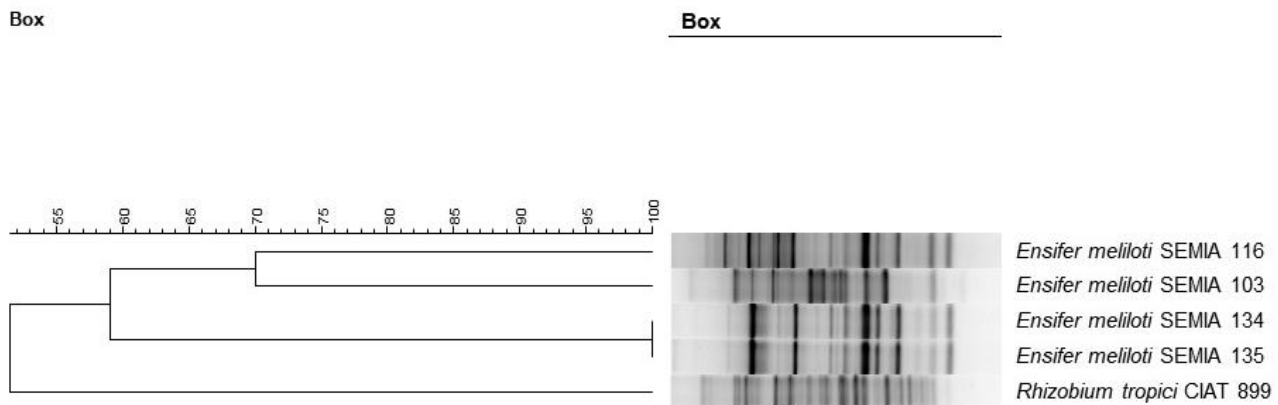


Figure 2. Dendrogram of alfalfa strains SEMIA 116, SEMIA 134 and SEMIA 135 used in commercial inoculants for the forage in Brazil based on cluster analysis of BOX-PCR products using the UPGMA algorithm and the Jaccard index, with 3% of tolerance. SEMIA 103 is also a symbiont of alfalfa, while CIAT 899 is a symbiont of common bean.

Plant performance with inoculation of PGPB

The analysis of variance indicated that the plant height (PH) was influenced by the interaction of treatments and cuts (Figure 3a). The height of the plants varied in the average of the three cuts from 37.9 to 53.3 cm, with the absolute control (non-inoculated without N-fertilizer, NI) having the lowest PH in relation to the other treatments. It should be noted that even in the absence of significance between treatments with PGPB, PH in the co-inoculation treatment with *S. meliloti* SEMIA 134 + *A. brasilense* (Ab-V5 + Ab-V6) was 12.7% higher than that in NI + N treatment (non-inoculated + N-fertilizer). In the third cut, both inoculated and co-inoculated treatments, except for those co-inoculated with SEMIA 135, were statistically superior in relation to both the NI and the NI + N treatments, emphasizing the benefits of the nitrogen fixing symbiosis with rhizobia even after successive cuts [42]; [43].

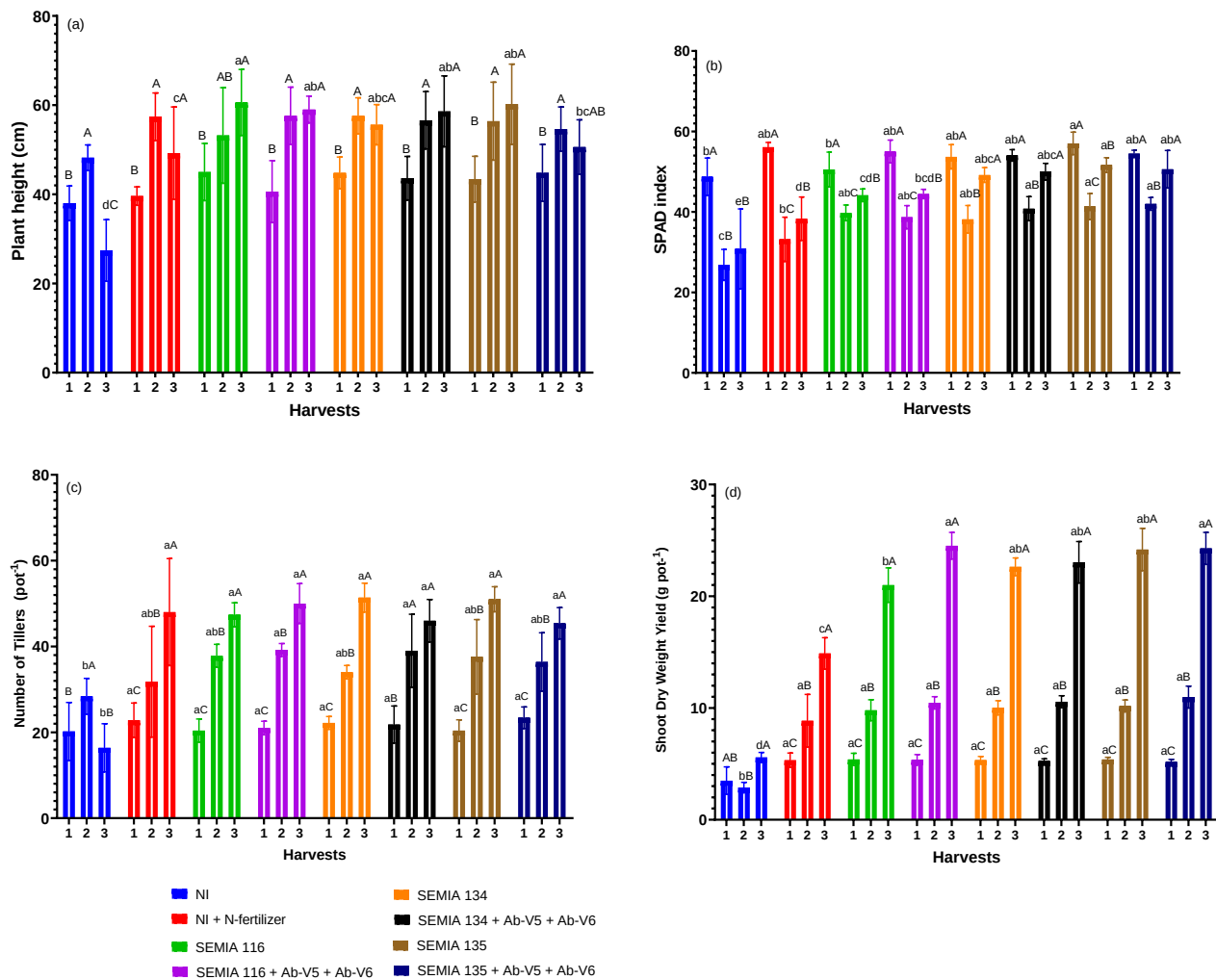


Figure 3. Plant height (cm) (a); relative chlorophyll index (SPAD index) (b); number of tillers (units pot^{-1}) (c) and shoot dry weight yield (g pot^{-1}) (d) in alfalfa inoculated with *S. meliloti* and co-inoculated with *A. brasilense* (Ab-V5 + Ab-V6) of the three harvests. Error bars represent the standard errors of the means. Averages followed by the same lowercase letter for treatments and upper case for harvests do not differ by t test (LSD) ($P \leq 0.05$).

There was a significant effect of treatment $\times$ cut for the SPAD index (Figure 3b), which varied from 35.5 to 50.0 for the average of the three cuts, and was similar to the range of 31.4 to 44.9 reported by [44] with the same alfalfa cultivar 'Crioula'. There were differences between the cuts, and in the second cut, the plants inoculated with *S. meliloti* + (Ab-V5 + Ab-V6) showed the highest values. It was also observed that the values of the SPAD index were more expressive in the third cut for the treatments involving the inoculation or co-inoculation with strains SEMIA 134 and SEMIA 135 than in the other treatments. The SPAD value in treatment T₈ (co-inoculation with SEMIA 135) was 32.0% higher than that in NI control, again demonstrating the importance of seed inoculation.

Considering that SPAD values above 30 indicate adequate nutrition with regard to N in alfalfa [44], it was observed that only the NI control showed low values in the second cut (26.8). As the SPAD index is used as an indicator of responses of plants that have higher N content, in the present study, except in plants

inoculated with strains of *S. meliloti* + (Ab-V5 + Ab-V6), the SPAD indexes decreased with the successive cuts in the NI and NI + N treatments (Figure 3b), indicating a probable decrease in the photosynthetic mechanism of the plants, possibly owing to the decrease in the contents of structural carbohydrates in the reserve mechanism in plants [45]. The number of tillers (NT) showed significant differences for the interaction treatments $\times$ cuts and ranged from 21.7 to 36.7 between cuts, with increase from the first to the third cut (Figure 3c); however, among the treatments, the NT varied significantly in the third cut, and in the third cut was lowest in the NI treatment.

For SDW parameter there was interaction between treatments $\times$ cuts (Figure 3d); the second lowest yield was obtained with the NI treatment, and in the third cut there an outstanding performance was achieved by the co-inoculated treatments in comparison to both NI and NI + N treatments. An increase in SDW was observed from the first to the third cuts in all treatments, except for the NI control. All *S. meliloti* showed good performance, but it is worth mentioning that co-inoculation of SEMIA 116 and *A. brasilense* produced 16.8% more SDW than with single inoculation with SEMIA 116 (Figure 3d).

There was a significant relation between the RDW and RV (Figure 4b and Figure 4c), which ranged from 3.3 to 17.6 g per pot, with treatments NI and NI + N being inferior to all other treatments (Figure 4b). The treatment co-inoculated with *S. meliloti* SEMIA 134 produced 89.2% RDW when compared to the NI + N treatment. For the RV, emphasis should be given to the co-inoculation with strain SEMIA 116, with, 45.8% higher than the NI + N (Figure 4c).

The increase in the RDW with the diazotrophic bacteria demonstrated that the stimulation of nodulation can occur as a direct response to the increase in the quantity of roots and RV. Similar results were obtained by [46]; [47], wherein inoculation with *A. brasilense* promoted the formation of root hair in common beans (*Phaseolus vulgaris*) and alfalfa, respectively. As rhizobial infection occurs through the formation of infectious threads in the root hair [48], stimulation of a greater number of epidermal cells to differentiate into infectious root hair cells can increase the potential of nodule initiation [49].

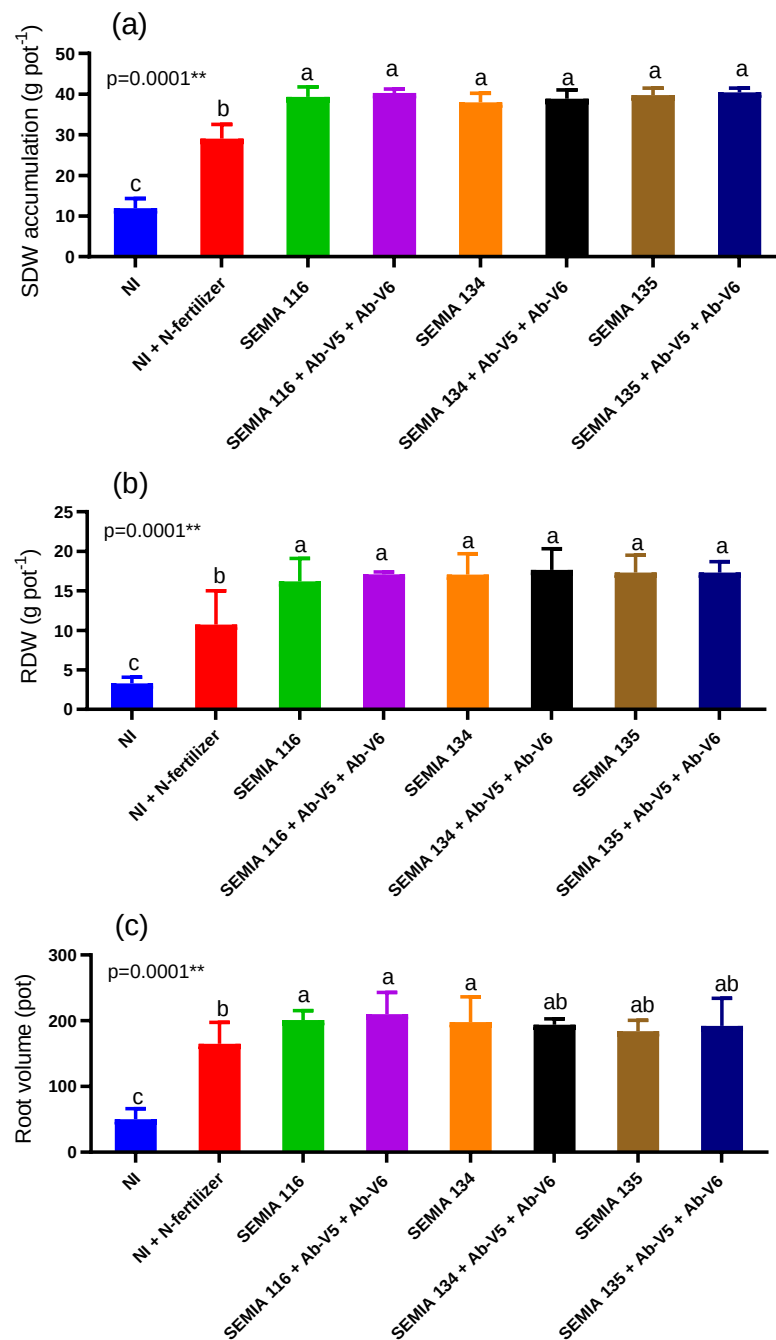


Figure 4. Shoot dry weight yield accumulation (g pot⁻¹) (a); root dry weight (g pot⁻¹) (b) and root volume (pot) (c) in alfalfa inoculated with *S. meliloti* and co-inoculated with *A. brasilense* (Ab-V5 + Ab-V6) of the three harvests. Error bars represent the standard errors of the means. Averages followed by the same lowercase letter for treatments do not differ by t test (LSD) ($P \leq 0,05$).

In addition to BNF, PGPBs are also known for their ability to produce phytohormones. [50] verified the effect of co-inoculation with *S. meliloti* and *Herbaspirillum frisingense* on alfalfa and concluded that inoculation with these strains had a beneficial effect on the symbiosis process with regard to the seed growth, the SDW and RDW, as well as increased number of nodules and nitrogenase activity. These results are consistent with those reported in the present experiment, as the PGPB showed beneficial effects,

resulting in an increase in the SDW, RDW, and RV (Figure 3d and Figure 4a and 4b and 4c).

Interaction between treatments $\times$ cuts was verified in the total N content (NC) of shoots an (Figure 5a). The NC was lower in the NI and NI + N treatments than in other treatments, except for the first cut, in that NI + N did not differ and ranged from 22.7 to 31.9 g kg⁻¹ N, whereas in the third cut, the co-inoculated treatment with *S. meliloti* SEMIA 135 was 58.3% higher than in the NI + N treatments. It should be noted that even without significant differences, the co-inoculation with *S. meliloti* SEMIA 135 was 8.1% higher in NC than the same treatment single inoculated with the same strain. According to [51] studying the efficiency of inoculants in alfalfa also found similar results, with the inoculated treatments being superior to the treatment both non-inoculated controls, demonstrating the efficiency of the inoculants in the cultivation of alfalfa.

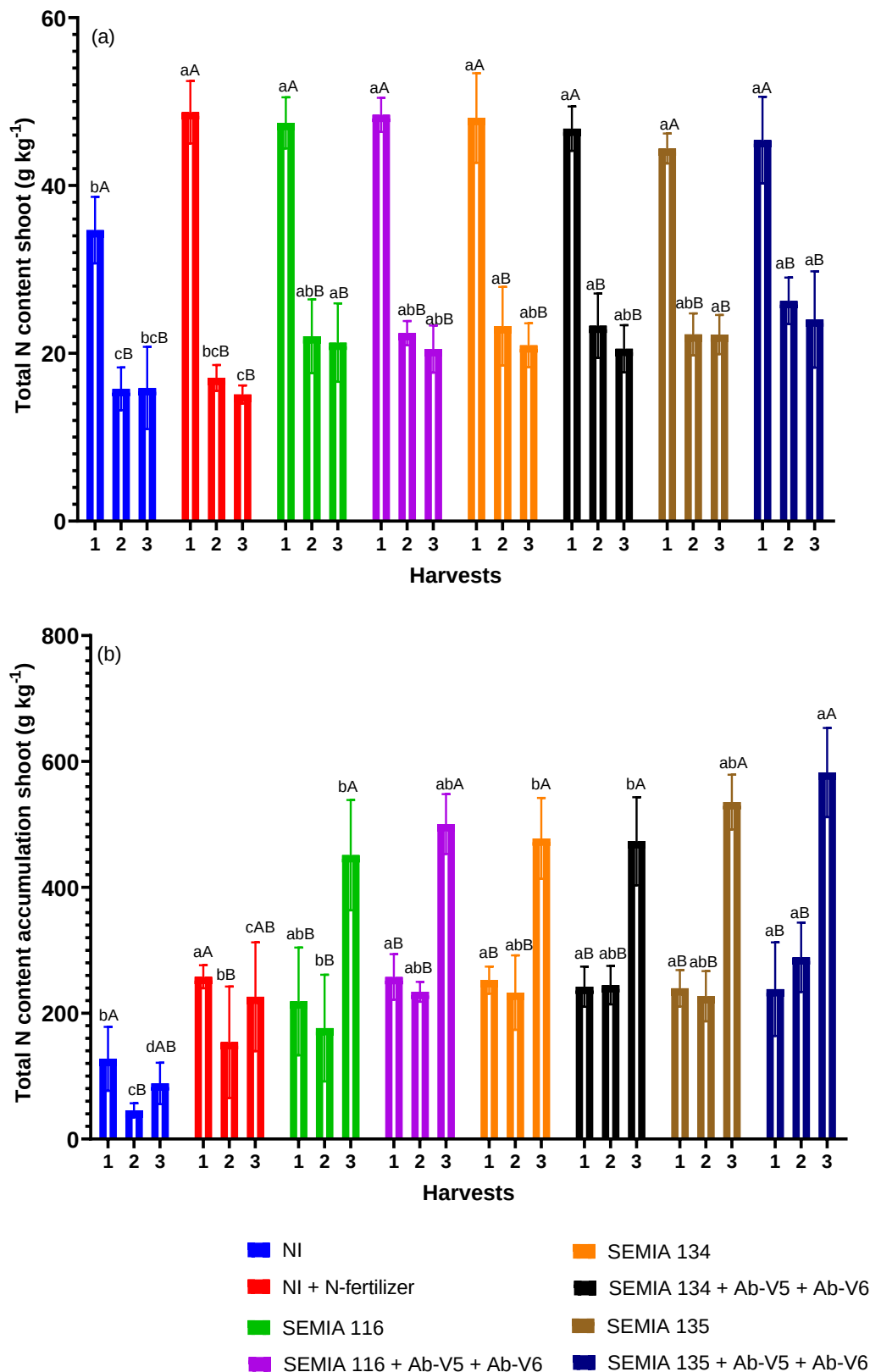


Figure 5. Total nitrogen content (g kg⁻¹) (a) and total N accumulation (g kg⁻¹) (b) of shoots in alfalfa inoculated with *S. meliloti* and co-inoculated with *A. brasilense* (Ab-V5 + Ab-V6) of the three harvests. Error bars represent the standard errors of the means. Averages followed by the same lowercase letter for treatments and upper case for harvests do not differ by t test (LSD) ($P \leq 0.05$).

In the second and third cuts, the NC in the NI + N treatment, that received 50 kg ha⁻¹ N indicate that this dose was not sufficient to guarantee a satisfactory growth of alfalfa, which was reflected by lower N levels, while the inoculation with the rhizobia strains allowed good performance. According to [52]; [4], [2], the ideal N content in SDW for alfalfa grown in the tropics should be in the range of 24.0- to 35.0 g kg⁻¹. However, differences in the NC depend on the time of cut and the stage of development. According to [53] found that when harvested at the first cut, the NC was 43 g kg⁻¹ N (growing phase) and 22 g kg⁻¹ N (end of flowering). For the total N accumulation, there was an interaction between treatments × cuts (Figure 5b). In the first cut, the lowest N accumulation was verified in the NI control, whereas in the second cut, the highest values were achieved in the co-inoculated and in the NI + N treatments co-inoculated treatments. In the third cut, the co-inoculation treatment with strain SEMIA 135 resulted in the accumulation of 157.5% more N than that the NI + N; although not significant difference, it produced 8.8% more N than *S. meliloti* SEMIA 135. This shows the possible activity of PGPB in total N accumulation in plants. In the average of the three cuts, the co-inoculation treatment with *S. meliloti* SEMIA 135 resulted in the accumulation of 370 g kg⁻¹ N per pot when compared to the NI +N treatment. Similar results were verified by [54], who found increases in total N accumulation in plants from the first to the third year, from 382 to 649 kg ha⁻¹; in our experiment, from the increases were from 229 to 417 g kg⁻¹ per pot (Figure 5b).

The total N content of the roots (NCR) was significant for treatments (Figure 6a). The NCR ranged from 13.1 to 17.8 g kg⁻¹, and were lower in the NI and NI + N treatments. The values were also higher than the average of 11.3 g kg⁻¹ obtained by [2]. Although not statistically different, co-inoculation with *S. meliloti* SEMIA 135 resulted in NCR 9.2% higher than that in single inoculation with SEMIA 135. The total N accumulation in roots showed significant differences for the treatments and varied from 43.5 to 312.3 g kg⁻¹ per pot in treatments NI and co-inoculation with *S. meliloti* SEMIA 135, respectively (Figure 6b). The co-inoculation with *S. meliloti* SEMIA 135 accumulated 120 % more N than that in plants of NI + N treatment.

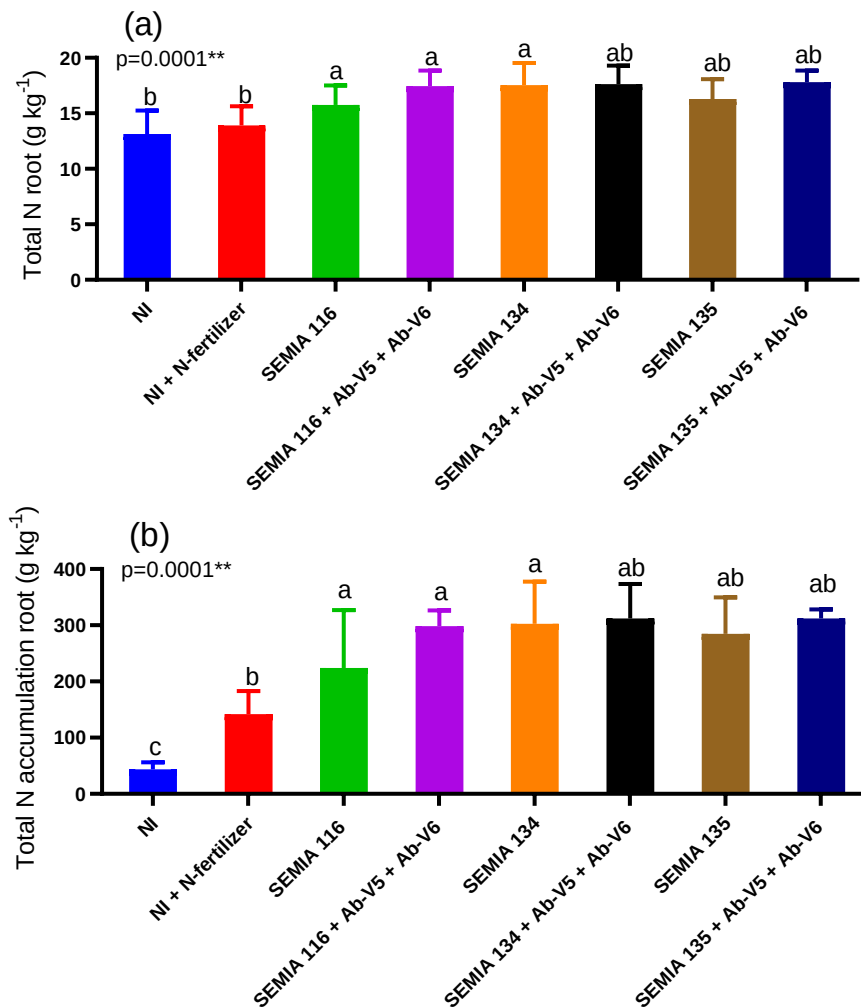


Figure 6. Total nitrogen content (g kg⁻¹) (a) and total N accumulation (g kg⁻¹) (b) in roots in alfalfa inoculated with *S. meliloti* and co-inoculated with *A. brasilense* (Ab-V5 + Ab-V6) of the three harvests. Error bars represent the standard errors of the means. Averages followed by the same lowercase letter for treatments do not differ by t test (LSD) ($P \leq 0.05$).

It is worth mentioning that, although without statistical difference, co-inoculation with *S. meliloti* SEMIA 135 and *A. brasilense* resulted in higher values than the single inoculation with SEMIA 135 for the following parameters: 8.1% in total N content of shoots; 9.8% in total N accumulation and 9.2% in NCR. According to [55] demonstrated an increase in the rhizobium population when grown with PGPB. According to [56], when describing the relationship between the plant growth-promoting *Burkholderia* sp. and *S. meliloti* PP3, found that in combination, plant growth was promoted, due to increased synthesis of indole-3-acetic acid and phosphate solubilization.

PGPB stimulate plant growth by facilitating the absorption of nutrients by the plant. It is suggested that the increase in mineral uptake by plants is owing to a general increase in root volume [57].

Nutritive value

Alfalfa nutritional properties varied with the rhizobial strains and the co-inoculation with *A. brasilense*

(Ab-V5 + Ab-V6) and the strains of *S. meliloti* used. The crude protein (CP) content showed significant interaction between treatments $\times$ cuts (Figure 7a). Except for the first cut in the NI control, this treatment, as well as the NI + N had the lowest levels of CP. The CP content was satisfactory and varied on average from 14.2- to 20.1%, and the co-inoculation treatment with *S. meliloti* SEMIA 135 resulted in 19.3% more CP than that in the NI + N treatment. According to [58] obtained similar results in the evaluation of nine alfalfa cultivars. As in several other parameters, co-inoculation resulted in 8.6% higher CP content than single inoculation with SEMIA 135, although not statistically different. According to [59] reported average levels of 18% to 25%, and these levels are close to that of the present study, which varied from 14% to 20%.

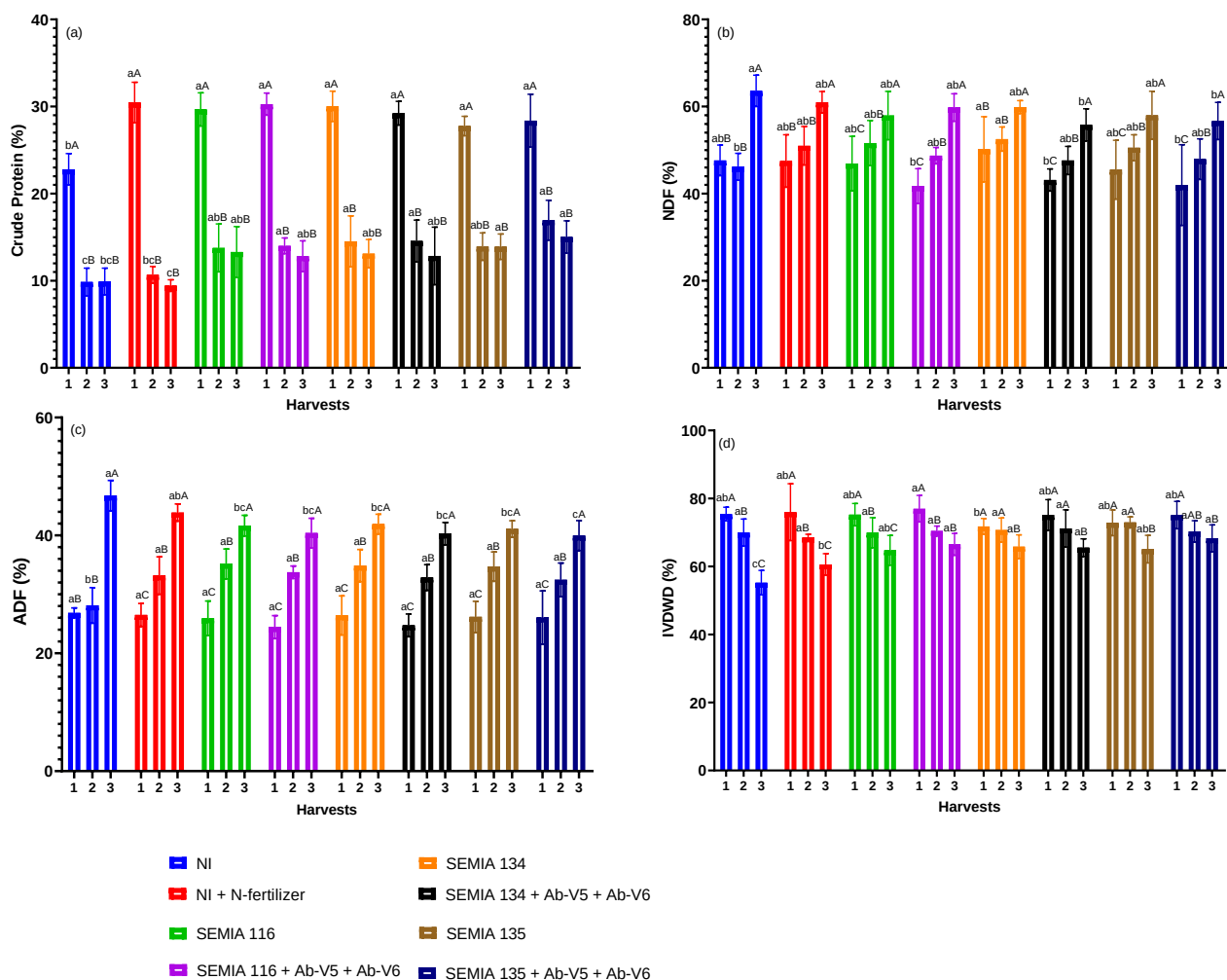


Figure 7. The crude protein (CP) (%) (a); neutral detergent fiber (NDF) (%) (b); acid detergent fiber (ADF) (%) (c) and in vitro digestibility dry weight (IVDWD) (%) (d) in shoots in alfalfa inoculated with *S. meliloti* and co-inoculated with *A. brasilense* (Ab-V5 + Ab-V6) of the three harvests. Error bars represent the standard errors of the means. Averages followed by the same lowercase letter for treatments and upper case for harvests do not differ by t test (LSD) ($P \leq 0.05$).

According to [60] evaluating the effect of different strains of *S. meliloti* found CP levels higher than those obtained in the present study, and only in the first cut the levels were higher than those reported by these authors. The effective application of strains of *S. meliloti* proved to be essential for increasing the CP

content by 19 to 42% when compared to the NI and NI + N treatments, respectively. The NDF showed significant differences for the treatments $\times$ cuts interaction (Figure 7b). In the mean of the three cuts, all co-inoculated treatments presented the lower NDF content, except in the third cut, with a good performance with the co-inoculation with SEMIA 116. The NDF content indicates the dry weight intake rate of alfalfa; the higher the value, the lower is the forage quality, thereby compromising the performance of animals [59]. The percentage of NDF makes up the cell wall structure, comprising mainly structural carbohydrates, which are of low availability in the digestion process [61]. Therefore, the reduction in NDF content implies an increase in the constituents of the cellular content, soluble carbohydrates, proteins, and lipids, which have greater availability.

The ADF showed significant differences for the treatment $\times$ cut interaction (Figure 7c). The ADF of the plants did not vary significantly between treatments in the first cut, whereas in the second cut, the value in the NI treatment was higher than that in the other treatments. In the third cut, the inoculated plants showed significantly lower ADF content than that in both non-inoculated controls. High ADF values indicate low energy production, i.e., the quality of forage is reduced [59]. The levels of ADF in the first two cuts were well below that of 24 to 35%, indicated as the maximum tolerated level, and in the third cut was higher (Figure 7c). According to [62] working with 'Crioula' reported values below 24% and [63] found average values of 30% ADF, which are similar to those obtained in the first cut and higher than those obtained in the other cuts. The ADF fraction represents the fibrous fraction of the food or the composition of the cell wall and is closely linked to digestibility as lignin is the main chemical component of the forage cell wall [61].

The IVDWD was significant for the treatments $\times$ cuts interaction (Figure 7d). In the first and second cuts, there were no differences between the treatments. In the third cut, the inoculated treatments were superior to the negative and positive controls, and the co-inoculation with SEMIA 135 showed 12.7% greater digestibility than that in the NI + N treatment. On average, the digestibility varied from 67 to 71%, staying within the value considered adequate by [64]. According to [62] obtained values from 68 to 71%, which are similar to those found in the present study. IVDWD depends on the cellulose and lignin content. As lignin is virtually indigestible, intense cell wall lignification in advanced stages of alfalfa growth tends to reduce the IVDWD coefficient. In the present experiment, treatments NI and NI + N in the third cut presented lower IVDWD than in other treatments, and high levels of NDF and ADF.

4. CONCLUSIONS

Application of N-fertilization increases the production cost, making alfalfa cultivation unviable. Inoculation with three strains of *Sinorhizobium meliloti* highly promoted alfalfa growth, considering several parameters, including plant height, relative chlorophyll index, number of tillers, shoot and root dry weight, nutritive value, and with an emphasis on root volume, and total N content and total N accumulated in shoots and roots. No further increases were observed with the co-inoculation with the PGPB *A. brasilense*. Studies in field and greenhouse conditions are necessary to verify the benefits of the use of PGPB in the cultivation of alfalfa.

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A Comparison of Quarterly Performance in Science of Grade 7 Students in Public School

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Abstract

In a typical science curriculum with different scientific disciplines (Chemistry, Biology, Physics and Earth Sciences) taught in every quarter, it is important to determine the difference in the performance of students under each discipline. In this study, the comparison of quarterly performance in Science of Grade 7 Students was examined. Wherein, the consolidated quarterly grades in science from the previous school year (June 2018 - April 2019) from five sections with a total of 272 male and female grade 7 students were used as data. It employed a quantitative research design using a One-way Analysis of Variance (ANOVA) to determine the significant difference in the mean grades per quarter. Additionally, an interview with the science teachers who handled the samples was conducted to gather qualitative data to further explain the results. The results of this study revealed a mean of 83.50 from the combined grades in the second quarter which is the lowest among the four quarters. However, the results from ANOVA

specific discipline is assigned in every quarter. In grade 7 for instance, the first quarter deals with Chemistry, the second quarter deals with Biology, third quarter deals with Physics, and the last quarter deals with Earth Science each with concepts and skills in increasing levels of complexity from one grade level to another, spiral progression [2]. Although the curriculum is designed in spiral nature which allows learning of concepts from concrete to abstract in gradual progress, it is often perceived difficult by the students due to the complexity of concepts [3]. In Physics and Chemistry, for instance, the way in which the ideas are presented requires the use of different levels: macro, micro, and symbolic level may cause the overworking of the memory resulting in difficulty. A study in University of the West Indies, Barbados, reported that there is significant difference in students' perception of difficult topics based on many factors, one of which is their interest in science, and the summary of finding revealed that Physics and Chemistry are found to have the highest levels of difficulty for most of the students compared to biology concepts which are more realistic and relevant [3].

On the other hand, studies have noted Biology as an autonomous discipline with a different conceptual framework from the physical sciences [4]. An interview from a junior high school teacher teaching the four disciplines described Biology as a more challenging discipline since it requires them to give more emphasis on inquiry, training the students to ask essential questions in investigating biological concepts rather than discussing the concepts to them. While a grade 6 teacher from a public elementary school in Manila described biology quarter specifically, the topic in asexual reproduction in plants as the most difficult topic for the

Furthermore, this kind of curriculum in science provides an opportunity for educators to assess how students perceive the nature of each science discipline and to compare the differences in their performance in every grading period.

In this study, the researcher determined which grading period for Grade 7 students will exhibit a significant difference among the others. Generally, to explore variations in the students' performances across all the quarters from the previous school year, the researcher used the consolidated quarterly grades, Form 18 of Grade 7 students in a public school in Manila. A methodology and results for the one-way analysis of variance among four grading periods are outlined.

2. BACKGROUND OF THE STUDY

Despite the major innovations in the curriculum and grading system, low performance in this science remains a problem. A relevant study described, that there are interrelated factors that contribute to this problem; first is poor preparation of teachers in terms, second is inefficient delivery of science content, and lastly, the lack of science culture in the country [5]. SEI- DOST & UP NISMED [6], discussed some of the problems in science education in the Philippines, these are low retention, analytical and communication skills of students. The factors that influence the low performance include the quality of teachers, the teaching-learning process, the school curriculum, instructional materials, and administrative support [6]. Also, relevant research identified that conceptions of the nature of science and scientific inquiry are specific to scientific disciplines [4]. Hence, the overall views of the teacher or the students of the nature of each discipline can be the reason for the subtle differences among the four disciplines. Thus, this study aimed to

examine if there is a significant difference among the quarterly performance in Science (Quarter I- Chemistry, Quarter II- Biology, Quarter III- Physics and Quarter IV -Earth Science) of Grade 7 students, was conducted. Specifically, the purpose of this paper is to:

1. Compare the significant difference in the quarterly performance of Grade 7 students in S.Y 2018-2019.
2. Describe the factors that affected the variance in quarterly grades based on interviews and previous studies.

3. METHODS

Sampling

Convenient cluster sampling was used to determine the samples in this study. The data were collected from a public high school in Manila, Philippines, wherein the consolidated quarterly grades in science from the previous school year (June 2018 to April 2019) from five sections with a total of 272 male and female grade 7 students were used. Table 1 shows the total quarterly grades used per section. A total sample (N) of 1088 quarterly grades were used in the study. Five sections were conveniently selected as representative sections from the higher, middle and lower section. Thus, the distribution of participants is not uniform in terms of academic performance.

Section	Quarter				Total
	1 st	2 nd	3 rd	4 th	
A	54	54	54	54	216
B	57	57	57	57	228
C	55	55	55	55	220
D	54	54	54	54	216
E	52	52	52	52	208
Total	272	272	272	272	1088

Also, during the previous school year, the data from each sample came from different grade 7 science teachers with different teaching styles and forms of assessments. It was a factor in the variance in grades per quarter for each section.

Design

The study is a quantitative research design that used the quarterly grades in science of 5 representative sections from higher, middle and lower sections of grade 7 students. To explore variations and the significant differences in the students' performances in every grading period, one-way analysis of variance (ANOVA) was used, with the grades as the dependent variable, and the grading period as an independent factor.

Procedure

The study used the consolidated quarterly grades or school form 18 from a public high school in Manila, with the permission of the school principal and adviser of five sections (Grade 7-1, Grade 7-5, Grade 7-11, Grade 7-19 and Grade 7-23).

In order to analyze the data gathered, the data were treated using a Statistical Package for Social Sciences (SPSS) software for easier and accurate results. One-way Analysis of Variance was used, with the grades as a dependent factor and grading periods as an independent factor, to generate results.

4. LIMITATIONS

The sample in this study was taken in one school only and the sections were not randomly selected, thus, the conclusion derived in the data may not be applicable to other groups. Also, this research was conducted in a public school where the population of students is considered a Mega Population, wherein, one section may consist of more than 50 students, compared to other private schools with a small population per section. Furthermore, other factors including subject teachers' experience, class population and time allotted per quarter which may have influenced the result from this research were considered.

5. RESULTS

Table 2 shows the comparison of the mean grades of the entire group per quarter. As observed in the table, the quarter with the highest mean is fourth quarter, 84.50 followed by third quarter, 84.40. Notably, this result describes that the performance of students in the fourth quarter (Earth Science) is higher among all other quarters. While the quarter with the lowest mean grade is the second quarter (Biology).

	N	Mean	SD
1 st Quarter	272	83.66	4.50
2 nd Quarter	272	83.50	5.61
3 rd Quarter	272	84.40	6.57
4 th Quarter	<u>272</u>	84.50	7.25
Total	1088		

An interview with the science teacher revealed that it is normally difficult to introduce chemistry in secondary level because the quarter includes the introduction of science processes skills before they can start the lessons in Matter. Time budget allotted and suspension of classes during the quarter were the factors identified by the teacher

that possibly affected students' learning in Chemistry topics.

On the other hand, no statistically significant difference was identified among the four quarters using one-way ANOVA. As can be seen from table 3, a significance value of .123 with a confidence interval level of

95% confidence interval level for the mean difference between the mean grades per quarter.

	Sum of Squares	df	Mean Square	F/Sig.
Between groups	213.31	3	71.10	1.93/
Within Groups	39960.39	108	36.86	.123
Total	40173.70	108		
		7		

Although there were no significant differences in students' performance per grading period, the students' performance within groups still varies in terms of mean differences per quarter. As stated in previous chapters, the convenient samples represent a cluster of higher, middle and lower sections hence, suggesting that students' performance in the second quarter is the lowest.

In terms of teachers' interviews, when asked about how the grades of students have affected the way in which they perceived each discipline, 2 out of 3 science teachers interviewed argued that based on their experience it is difficult to teach the second quarter topics. Teachers gave the following explanations:

However, 1 out of 3 grade 7 science teachers interviewed claimed:

On the other hand, two students from the samples, now in grade 8 were also asked, and their responses revealed that they find third quarter (Physics) as the most difficult because it involves a lot of computations. A relevant study described that students were not involved with the generation of equations. In explaining physical phenomena, Physics teachers use mathematics and emphasis on generating models

5. DISCUSSION, CONCLUSION AND RECOMMENDATIONS

The main purpose of this study was to compare if there is a significant difference among the quarterly performance in science of grade 7 students. Using one- compare the mean grades between each quarter and determine which quarter will have the lowest mean grade hence, considered being the quarter with the lowest students' performance.

Although the results have shown no significant difference in the quarterly performance, research like this can serve as an additional reference to help further improve the established practices in teaching different scientific disciplines. Moreover, based on the interview of science teachers teaching the four different disciplines, this research helped generate more insights about the subtle factors that affect the teaching-learning process.

As the educational system continues to progress to address the needs of the 21st-century science classrooms, it is still important to consider other factors and variables as a root cause of low performance of students in science. And, how the mean grades per quarter are influenced by the students' perceptions of science classroom [5] and conception of the nature of each scientific discipline. That is why the researcher plans to conduct further research in connection with comparing variations in their quarterly performances with larger participants considering the different settings (public and private schools) and students' perceptions of science classroom.

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Synchronous Distributed Generation Islanding Protection using Paraconsistent Relay

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Abstract

This article presents the intelligent multifunctional protection (IR) relay for systems based on synchronous generators using a paraconsistent neural network. This network works with degrees of favorable, unfavorable evidence, sensitivity and time. The IR includes islanding, fault detection, fault type recognition and selective fault blocking. The proposed multi-function APL4v IR was tested in a hardware-in-the-loop (HIL) environment. The results show that the proposed IR is superior to the traditional islanding recognition methods regarding reliability, safety and detection time.

Keywords: Paraconsistent Neural Network, Islanding detection, Distributed Generation (DG).

1. Introduction

The Brazilian Energy Sector is under intense transformation, the decentralized and environmentally sustainable supply has driven the use of small and medium-sized generations (microgeneration and mini-generation) connected to distribution systems called Distributed Generations based on inverters (DGs). The use of DGs is beneficial to power utilities, DG owners and end users as it improves reliability, energy quality and is economically advantageous. However, several technical conditions need to be analyzed in relation to the insertion of DGs, in order to identify the impacts caused in the electrical network. One of these conditions is the islanding that can be classified in intentional islanding when the generation source is disconnected from the network and the unintentional islanding when short-circuit problems and device

failures are detected in the distribution network.

The unintentional islanding must be detected by the DG protection system, as it can cause deterioration of the quality of energy, life risk for the maintenance teams, as well as problems in the protection of the islanded distribution system. On the other hand, undue detection may result in instability of the interconnected system in cases of heavy dependency on DGs, decrease of the quality of the energy, attenuation of the quality of the supply, as well as the reduction of the reliability of the distribution system, besides the increase of operating costs.

The anti-islanding protection techniques can be classified according to their operational characteristics and can be classified in remote and local techniques.

Remote techniques are more reliable and efficient in detecting islanding than local techniques. However, remote techniques are little used due to the high operational cost and the need for a flawless communication network, and it has as a functional principle the communication between the utility, the protection devices, the switching devices of the distribution network and the DG [5].

The local techniques are divided into three classes: passive, active and hybrid [1], [2]. Among the typical active techniques, the most frequent are: Active Frequency Drift (AFD), Sandia Frequency Shift (SFS), Slip Mode Frequency Shift (SMS) and impedance measurement method. These techniques introduce into the distribution system an instability that is normalized by connection to the host system or causes a disturbance that is absorbed by the interconnected system. The occurrence of the islanding arises from the loss of connection with the interconnected system and the parameters of the generations distributed as voltage, frequency, impedance suffer a variation that is used for the detection of the islanding. These techniques present a deterioration in the quality of the electric energy and are associated to the generators that use inverters for the connection to the electric grid, leading to the failure of islanding detection [6].

The hybrid techniques combine low non-detection zones (NDZ) of the active methods and the non-interference in the quality of the electric energy of the passive methods. Generally, hybrid methods use a passive technique to perform a first assessment of the state of the distribution system. When an abnormality is detected, an active method is employed to force the system to a condition that characterizes the islanding.

The Fault detection is another important part of DG interoperability detection. The operational rules of DGs require immediate disconnection at the beginning of any failure. Among the types of faults, those involving short-circuits are the most notable ones, standing out the lack of a single-phase line-to-ground short circuit that corresponds to 70% of this fact.

Therefore, this article proposes a multi-function Intelligent Relay (IR) for inverter-based systems, using 4-Values Annotated Paraconsistent Logic, which allows the treatment of inconsistent, indeterminate or indefinite signals. The analysis of signals using APL4v allows several problems caused by contradictory, imprecise or indefinite situations to be treated in a way that detects the fault or fault closest to its reality, in addition to analyzing the behavior of the specialists over time. This method gave rise to the algorithm called "Para-Specialist" implemented in IR.

The article is divided into the following sections: Section 2 presents the development and implementation

of intelligent multifunction relay; Section 3 shows real-time simulation and analysis of results; Section 4 presents the conclusions obtained from IR.

2. Methodology for the Development and Implementation of the Multifunction Intelligent Relay

2.1 The Annotated Paraconsistent Logic (APL)

The IR - APL4v has as its operational principle a non - classical logic called Paraconsistent Annotated Logic (APL). Which deals with contradictions, inaccuracies of data or signals, coming from the same source or from different sources, solving these inconsistencies. For each proposition, which are symbolic sentences that define something as true or false, two degrees are associated, the degree of favorable

evidence through the degrees of specialties (e), the maximum degree of specialty ($e_{\max} = 1$) and the minimum degree of specialty ($e_{\min} = 0$) known as neophyte. The Specialists have the role of decision-making in a manner consistent with the minimum of indecision or ignorance of the cause. The minimal specialty degree ($e_{\min}$) neophyte due to its inexperience, I acquired the experience as the variable time (t) goes through. In this way, your specialty increases to define two logical states True or False. This analysis can be done for any level of specialty. The fourth dimension "time" allowed to visualize the behavior of the specialists in the decision making of the system making the extremely sensitive. Therefore, the Paraconsistent Logic of 4 Values

according to the configuration of the distribution feeder, the islanding and fault events are simulated in real time. During the simulations, the voltage and current measurements at the common coupling point (PCC) of the DG are captured and stored for analysis by the system called the Paraconsistent Analysis Node (PAN). Based on the obtained data, the resources have patterns or characteristics of variation that during the islanding conditions and faults are calculated, as for example the frequency, rate of change of frequency, active and reactive power. After the data is processed, the proposed logic is used to find the best characteristics with high confidence and security indexes that will be incorporated into the intelligent relay (IR).

2.1.1.1 Feature extraction

The main characteristics selected in the PCC of the DG are used to form the decision-making models according to Table 1, where we can notice twenty-seven parameters associated to measured and / or calculated quantities, which are used by the extractor algorithm in order to be used by the paraconsistent neural network.

TABLE I
CHARACTERISTIC EXTRACTION INPUT PARAMETERS

Parameter	Variable	Description	Dimension
		Frequency	Hz
		Frequency deviation	Hz
		ROCOF	Hz/s
		Voltage	pu
		Voltage deviation	pu
		ROCOV	pu/s
		Current	pu
		Current deviation	pu
		Rate of change of current	pu/s
		Active power output	pu
		Deviation of active output power	pu
		Active power output change with time	pu/s
		Reactive power output	pu
		Output reactive power deviation	pu
		Reactive power output change with time	pu/s

		Power factor	
		Power factor deviation	
		Rate of change of power factor	
		Phase angle	rad.
		Change in the phase angle difference	rad.
		Rate of change of phase angle difference	rad./s
		Voltage total harmonic distortion	
		Deviation of the total harmonic distortion of the voltage	
		Rate of change of total harmonic distortion of voltage	
		Current total harmonic distortion	
		Deviation of the total harmonic distortion of the current	
		Rate of change of total harmonic distortion of current	

2.1.1.1.1. The Islanding Detection Function

In the islanding detection function, the relay logic is trained from numerous loading scenarios of the system in order to cover different system conditions and minimize its zone of non-detection by choosing the best characteristics. Breaker opening events and faults can also be recognized by the islanding function. In addition, the islanding detection function can also prevent undue disarming, since all possible non-islanding events, such as load reduction, load increase, capacitor switching, are part of the training scenarios. Therefore, the islanding detection logic is constructed with enough information to distinguish the islanding and non-islanding conditions.

2.1.1.1.1.1. The fault detection function and the fault type recognition functions

This function detects all types of symmetric and asymmetric faults within their protection zones employing different combinations of features / parameters of DG. Through the Network of Paraconsistent Analysis (PAN) that provides the secure information about which propositions with a greater or lesser degree of contradiction. With this information the system is able to make more reliable decisions, besides having the values to act in the control of the input signals, weakening or strengthening evidences to diminish the contradictions to produce a robust decision system and able to bring result with high degree reliability.

This function is able to identify four types of faults: ground fault (LG), line-fault (LL), three-phase phase fault (LLL) and line-to-ground fault line (LLG). In addition, for earth faults, the variable impedance faults are considered in the proposed relay training period to improve the adaptability of the fault detection function.

2.1.1.1.1.1.1. Selective blocking function – Fault Ride Through

The proposed fault-selective blocking function is obtained through PAN analysis, using the information

obtained by the islanding detection functions, faults and recognition of the failure type.

Figure 2 shows the functional diagram of the proposed intelligent relay. Indicating for islanding events, faults, blocking and fault identifiers. Fault logic is supervised by selective blocking logic through logic E.

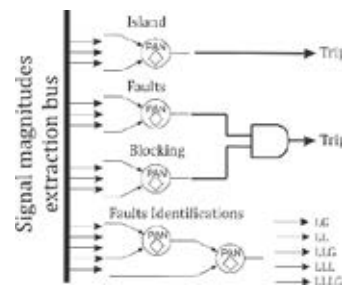


Figure 2 – Representation of Analysis Node

3. Real time Simulation and Analysis of Results

In order to evaluate the performance of the proposed relay, the IEEE 34 bus test network was simulated in real time in the Typhoon-HIL equipment with two islanding situations, by opening the connection line between 800 and 802 (islanding 1) and between 830 and 854 (islanding 2) as shown in figure 3, where each of the DGs had the proposed relay. Two loading conditions were considered, 100% and 50%. In the first, the system load is equal to the load of the IEEE bus 34 of the original test system; in the second, the load is reduced by 50%. The tests also included two levels of distributed generation penetration: 2.5 MW and 1.0 MW, resulting in eight different situations. From these eight simulations, faults were incorporated into the 802, 830, 852 and 842 bars

100%, and two distributed generation penetration levels. A total of 2160 simulated cases were used, of which 50% were used for the training of the paraconsistent neural network and the remaining 50% were used for the recognition of islanding patterns, faults, types of faults and selective block.

Figure 3 - Detection of islanding tested in the IEEE 34 bus test system [6].

In Figure 4 it can be seen that the real-time simulation environment is performed on the Typhoon-HIL equipment, which serves as a coupling for the actual control of the Intelligent Relay used in the IEEE 34 bus test system.

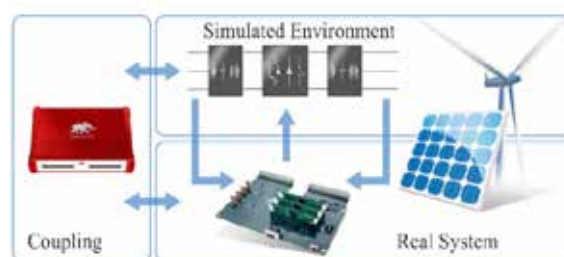


Figure 4 - Real-time system operation diagram.

The waveforms presented in Figure 5 characterize two situations. The first situation, represented by

Figures 5a and 5b, shows the frequency and line voltage of phase "a" when the bar 802 is opened, respectively. These signals were extracted from the DG bar, which in turn demonstrates the penetration capacity of the proposed relay. The second situation, shown by Figures 5c and 5d, shows the frequency and line voltage of the phase "a" When a single-phase short-circuit LG occurs in the bar 802, where it is possible to see the penetration capacity of the proposed relay.

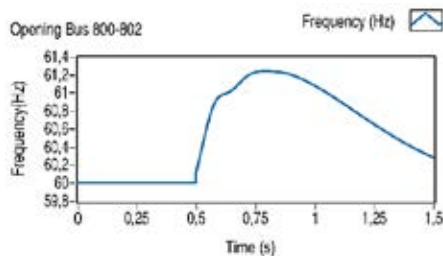


Figure 5(a) - Characteristics of Signs Extracted in Bus DG. - Frequency characteristic during bus 802 opening;

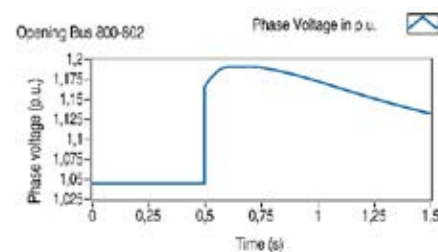


Figure 5(b) - Characteristics of Signs Extracted in Bus DG - Characteristics of line voltage at phase "a" during the opening of bus 802

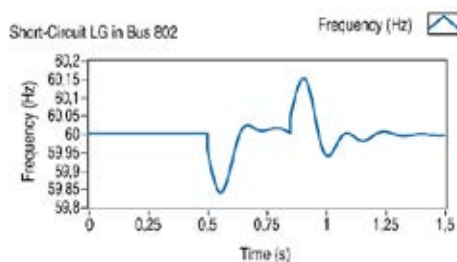


Figure 5(c) - Characteristics of Signs Extracted in Bus DG - Frequency characteristic during LG single-phase short-circuit on bus 802;

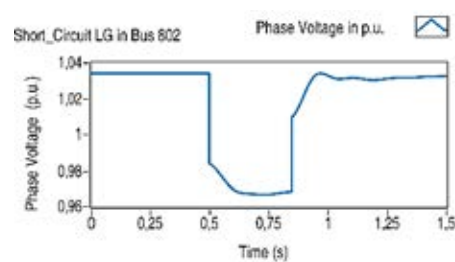


Figure 5(d) - Characteristics of Signs Extracted in Bus DG - voltage characteristic - of the line in Phase "a" during the single-phase short-circuit LG on bus 802;

A Paraconsistent Neural Network (PNN) was developed based on the PAN para-specialist algorithm. The algorithm formed by 52 PANs can analyze the islanding condition based on the classification of the deviation and the degree of pertinence of each of the deviations. These degrees of pertinence were divided into three large gr

and what relates the angle to the THD's (voltage and current). Figure 6 shows the paraconsistent neural network. It should be noted that 3 more algorithms were constructed in order to complete the functions of the proposed relay. In this work only the main algorithm is demonstrated. Therefore, the events of faults, blocking and fault identifiers are not displayed, but for operation were incorporated from the controller.

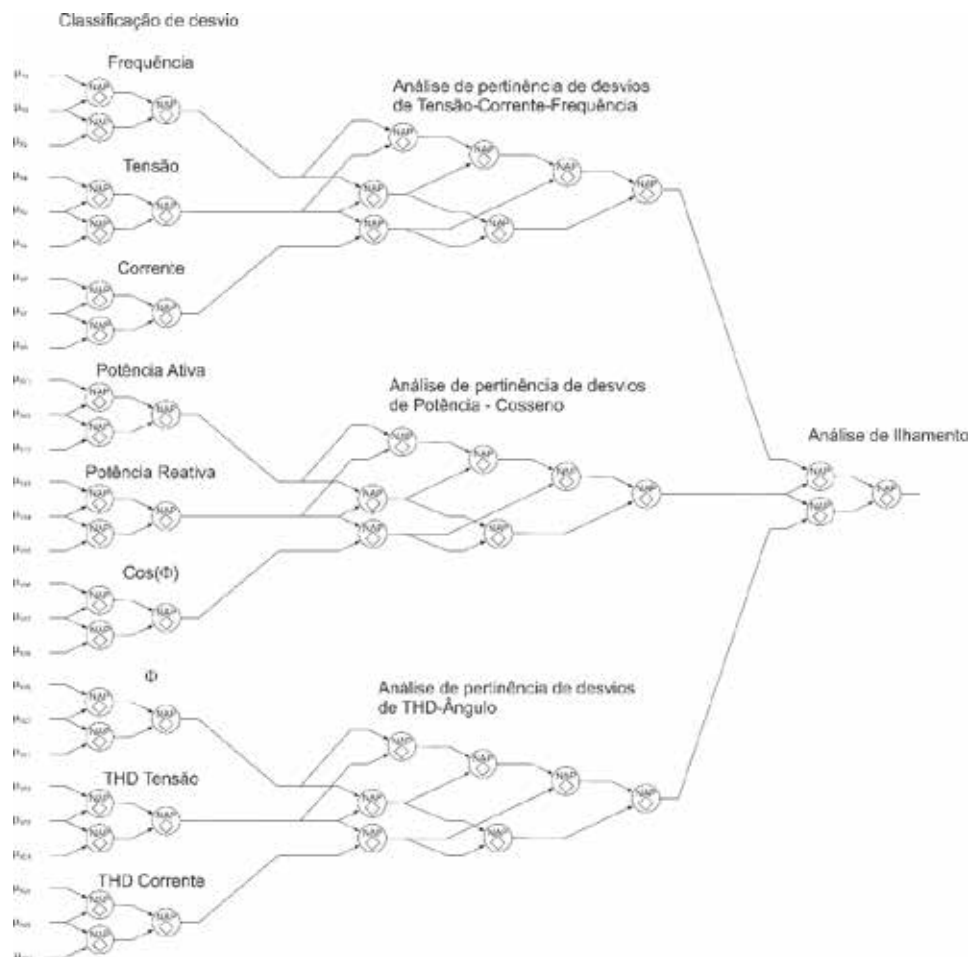


Figure 6 - Diagram of the Paraconsistent Neural Network applied in the recognition of islanding.

After the training of the paraconsistent neural network, based on the proposed logic, the following results are presented in Figure 7, where it can be noted the performance comparisons between the proposed intelligent relay and the ROCOF and ROCOV relays.

Figure 7a compares the proposed relay with the ROCOF relay in DG1 with the settings of 0.1 Hz/s and 0.25 Hz/s varying the active power given in pu, it is observed that the proposed relay result in any range of active power corresponds to 100% accuracy. In Figure 7b the comparison of the proposed relay with the ROCOV relay in DG1 with the 0.07 V/s and 0.1 V/s adjustments by means of the variation of the reactive power given in pu, it is noted that the relay result proposed in any variation of the reactive power corresponds to 100% accuracy. Figure 7c compares the proposed relay with the ROCOF relay in DG2 with the settings of 0.1 Hz/s and 0.25 Hz/s by varying the active power given in pu, it is noted that the proposed relay result in any active power range corresponds to 100% accuracy. In Figure 7d the comparison with the proposed relay with the ROCOV relay in DG2 with the 0.07 V/s and 0.1 V/s adjustments by means of the variation of the reactive power given in pu, it is noticed that the result of the proposed relay in any variation of reactive power corresponds to 100% accuracy.

The consolidation of the comparison of the Multifunction Intelligent Relay with the ROCOF relay is shown in Figure 7e and, finally, Figure 7f shows the consolidated comparison between the proposed intelligent relay and the ROCOF relay where the reliability rate was 100%.

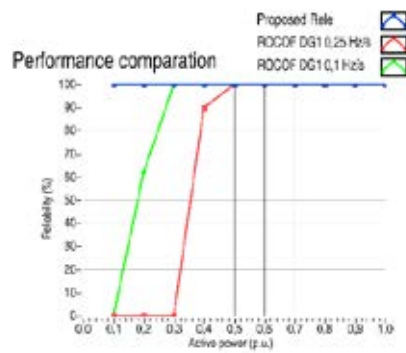


Figure 7(a) - Comparison of performance of the proposed relay
- Comparison of the proposed relay with the ROCOF relay in DG1.

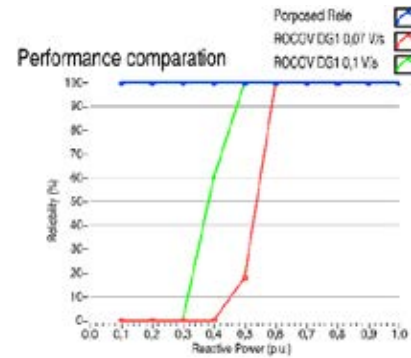


FIGURE 7(b) - Comparison of performance of the proposed relay -
Comparison of the proposed relay with the ROCOV relay in DG1

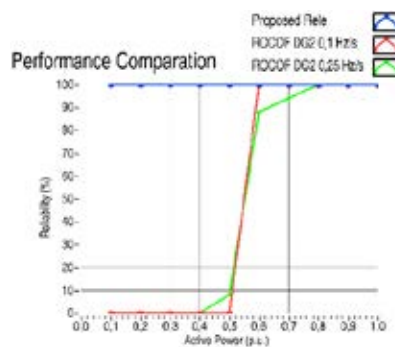


Figure 7(c) - Comparison of performance of the proposed relay
- Comparison of the proposed relay with the ROCOF relay in DG2.

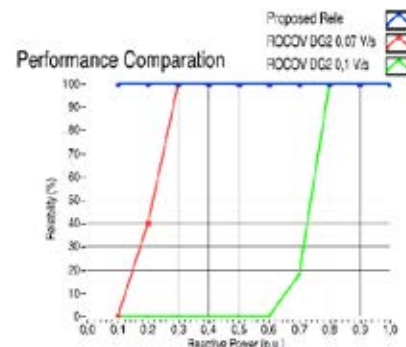


Figure 7(d) - Comparison of performance of the proposed relay
- Comparison of the proposed relay with the ROCOV relay in
DG2.

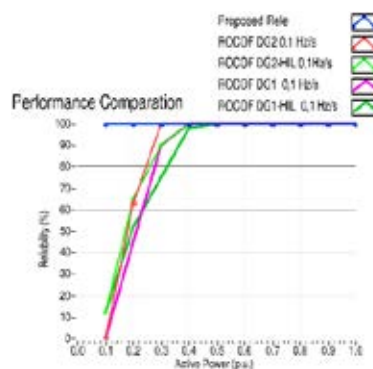


FIGURE 7(e) - Comparison of performance of the proposed
relay - Comparison of the proposed relay with the ROCOF relay in
DG1 and DG2.

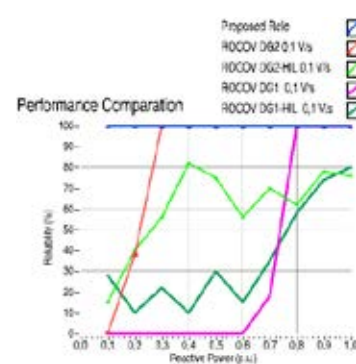


FIGURE 7(f) - Comparison of performance of the proposed
relay - Comparison of the proposed relay with the ROCOV relay in
DG1 and DG2.

4. Conclusion

The proposed intelligent relay was efficient when compared to traditional ROCOF and ROCOV islanding recognition methods. It was observed that the ROCOF and ROCOV relays failed to recognize

islanding whenever the active or reactive power was low, in the order of 0.1 to 0.5 pu. The proposed relay in any power operation responded in a very relevant way, since achieved 100% accuracy. Due to the nature of the PAN, the processing speed of islanding and fault recognition is fast, in the order of 10.3 to 45.8%. Another is that the computational cost of the algorithm is very low because it involves simple mathematical operations that can be applied to digital signal processors.

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Nitrogen in Shoots, Number of Tillers, Biomass Yield and Nutritive Value of 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 plant growth-promoting bacteria (PGPB) strains of Azospirillum brasilense, Pseudomonas fluorescens and Rhizobium tropici on biomass yield, number of tillers, nitrogen accumulation and nutritive value of shoots of Megathyrsus (syn. Panicum) maximum cultivar BRS Zuri (Zuri Guinea grass). For that, one experiment was performed for 14 months to evaluate inoculation and re-inoculation with Azospirillum brasilense strains Ab-V5 and Ab-V6, Pseudomonas fluorescens strain CCTB 03 and of co-inoculation with Rhizobium tropici strain CIAT 899 + A. brasilense strain Ab-V6 combined with N-fertilizer (100 kg of N ha⁻¹). Shoot dry weight yield (SDWY), number of tillers (NT), total N concentration (TNC), total N uptake (TNU) and nutritive value of Zuri Guinea grass was evaluated for eight cuts, and inoculation increased all parameters. In the NT, the treatments inoculated with PGPB were superior to the positive non-inoculated control receiving N-fertilizer, by up to 36%. For the accumulated of SDWY the treatment re-inoculated with P. fluorescens CCTB 03 after each cut was statistically superior in 7% the positive control. The PGPB when combined N-fertilizer also increased SDWY, NT, the relative chlorophyll index, TNC, total N uptake, neutral detergent fiber, acid detergent fiber, crude protein and in vitro digestibility dry matter of Zuri Guinea grass. The results indicate that PGPB can represent a sustainable alternative for reducing the use of N-fertilizers. The lower 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: *Megathyrsus*, biological nitrogen fixation, crude protein, SPAD, tropical forage grass.

1. INTRODUCTION

Standing out approximately 15 years ago among the largest meat producers and exporters in the world,

Brazil has reached this level due to its large production capacity for beef cattle on pasture [1]. Among the areas destined to the sector, about 90% of the cultivated pastures are occupied with the genera *Urochloa* spp. and *Megathyrsus* spp. [2]. In the genus *Megathyrsus* (syn. *Panicum*), *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.

Most of the soils under pastures in the tropics have a degradation level that impairs the forage yield potential, especially because of mismanagement and lack of fertilization [4]. The area with pastures in Brazil is estimated to be about 180 million ha, with about 70% under some level of degradation [5]. This scenario is aggravated because naturally low-fertility soils are used extensively for pastures.

Nitrogen plays a key role in the maintenance or increase the potential yields of forage grasses due to its influence on plant biomass production [6]; [7], especially leaf size, stem morphology, and the development of tillers [8]. However, the high price of chemical N-fertilizers limits its broad use in extensive pastures. On the other hand, when used in excess, N-fertilizers result in contamination of surface and groundwaters with nitrate and increased greenhouse gases emissions (GGE) [9]. Therefore, the use of plant-growth promoting bacteria (PGPB), especially diazotrophs such as *Azospirillum* as inoculants of 'Marandu' palisade grass seeds could improve forage production, and the nutritional status [10], especially in low-fertility soils [11]; [12]; [13]. Additionally, concerns about mitigation of the emissions of GHG are also applicable to the agribusiness sector [14]. If, on the one hand, cattle production is placed as a protagonist in the emission of GHG [15], initiatives such as the use of PGPB figure as an important alternative to increase production with sustainability [13]; [16]; [17]; [18]. PGPB may promote plant development by a variety of mechanisms, including biological N₂ fixation, production of phytohormones and phosphate solubilization [19]; [20]; [21]; [22]. For example, trials performed with *Urochloa* spp., inoculation with *Azospirillum brasilense* resulted in a contribution estimated as 40 kg ha⁻¹ of N, in addition to important sequestration of CO₂, helping in the mitigation of GGE [13].

Nowadays, it is well established that priority should be given to the use of alternative strategies that promote improvements in animal production, especially management strategies that associate sustainability with profitability. Therefore, the use of PGPB as inoculants of forage grasses may represent an important management alternative to improve pasture production and quality, and animal production. The objective of this study was to evaluate the effects of elite strains of *A. brasilense*, (Ab-V5 and Ab-V6), *Pseudomonas fluorescens* CCTB 03 and *Rhizobium tropici* CIAT 899, previously identified in other crops [23]; [24]; [12]; [25]; [13]; [26], on growth and nutritive value of Zuri Guinea grasses.

2. MATERIALS AND METHODS

Experimental sites

The experiments were carried out in the experimental area of the Faculty of Veterinary Medicine, at São Paulo State University (UNESP) in Araçatuba County, São Paulo State, Brazil (21°11'12" LS, 50°26'20" LW, 390 m above sea level) during 14 months (November to January of 2018/2020). The climate, according

to Köppen, is Aw, characterized by hot and humid summers and warm and dry winters, with most of the rainfall distributed between November and March. The average annual temperature and rainfall are, respectively, 22 °C and 1,206 mm, with an average maximum temperature of 31 °C and average minimum of 19 °C. Details on the climatic events during the experiment are shown in Figure 1.

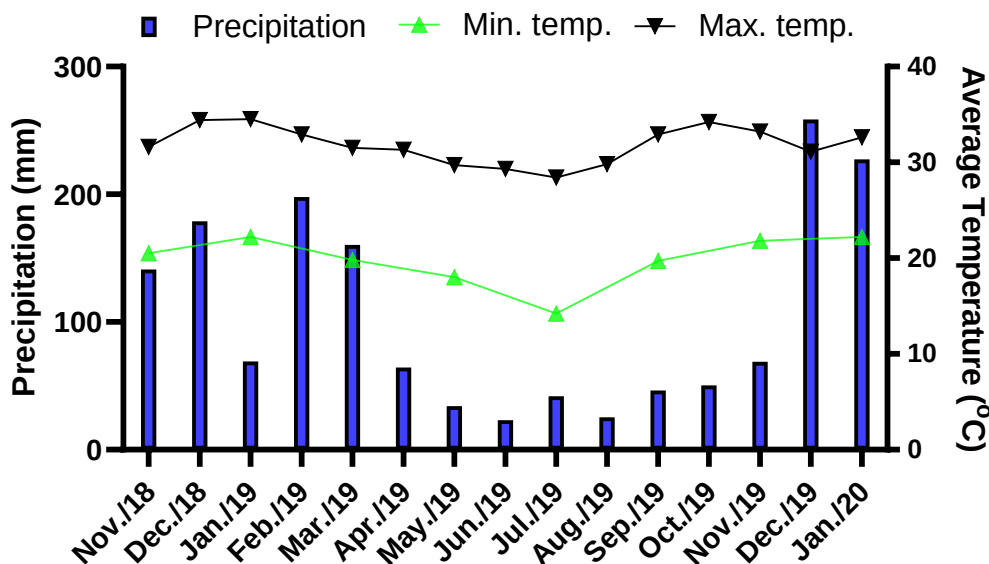


Figure 1. Maximum and minimum temperature (°C) and precipitation (mm) during the experiment (2018/2020).

The soil was classified as an Ultisol [27] and sampled at the 0-20 cm layer before the experimental installation for analysis of chemical properties and granulometric fractions, according to [28]. The results obtained were: 9 mg dm⁻³ P (resin); 24 g dm⁻³ O.M.; 4.9 pH (CaCl₂); K = 1.9 mmolc dm⁻³; Ca = 13 mmolc dm⁻³; Mg = 11 mmolc dm⁻³; H + Al = 30 mmolc dm⁻³; base sum (SB) = 25.9 mmolc dm⁻³; cation exchange capacity (CEC) = 55.9 mmolc dm⁻³; base saturation (V) = 46.3%. The need for liming was determined from the base saturation method to reach 70% of BS [29]. The limestone was distributed homogeneously on the soil surface and incorporated by plowing at a 0.2 m depth. Using the semi-solid NFb (N-free broth) culture medium the total population of diazotrophic microorganisms in the soil was estimated at 9.5x10⁴ bacteria g⁻¹ of soil by the most-probable number method, according to [30]; [31].

Experimental design and treatments

The experiment was installed in November 2018 and sowing in plots of 3 x 4 m. The experimental design was a complete randomized block design with four replications. The treatments were seeds of *Megathyrsus* (syn. *Panicum*) *maximus* cv. BRS Zuri. The main plots consisted of different treatments. The treatments were determined based on the inoculation of plant-growth promoting bacterial (PGPB) strains: (1) *Azospirillum brasilense* strains Ab-V5 (=CNPSo 2083) and Ab-V6 (=CNPSo 2084), (2) *Pseudomonas fluorescens* strain CCTB 03 (=CNPSo 2719) and (3) co-inoculation with *Rhizobium tropici* CIAT 899 (=CNPSo 103, =SEMIA 4077), and *Azospirillum brasilense* Ab-V6; all inoculant treatments received 100 kg of N ha⁻¹, as will be detailed. The 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.) [12], wheat (*Triticum aestivum* L.) [12], *Brachiaria* (*Urochloa* spp.) [13] and co-inoculation of soybean (*Glycine max*) and common bean (*Phaseolus vulgaris* L.) [25]; *P. fluorescens* is used in maize [26], *R. tropici* CIAT 899 in common bean [25]. 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 eight 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). *A. brasilense* was prepared in DYGS medium [21], *P. fluorescens* in TSB medium [31], while *R. tropici* CIAT 899 inoculum was produced in YM medium [31]. At sowing, the concentration of each bacterial inoculant was adjusted to 2×10^8 cells per mL.

Fifteen mL of each inoculant (2×10^9 cells mL⁻¹) were used for each kg of seed, resulting in the supply of 3×10^9 cells kg⁻¹ of seed, as recommended for brachiarias [13]. Considering that 1 g of seeds corresponds to approximately 660 seeds, the concentration of bacteria was of about 4.5×10^3 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. 10 kg ha⁻¹ of viable pure seeds were used. This is the usual inoculation procedure adopted by the farmers pastures.

Phosphate fertilization consisted of 100 kg P₂O₅ ha⁻¹. Potassium fertilization consisted of 60 kg K₂O ha⁻¹. The fertilizer was distributed manually and incorporated at a 0-0.1 m depth. Fifteen days after emergence, 60 kg of N ha⁻¹ was applied in the form of urea in all treatments, except for the negative control. After the second cut, 40 kg of N ha⁻¹ were applied as urea the haul in the treatments, totaling 100 kg of N ha⁻¹.

The plants were cut when they were 0.7m tall. The T₄ (strains Ab-V5 + Ab-V6), T₆ (strain CCTB 03) and T₈ (strains Ab-V6 + CIAT 899) treatments inoculated with PGPB were reinoculated after each cut by spraying a known volume (300 mL) after the 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.

Plant harvest and measurements of productive and nutritional parameters

In the fourteen months, the experimental cuts were performed on Dec./2018, Jan./2019, Feb./2019, Mar./2019, Apr./2019, Jun./2019, Dec./2019 and Jan./2020. For yield determination, only the useful area of the plot was considered, the 0.5 m around it was disregarded. Cuttings were performed eight times during the rainy and dry seasons to determine the plant dry mass when the best treatment reached 0.7 m in height (four-week intervals spring and summer), when shoots were harvested down to 0.2 m above the surface of the ground. The samples for shoot dry mass estimation were taken with a sampler device delimiting a 1 m² area and cutting the plants at 0.2 m height above the soil.

After each harvest, the shoots were identified, weighed and oven dried at approximately 65 °C until

they reached a constant weight. Shoots were subsequently weighed to obtain shoot dry weight yield (SDWY). After drying, the samples were ground to pass a 1 mm screen in a Wiley type mill. Total N concentration was determined according to [32]. Crude protein was determined by multiplying N concentration by 6.25. The acid detergent fiber (ADF) and neutral detergent fiber (NDF) concentration was determined according to [33] and in vitro digestibility dry matter (IVDMS) were determined according to [34].

Before each cutting, plant height readings were taken with a millimeter ruler. The relative chlorophyll index (RCI) was determined using a SPAD502 Plus chlorophyll meter (SPAD - Soil and Plant Analysis Development) (Spectrum technologies, Plainfield, IL, USA). The RCI values were obtained by the average of ten readings performed in the middle third of newly expanded leaves (diagnostic leaves) of each experimental unit. The tiller number was counted before the forage was cut, in a circular area of 0.25 m² at the center of each plot. The material was then collected, and a second separation was performed on the grass leaves and stems to determine the mass of each component.

Statistical analysis

The data were tested for error normality and homogeneity of variances. The results were assessed using analysis of variance (ANOVA), F test ($p \leq 0.05$) and compared using the Scott-Knott test with a 5% probability using SAS (Statistical Analysis System, version 8.2) [35].

3. RESULTS AND DISCUSSION

It is worth mentioning that all inoculated treatments received the same amount of N-fertilizer than the positive control, as rhizospheric diazotrophic bacteria cannot supply all plant's N demands, and the objective of the study was to maximize the biomass production.

Shoot dry weight yields and numbers tillers and relative chlorophyll index

The results obtained in the 14 months (2018/2020) of growth are presented in showing eight evaluation cuts. In the analysis of variance, the parameters of shoot dry weight yields (SDWY), and the SDWY accumulation, relative chlorophyll index (RCI), and tillers units were highly significant, indicating higher yields in the treatments inoculated with PGPB receiving N-fertilizer ($p \leq 0.05$).

For most of the evaluated parameters, the treatments in which the plants were inoculated with PGPB + N-fertilizer had a better performance than those of the positive control, with N-fertilizer and without inoculation. Therefore, and as expected for PGPB with grasses, that the results indicated that PGPB can promote plant growth [36], resulting in a synergistic effect between PGPB inoculation and N fertilization [36, 37].

Statistically significant differences in the second, third, fourth, fifth and eighth evaluation were found for the number of tillers (Figure 2). In the second evaluation, the number of tillers for treatments inoculated with *P. fluorescens* CCTB 03 (207 units m⁻²) and co-inoculated with Ab-V6 + *R. tropici* CIAT 899 (214 units m⁻²) were higher than the other treatments, including the positive control (166 units m⁻²), leading to an increase of 29% in relation to this treatment. In the third evaluation, the co-inoculation with

Ab-V6 + *R. tropici* CIAT 899 (370 units m⁻²) was superior than the other treatments and 25% higher than the positive control (296 units m⁻²). In the fifth evaluation, the treatments inoculated with *A. brasilense* Ab-V5 + Ab-V6 (228 units m⁻²) and Ab-V6 + *R. tropici* CIAT 899 (221 units m⁻²) were superior to the other treatment including the positive control (186 units m⁻²). Finally, in the eighth evaluation, PGPB were superior to the positive control, with increases of up to 36%.

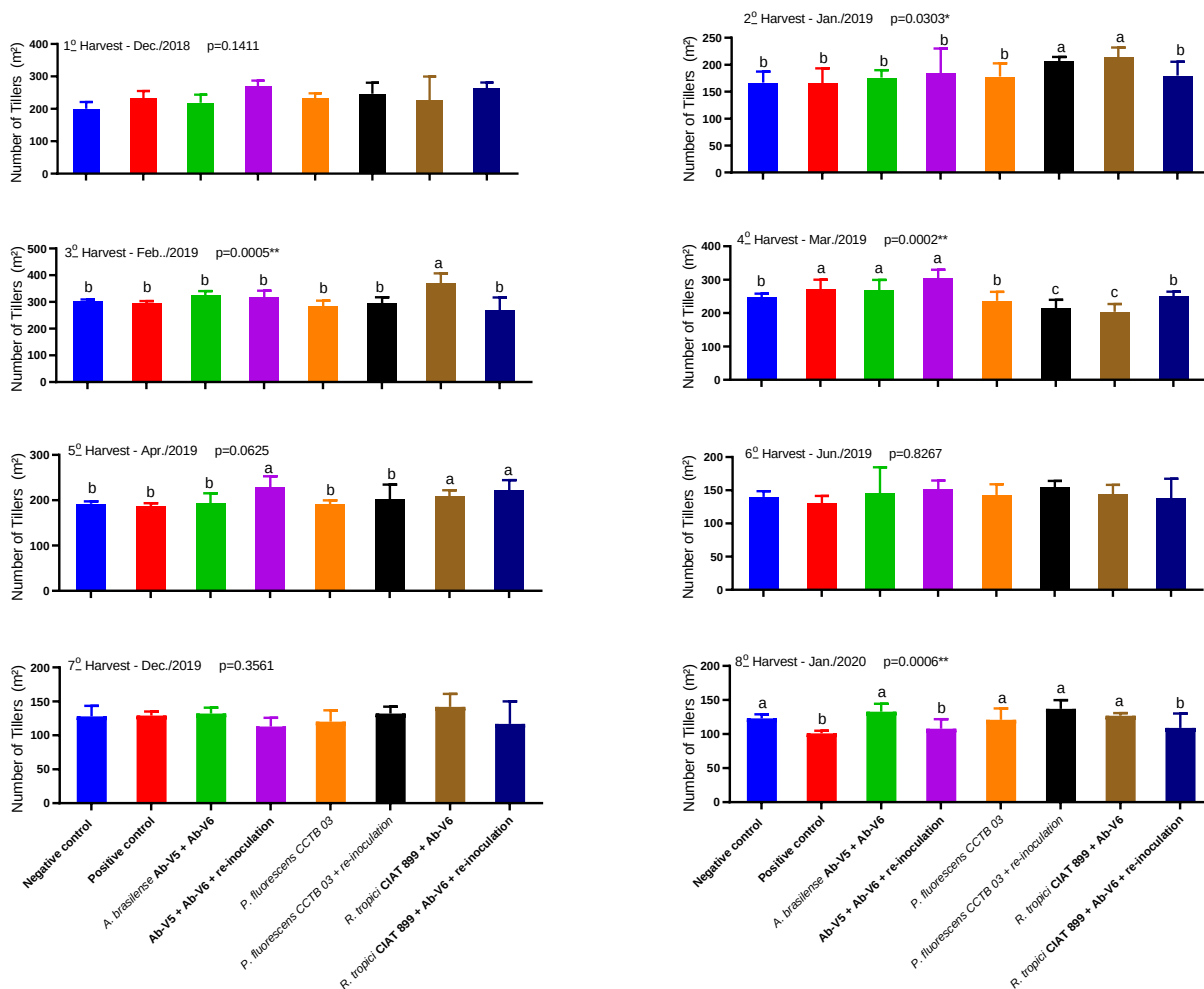


Figure 2. Number of tillers (units m⁻²) in Zuri Guinea grass inoculated with strains *Azospirillum brasilense*, *Pseudomonas fluorescens* and *Rhizobium tropici*. T1= Negative control (without N and inoculation), T2= Positive control (with N and without inoculation), T3= *A. brasilense* Ab-V5 + Ab-V6, T4= *A. brasilense* Ab-V5 + Ab-V6 + re-inoculation after cut, T5= *P. fluorescens* CCTB 03, T6= *P. fluorescens* CCTB 03 + re-inoculation after cut, T7= *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 and T8= *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 + re-inoculation after cut. Error bars represent the standard errors of the means. Averages followed by lowercase letters differ for treatments by the Scott-Knott test ($p \leq 0.05$).

For many PGPB, one main benefit results from the synthesis of phytohormones such as auxins as indoleacetic acid (IAA) and gibberellins. IAA has an important effect on root growth, resulting in increases in the absorption of water and nutrients, ensuring the efficient use of these resources [12]. 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 [38]; [8].

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 [23], and the same for *R. tropici* CIAT 899 [39].

In a previous study [40], increments of 9% in the number of leaves and of 12% in the number of tillers per plant in *U. brizantha* cv. 'Marandu' were found with the inoculation of *Azospirillum*. Evaluating tillering at a dose of 100 kg ha⁻¹ of N with *U. brizantha* cv. 'Xaraés' inoculated with *P. fluorescens* CCTB 03 and *Pantoea ananatis* AMG521 it was shown that the two bacteria promoted the greatest increase in the number of basal tillers, more than 100% in relation to the other treatments [18]. At the dose of 50 kg ha⁻¹ of N, there were no significant increases in the number of basal tillers by inoculation, except for the inoculation with *A. brasilense* Ab-V5, where the number was lower. Similar results were obtained in our study where the significant effects with the PGPB inoculation promoted an average increase of 28% in the tillering of the grass. However, other studies have shown lower increases, of 5% in SDWY [40], or lack of responses [42].

For the relative chlorophyll index (RCI), a significant effect of treatments was found in the first evaluation of Zuri grass (Figure 3). There was a decrease in the values from the first to the eighth evaluation, which is probably due to the lower N content in the plants' chlorophyll over 14 months of experimentation. In the first evaluation, treatments inoculated with PGPB did not differ statistically from the positive control. In the first five evaluations that corresponded to the summer and autumn seasons, the values varied from 30 to 45 and afterwards they decreased, presenting values below 30.

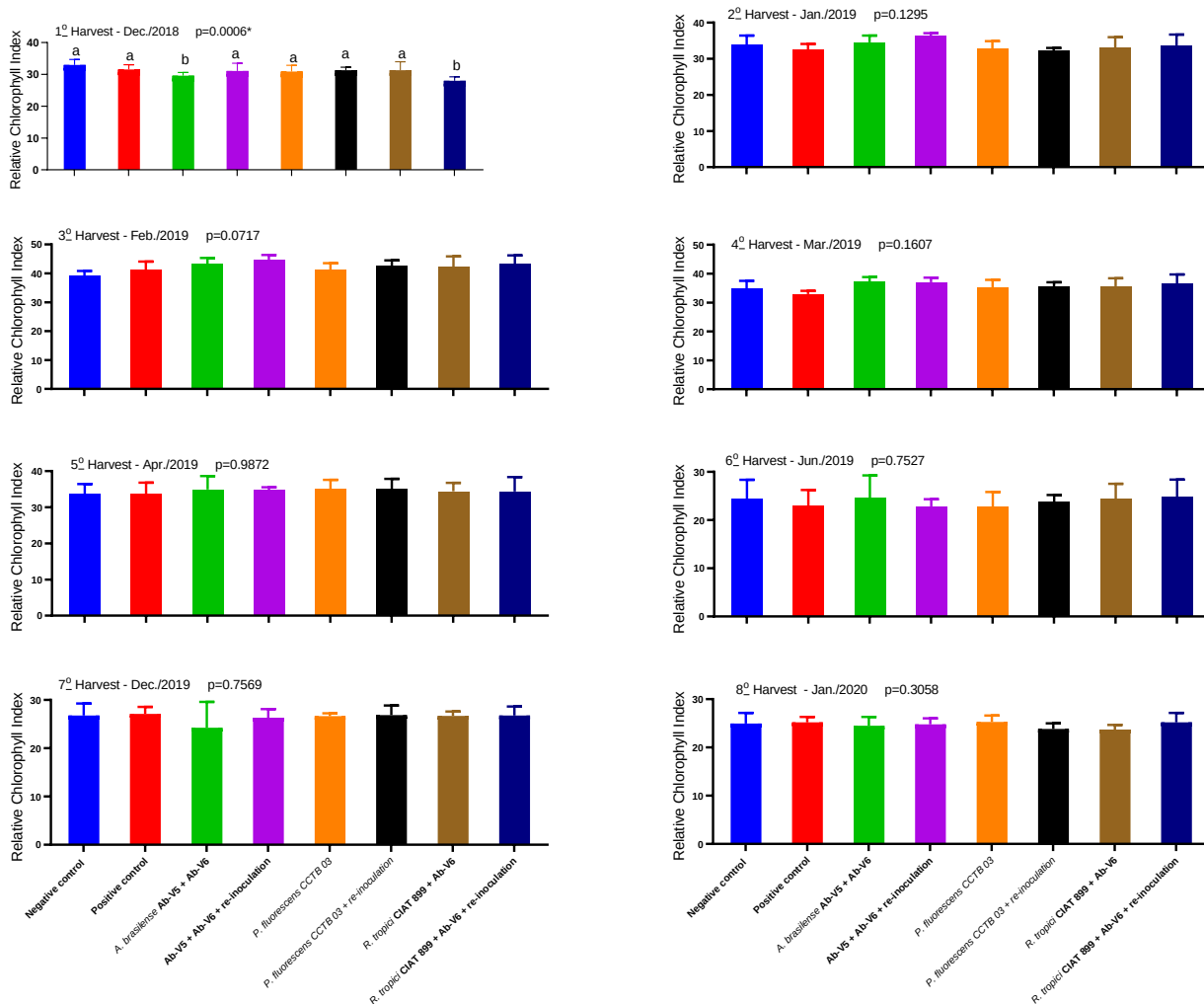


Figure 3. Relative chlorophyll index (RCI) in Zuri Guinea grass inoculated with strains *Azospirillum brasilense*, *Pseudomonas fluorescens* and *Rhizobium tropici*. T1= Negative control (without N and inoculation), T2= Positive control (with N and without inoculation), T3= *A. brasilense* Ab-V5 + Ab-V6, T4= *A. brasilense* Ab-V5 + Ab-V6 + re-inoculation after cut, T5= *P. fluorescens* CCTB 03, T6= *P. fluorescens* CCTB 03 + re-inoculation after cut, T7= *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 and T8= *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 + re-inoculation after cut. Error bars represent the standard errors of the means. Averages followed by lowercase letters differ for treatments by the Scott-Knott test ($p \leq 0.05$).

The treatments in which plants were inoculated with PGPB and fertilized with N had higher RCI values relative to the unfertilized plants. According to [8], the photosynthetic capacity is optimized with 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 30 can be considered as indicative of good nutritional status of grass.

There was a significant effect of treatments for SDWY in the first, second, fourth and sixth evaluations (Figure 4). In the first evaluation, the treatments inoculated with PGPB were superior but did not differ from the positive control, probably due to the initial growth vigor of the grass. In the second evaluation, the treatments inoculated with *P. fluorescens* CCTB 03 were superior to the others, but did not show

statistical difference from the positive control. Although in the re-inoculated treatment with *P. fluorescens* CCTB 03 after cutting the grass did not differ from the positive control, it produced 7% more SDWY. In the fourth evaluation cut of Zuri Guinea grass, the treatments re-inoculated with PGPB after cutting were superior to the positive control, producing 29% more SDWY. In the sixth cut, the treatment inoculated with *A. brasilense* Ab-V5 + Ab-V6 was superior to the others and in relation to positive control it produced 42% more SDWY.

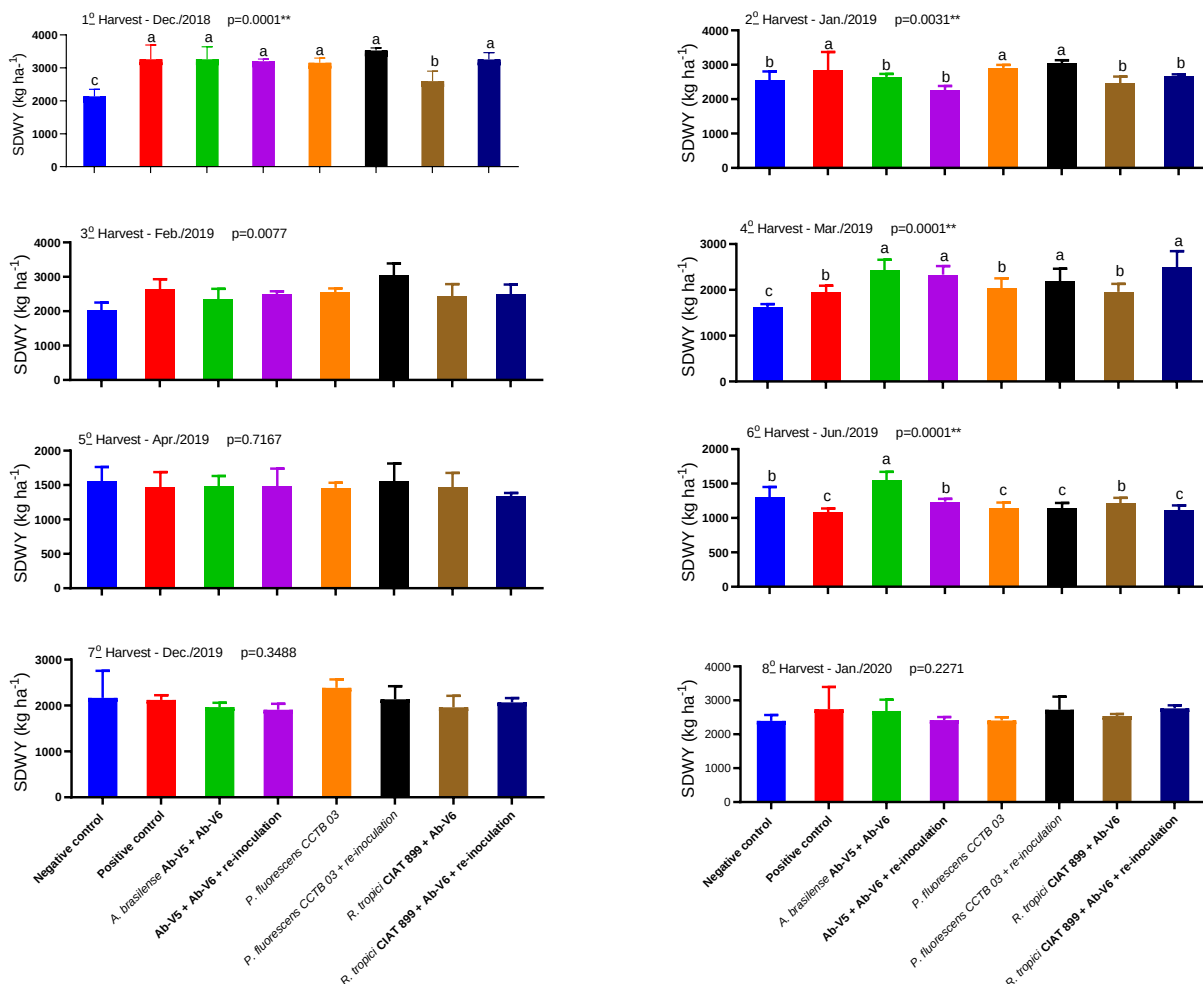


Figure 4. Shoot dry weight yield (SDWY) (kg ha⁻¹) in Zuri Guinea grass inoculated with strains *Azospirillum brasilense*, *Pseudomonas fluorescens* and *Rhizobium tropici*. T1= Negative control (without N and inoculation), T2= Positive control (with N and without inoculation), T3= *A. brasilense* Ab-V5 + Ab-V6, T4= *A. brasilense* Ab-V5 + Ab-V6 + re-inoculation after cut, T5= *P. fluorescens* CCTB 03, T6= *P. fluorescens* CCTB 03 + re-inoculation after cut, T7= *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 and T8= *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 + re-inoculation after cut. Error bars represent the standard errors of the means. Averages followed by lowercase letters differ for treatments by the Scott-Knott test ($p \leq 0.05$).

According to Resende and collaborators [2], the effects of inoculation with *A. brasilense* strains (Ab-V5 + Ab-V6) and with *R. tropici* + Ab-V6 in maize, increases in height and consequently in production of dry mass of the aerial part of the plants were found in relation to the control treatment without inoculation.

Evaluating the agronomic response of triticale culture to different forms of application of strains of *Azospirillum*, Sipione and collaborators [41] did not find positive effects of leaf inoculation for height, stem dry matter and shoot dry matter.

PGPBs have the ability to promote growth and make nutrients available to plants, biologically fix nitrogen, solubilize phosphate, increase plant resistance to biotic and abiotic stresses and produce metabolites essential for growth [44]; [45]; [46]; [47].

The co-inoculation of *Azospirillum* Ab-V6 and *R. tropici* CIAT 899 has shown successful results for growth of maize, and a main driven effect could be the induction of plant systemic resistance to tolerance of abiotic stresses [24]. 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 [47];[48]. In Gramineae, strains of *Azospirillum* (Ab-V5 and Ab-V6) contribute as plant growth promoters [25] mainly by the synthesis of (IAA) [8]; [49]; [24], while *Rhizobium* could also phytohormone in non-legumes [50]; [51]; [37]. For example, Itzigsohn *et al.* [52] 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 [53]. This justifies the significant results by PGPB in the present work, since the soil used was of low fertility although chemical correction was carried out.

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) [54]. 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, higher dry and green mass productions was verified in comparison to plants receiving only N fertilization and emphasized that such increases were the result of the release of phytohormones [55].

The results obtained in the present experiment are in agreement with previous results [56] obtained with Coastcross-1 grass (*Cynodon dactylon*), inoculated with *Azospirillum* strains Ab-V5 and Ab-V6 and fertilized 100 kg ha⁻¹ of N, with positive effects on the production of forage of the aerial part when compared to the non-inoculated treatments. Other studies [13] also reported beneficial effects on the shoot aerial part of *Urochloa* spp. Grasses, combining strains of *Azospirillum* Ab-V5 and Ab-V6 and 40 kg ha⁻¹ of N, with the bacteria promoting increases in production from 17.4 to 29.5%. The results reported [40] also evaluate the seed inoculation effects of *A. brasilense* strains Ab-V5 and Ab-V6 on the shoot of *U. brizantha* cv. 'Marandu' and found that the overall increase in shoot dry mass due to inoculation was of 13% and 6% in the first and second years, respectively, compared with the control. Other authors have also observed increases in shoot dry mass yield in plants inoculated PGPB [57]; [58]; [59], demonstrating its general, non-specific potential as plant-growth promoter.

Therefore, there are positive effects of PGPB inoculation in the production of SDWY and in tillering of Zuri guinea grass, which promoted increases in production when compared to treatments without inoculation (positive control), since bacteria secrete substances that increase root growth, plants have greater support and conditions for productivity and growth. The results show s that PGPBs alone do not

replace N-fertilizers in grasses, but when associated, they promote greater absorption and use of the N available in the soil [60]; [61], showing a possible synergistic effect between inoculation x nitrogen fertilization [35]. In Zuri guinea grass the results were more expressive at the dose of 100 kg ha⁻¹ of N-fertilizer.

For the accumulated of SDWY in the eight evaluation cuts of Zuri guinea grass, the treatment reinoculated with *P. fluorescens* CCTB 03 (19332 kg ha⁻¹) after each cut was statistically superior to the positive control (18103 kg ha⁻¹) (Figure 5), with 7% increase in relation to positive control. However, it did not differ statistically from the treatments Ab-V5 and Ab-V6 (18345 kg ha⁻¹) and Ab-V6 + *R. tropici* CIAT 899 (18199 kg ha⁻¹) that were reinoculated after each cut. This higher rate of SDWY accumulation is possibly related to the increase in the activity of photosynthetic enzymes and N assimilation enzymes [12]. Similar results were previously obtained [62], with inoculated *U. brizantha* cv. 'Marandu'. The authors pointed out the inoculation as a sustainable alternative to increase forage production. The increase in production may be related to the greater release of phytohormones essential for growth, which improve the absorption of macro and micronutrients [63].

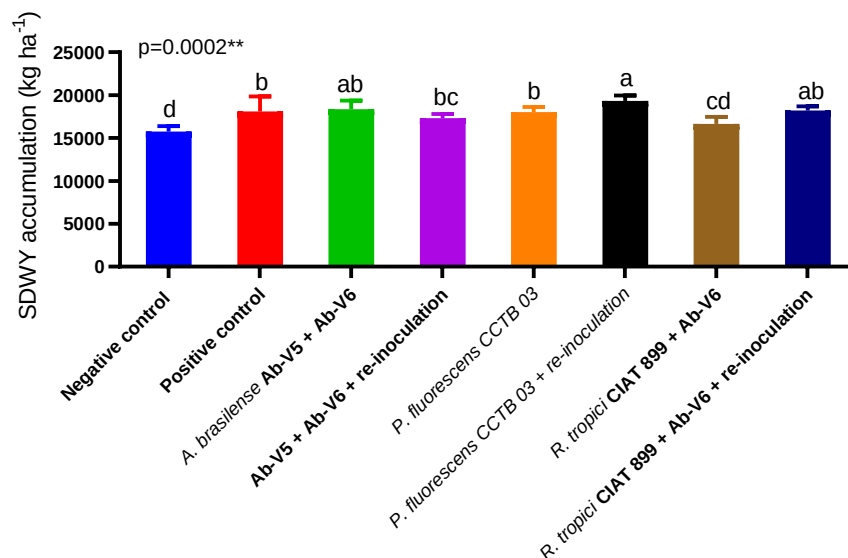


Figure 5. Shoot dry weight yield (SDWY) accumulation (kg ha⁻¹) in Zuri Guinea grass inoculated with strains *Azospirillum brasilense*, *Pseudomonas fluorescens* and *Rhizobium tropici*. T1= Negative control (without N and inoculation), T2= Positive control (with N and without inoculation), T3= *A. brasilense* Ab-V5 + Ab-V6, T4= *A. brasilense* Ab-V5 + Ab-V6 + re-inoculation after cut, T5= *P. fluorescens* CCTB 03, T6= *P. fluorescens* CCTB 03 + re-inoculation after cut, T7= *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 and T8= *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 + re-inoculation after cut. Error bars represent the standard errors of the means. Averages followed by lowercase letters differ for treatments by the Scott-Knott test ($p \leq 0.05$).

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 resulted in improved SDWY accumulation. These results disagree

with [64], who concluded that the re-inoculation of *A. brasilense* in Coastcross-1 grass after the first year of cultivation was not necessary, and also with [65], who 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 nutrient with the greatest accumulation were N, important nutrients for forages [66]; [67]. The increases in N accumulation, 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*, probably also by a contribution of biological nitrogen fixation [21]; [68]. In addition, *Azospirillum* may influence the activity of glutamine synthetase in grass roots, impacting plant N nutrition and growth [69]; [70].

Re-inoculation after cutting is a practice that proved to be feasible to provide SDWY accumulation for PGPB and, therefore, deserves to be better studied if it can be alternated with each cut or even with strategic applications during the year.

Total N concentration and total N Uptake in shoots

Statistically significance differences in the total N concentration in the shoots of Zuri Guinea grass were observed in the experiment (Figure 6). Plants inoculated with *A. brasilense* Ab-V5 + Ab-V6 and *P. fluorescens* CCTB 03 and Ab-V6 + *R. tropici* CIAT 899 at sowing after the eight cuttings had the best performance in terms the total N concentration, with an average increase of 38%, 44% and 45%, respectively, in relation to positive control. The total N concentration for the treatments re-inoculated after cutting showed no statistical difference in relation to the positive control.

Regarding the nutrient concentration, leaf N increased with the evaluations demonstrating that biological nitrogen fixation was effective. However, results obtained by [40] evaluating the seed inoculation effects of *A. brasilense* strains Ab-V5 and Ab-V6 on the total N concentration of *U. brizantha* cv. 'Marandu' disagree have reported no effects due to the inoculation with *Azospirillum*. Increases in the other total N concentration might be related to the improvement of plant effectiveness in nutrient uptake, since there is a physical response to the increase of the root absorptive surface, including an increase of specific uptake mechanisms via transporters, which are mainly proteins depending on N to be formed. The total N concentration was within the range considered adequate for this forage species [71].

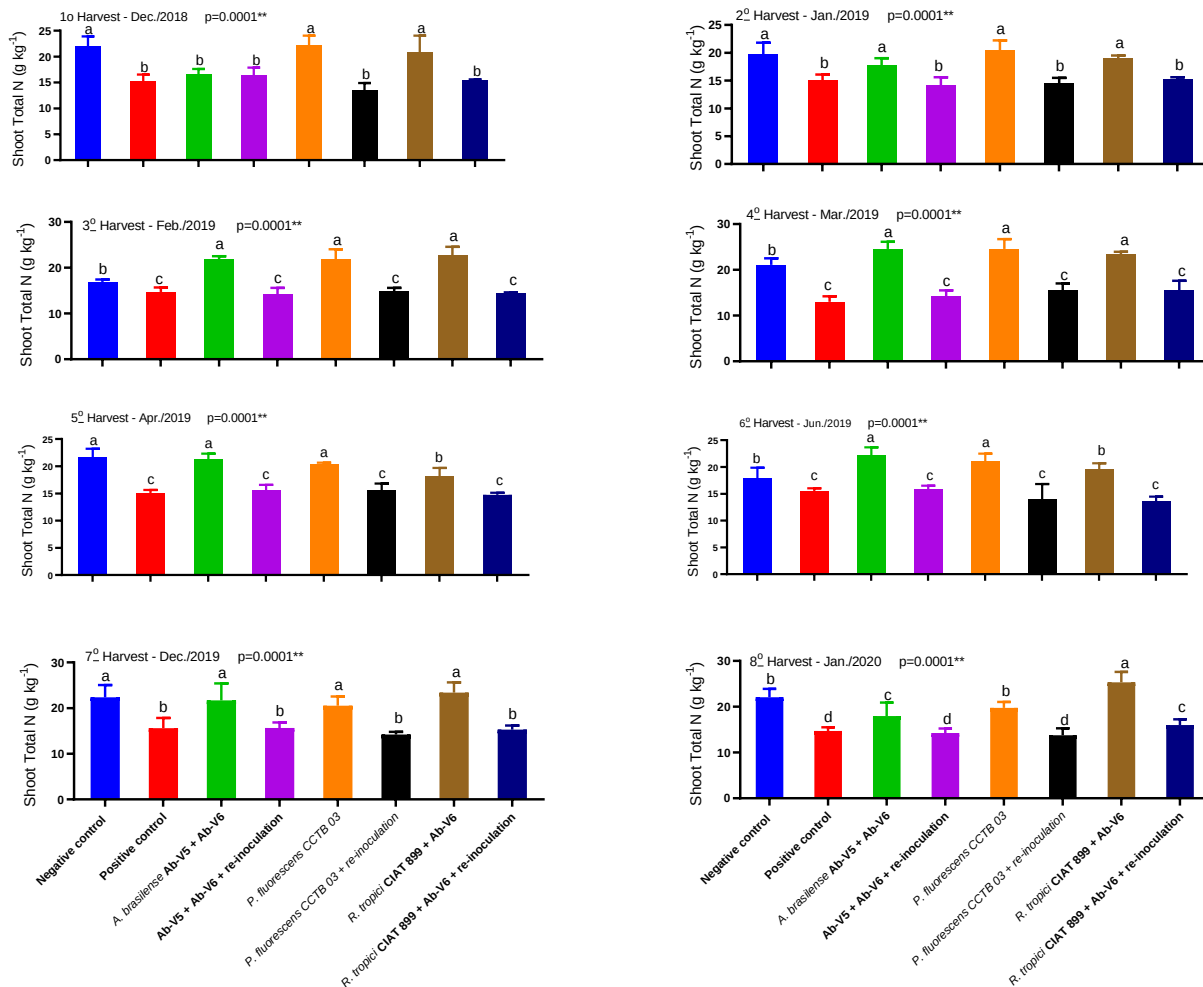


Figure 6. Total N concentration (g kg⁻¹) in the shoots of Zuri Guinea grass inoculated with strains *Azospirillum brasilense*, *Pseudomonas fluorescens* and *Rhizobium tropici*. T1= Negative control (without N and inoculation), T2= Positive control (with N and without inoculation), T3= *A. brasilense* Ab-V5 + Ab-V6, T4= *A. brasilense* Ab-V5 + Ab-V6 + re-inoculation after cut, T5= *P. fluorescens* CCTB 03, T6= *P. fluorescens* CCTB 03 + re-inoculation after cut, T7= *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 and T8= *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 + re-inoculation after cut. Error bars represent the standard errors of the means. Averages followed by lowercase letters differ for treatments by the Scott-Knott test ($p \leq 0.05$).

In relation to the total N uptake, plants fertilized with N and inoculated with *P. fluorescens* CCTB 03 at sowing after the cuttings presented the highest value, of 43% more and differing statistically from the positive control (Figure 7). The negative control was statistically lower than the other treatments. The treatment inoculated with *A. brasilense* Ab-V5 + Ab-V6 accumulated 37% more, differing statistically from the positive control.

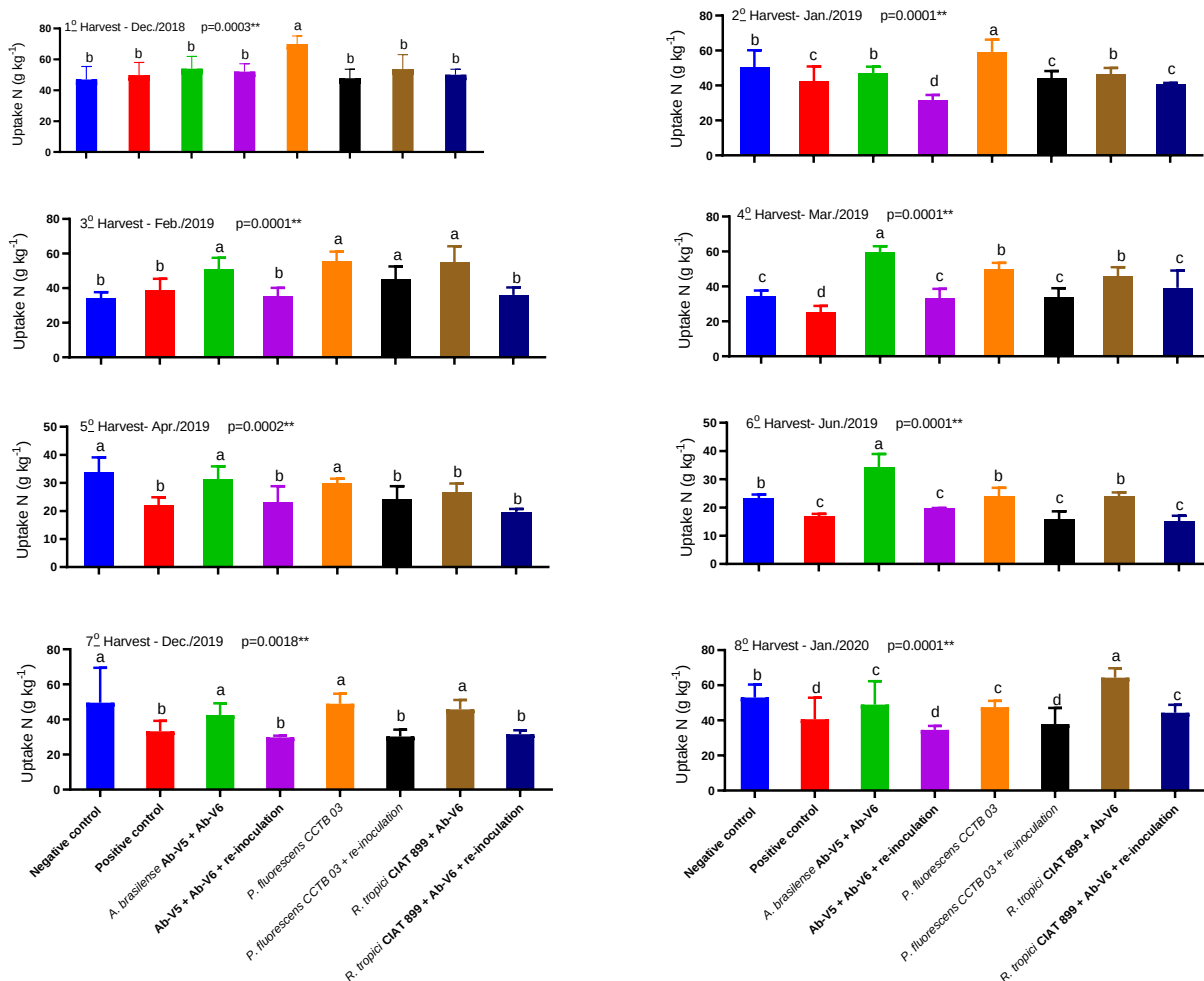


Figure 7. Total N uptake (g kg⁻¹) in the shoots of Zuri Guinea grass inoculated with strains *Azospirillum brasilense*, *Pseudomonas fluorescens* and *Rhizobium tropici*. T1= Negative control (without N and inoculation), T2= Positive control (with N and without inoculation), T3= *A. brasilense* Ab-V5 + Ab-V6, T4= *A. brasilense* Ab-V5 + Ab-V6 + re-inoculation after cut, T5= *P. fluorescens* CCTB 03, T6= *P. fluorescens* CCTB 03 + re-inoculation after cut, T7= *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 and T8= *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 + re-inoculation after cut. Error bars represent the standard errors of the means. Averages followed by lowercase letters differ for treatments by the Scott-Knott test ($p \leq 0.05$).

The total N concentration and total N accumulation in the shoots of Zuri Guinea grass showed positive effects when the plants were inoculated with PGPB, probably explained by the increase in root volume and consequently greater absorption of water and nutrients [67]; [66]. The benefits were mainly attributed to the strains of *Azospirillum* and *Pseudomonas*. We may suppose that the effects could be attributed to improvement in root growth, enhancing the absorption of water and nutrients by plants [69], in addition to the BNF and activity of glutamine synthetase by *Azospirillum* [69]; [70], as mentioned before.

Evaluating the effects of inoculation [13]; [72] of strains of *A. brasilense* (Ab-V5 + Ab-V6) in *U. brizantha* and *U. ruzizienses* resulted in increments of 4 to 15% in the total N accumulation, when compared to the positive control. In a previous report [39] of the inoculation of Zuri Guinea Grass also increased up

to 8.8% the N accumulation, while in our study the values were of up to 40%.

Considering the potential for increasing biomass production of Zuri Guinea grass, *Azospirillum* and *Pseudomonas* are promising PGPB. For example, *Azospirillum* inoculation associated with 40 kg ha⁻¹ of N as topdressing 30 days after sowing corresponded to an extra application of 40 kg ha⁻¹ of mineral N [25]. This is an important issue to be considered for the reduction of the environmental impacts of mineral N fertilizers because of more efficient use. Besides being converted into proteins in plant biomass, the more efficient use of mineral N by plants inoculated with *Azospirillum* reduces nitrate losses to groundwater by leaching or greenhouse gas emissions to the atmosphere via denitrification. Thus, the use of more environmentally-friendly tools for pasture establishment is important for maintaining the sustainability of livestock activities, as it improves the land efficiency and nutrient use, helps soil and water conservation and contributes for the sequestration of C in either plant shoot biomass [13] or in the soil as roots.

Nutritive value in Zuri Guinea grass

Statistically significant differences in the neutral detergent fiber (NDF) in the shoots of Zuri Guinea grass were observed in the experiment (Figure 8). The treatments inoculated with PGPB did not differ from the positive control in the eight evaluations.

Animal consumption of dry matter and digestibility are related to NDF and ADF, respectively. In this way the ADF indicates the percentage of highly indigestible material, therefore low values of ADF indicate greater energy and high digestibility, and forages with low content of NDF have higher consumption rate; therefore, contents of NDF greater than 60% in the dry matter of the food are detrimental to consumption, with lower values being desirable [73]. The NDF values of the present study were above 60%, being in a range not recommended for a good rate of forage consumption by the animals [74].

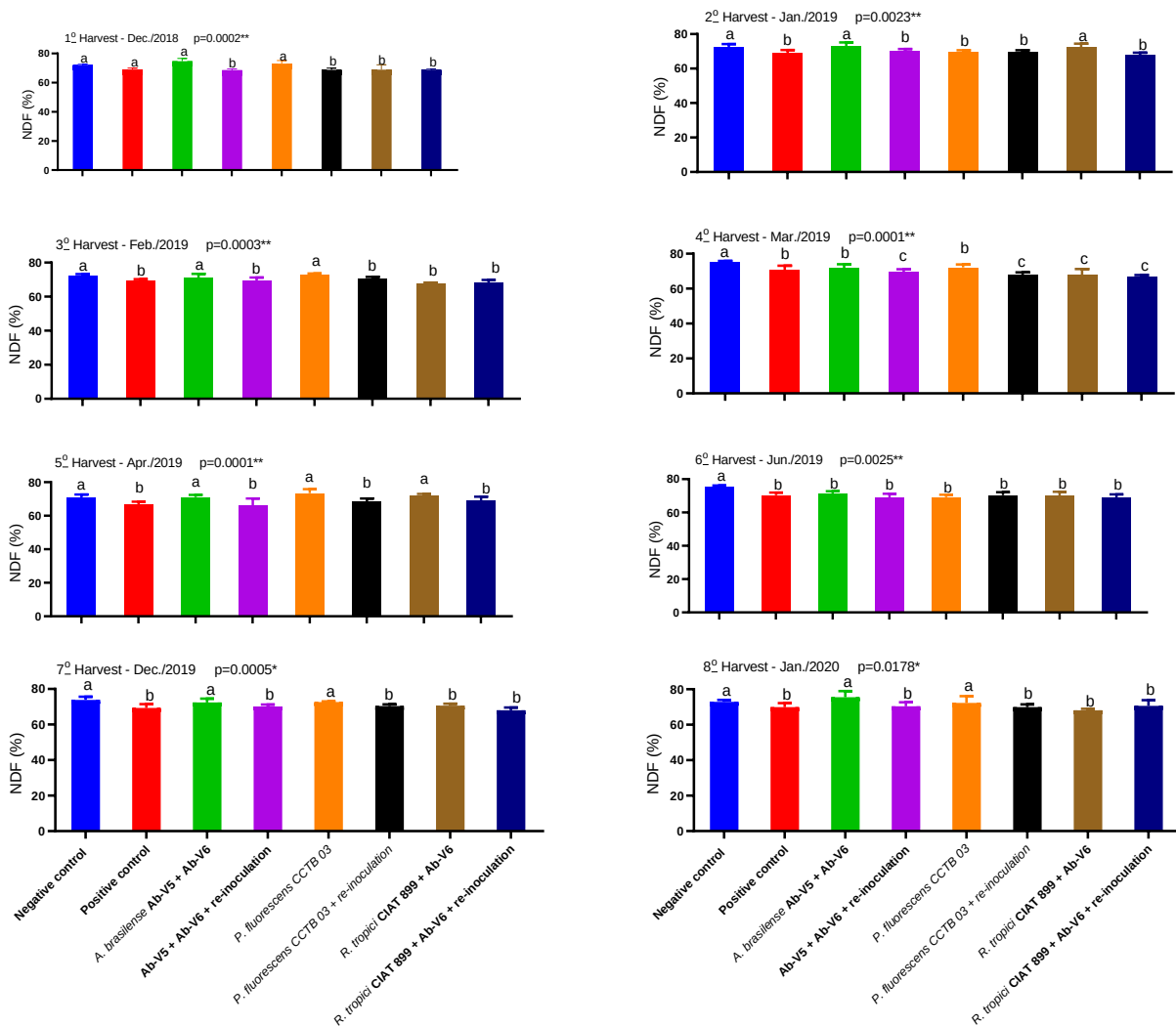


Figure 8. Neutral detergent fiber (NDF) (%) in the shoots of Zuri Guinea grass inoculated with strains *Azospirillum brasilense*, *Pseudomonas fluorescens* and *Rhizobium tropici*. T1= Negative control (without N and inoculation), T2= Positive control (with N and without inoculation), T3= *A. brasilense* Ab-V5 + Ab-V6, T4= *A. brasilense* Ab-V5 + Ab-V6 + re-inoculation after cut, T5= *P. fluorescens* CCTB 03, T6= *P. fluorescens* CCTB 03 + re-inoculation after cut, T7= *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 and T8= *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 + re-inoculation after cut. Error bars represent the standard errors of the means. Averages followed by lowercase letters differ for treatments by the Scott-Knott test ($p \leq 0.05$).

The percentages of acid detergent fiber (ADF) in the aerial part of the Zuri Guinea grass showed significance in the analysis of variance for the treatments in the second, fourth, sixth and eighth assessment cut (Figure 9). The co-inoculated treatment with Ab-V6 + *R. tropici* CIAT 899 showed the lowest ADF content in the cuts in relation to the positive control.

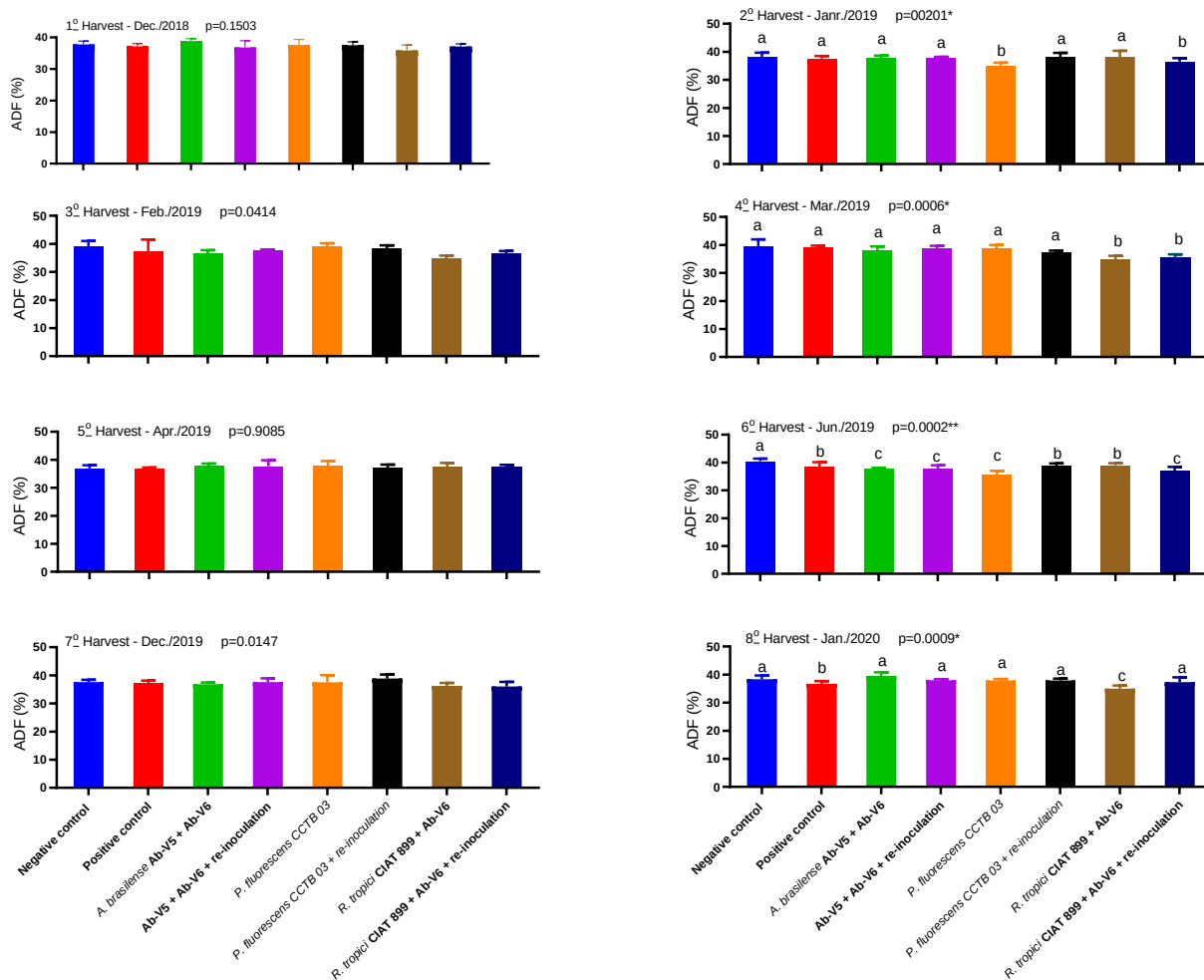


Figure 9. Acid detergent fiber (ADF) (%) in the shoots of Zuri Guinea grass inoculated with strains *Azospirillum brasilense*, *Pseudomonas fluorescens* and *Rhizobium tropici*. T1= Negative control (without N and inoculation), T2= Positive control (with N and without inoculation), T3= *A. brasilense* Ab-V5 + Ab-V6, T4= *A. brasilense* Ab-V5 + Ab-V6 + re-inoculation after cut, T5= *P. fluorescens* CCTB 03, T6= *P. fluorescens* CCTB 03 + re-inoculation after cut, T7= *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 and T8= *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 + re-inoculation after cut. Error bars represent the standard errors of the means. Averages followed by lowercase letters differ for treatments by the Scott-Knott test ($p \leq 0.05$).

Statistically significant differences in the crude protein (CP) in the shoots of Zuri Guinea grass were observed in the experiment (Figure 10). The treatments inoculated with PGPB differed from the positive control in the eight evaluation cuts.

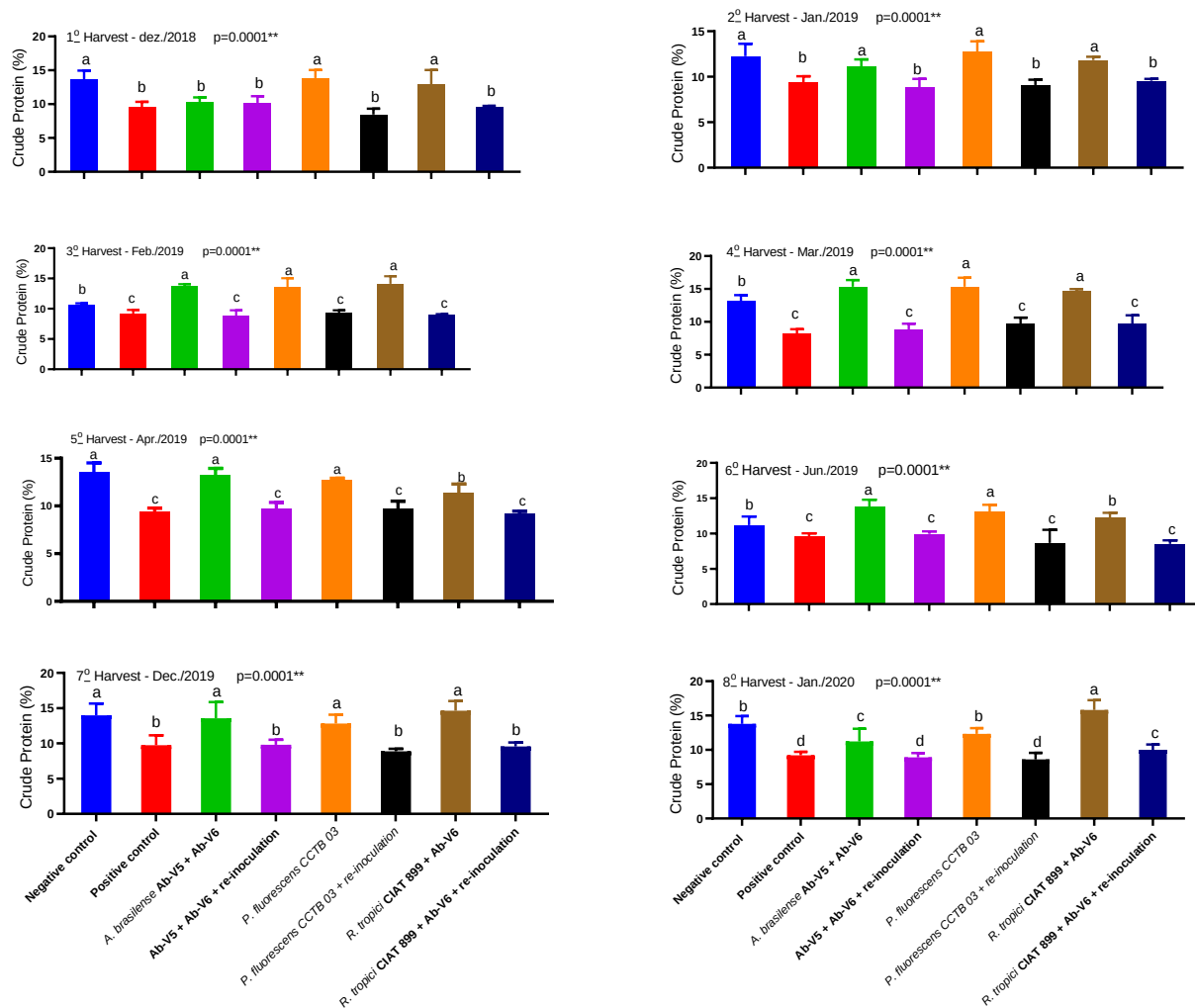


Figure 10. Crude protein (CP) (%) in the shoots of Zuri Guinea grass inoculated with strains *Azospirillum brasilense*, *Pseudomonas fluorescens* and *Rhizobium tropici*. T1= Negative control (without N and inoculation), T2= Positive control (with N and without inoculation), T3= *A. brasilense* Ab-V5 + Ab-V6, T4= *A. brasilense* Ab-V5 + Ab-V6 + re-inoculation after cut, T5= *P. fluorescens* CCTB 03, T6= *P. fluorescens* CCTB 03 + re-inoculation after cut, T7= *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 and T8= *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 + re-inoculation after cut. Error bars represent the standard errors of the means. Averages followed by lowercase letters differ for treatments by the Scott-Knott test ($p \leq 0.05$).

Evaluating the effect of inoculation by *A. brasilense* on seeds of *U. brizantha* cv. 'Marandu' associated with the use of N, according to [75] found no significant effects of inoculation for the CP and NDF content of the grass, showing results that differ from those of the present study. According to [76], when evaluating the effect of inoculation with *P. fluorescens* and N levels on the CP content in corn, also did not find significant effects of inoculation, whether combined with N fertilization or not. In the present study, a response of up to 44% increase in CP content was found for bacteria and especially for *P. fluorescens* CCTB 03.

Statistically significant differences in the *in vitro* digestibility of dry matter in the shoots of Zuri Guinea

grass were observed in the experiment (Figure 11). The treatments inoculated with PGPB differed from the positive control in the evaluations.

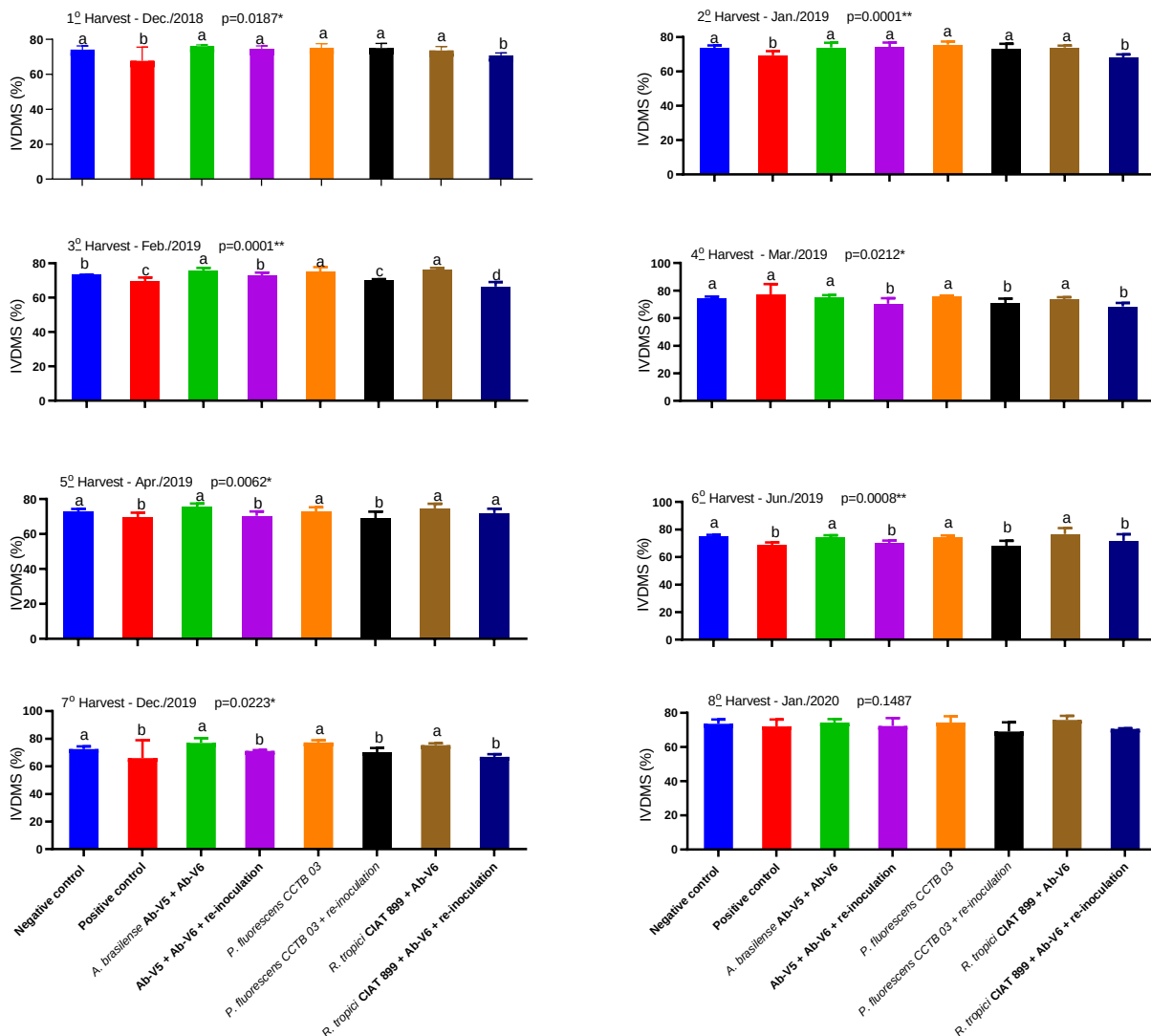


Figure 11. In vitro digestibility of dry matter (IVDMS) (%) in the shoots of Zuri Guinea grass inoculated with strains *Azospirillum brasilense*, *Pseudomonas fluorescens* and *Rhizobium tropici*. T1= Negative control (without N and inoculation), T2= Positive control (with N and without inoculation), T3= *A. brasilense* Ab-V5 + Ab-V6, T4= *A. brasilense* Ab-V5 + Ab-V6 + re-inoculation after cut, T5= *P. fluorescens* CCTB 03, T6= *P. fluorescens* CCTB 03 + re-inoculation after cut, T7= *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 and T8= *R. tropici* CIAT 899 + *A. brasilense* Ab-V6 + re-inoculation after cut. Error bars represent the standard errors of the means. Averages followed by lowercase letters differ for treatments by the Scott-Knott test ($P \leq 0.05$).

The results of IVDMS are superior to those previously reported [62], who assessed the viability of *A. brasilense* associated with N fertilization in the chemical composition of 'Marandu' grass at different times of the year, and did not find significant effects of inoculation on the levels of IVDMS in summer and winter.

5. Conclusions

The PGPB when combined N-fertilizer, increased yield, tillers units, the relative chlorophyll index, the nutrient concentration total N, the uptake total N, NDF, ADF, CP and IVDMS of Zuri Guinea grass. This result indicates that PGPB can be a sustainable alternative for reducing the use of N-fertilizers. The lower 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.

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Vitamin D3 Supplementation: An Option Associated with The Treatment of Multiple Sclerosis: A Systematic Review and Meta-Analysis

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ABSTRACT

Multiple sclerosis (MS) is a chronic complex neurodegenerative disease. A systematic review and meta-analysis were conducted on observational studies and analytics on impact of Vitamin D supplementation in patients with Multiple Sclerosis. In our research, a total of 457 articles were selected and identified for analysis. This systematic review article and meta-analysis, which included evidence from randomized controlled trials conducted with patients with multiple sclerosis, revealed that Vitamin D3 supplementation is effective as an option associated with the treatment of this disease, and that it also has a diffuse protective role against various remission outbreaks in the health. Doses (50,000 IU/week) are appropriate to restore neuroimmunological parameters when used within 12 weeks.

Keywords: Vitamin D3, Multiple Sclerosis, Neurogenesis, Supplementation, deficiency.

1.0 INTRODUCTION

Multiple sclerosis (MS) is a chronic complex neurodegenerative disease. MS presents destruction of the myelin which develops alterations in the conduction of the nervous impulse with degenerative behavior to which it is often related to autoimmune characteristics [1].

In Brazil, MS has a prevalence rate of 15 cases per 100.000 inhabitants [3-4], on the other hand, in countries as United States of America, Russia and Canada the prevalence increases by around 50-200 cases per 100.000 inhabitants [1-4]. This disease occurs mainly in the adult population from 18 to 55 years [4]. However, it is currently being diagnosed in children and adolescents [3-4]. Women have a higher prevalence [19], around three cases for every two cases for men [04]. It is a disease that impacts on work [01], family, as well as social and economic issues [24]. In Brazil, MS is considered as severe and rare [04]

and its treatment are performed in the Unified Health System (Ministry of Health), which is considered of high cost to the Brazilian government [3]. In Brazil, in some cities such as São Paulo (03), Santos and Campo Grande, the rates of people with MS reach around 15 cases per 100,000 inhabitants [04]. Currently, treatment with Vitamin D3 can be considered as usual for disease [3], although other studies are ongoing [11].

Vitamin D3 is a key hormone for calcium homeostasis, development of a healthy skeleton [16], immune, cardiac and neurological system [18]. Vitamin D is taken orally and after the ingestion process is transported to the liver. In the liver, the hydroxylation of Carbon 25 occurs and thus, it will result in the production of 25-hydroxyvitamin D [25 (OH) D] and thus, this molecular compound is the main circulating vitamin formula used by the body. It is worth mentioning that the mediation of hydroxylation in the liver occurs by several enzymes known as 25-hydroxylase, the most important in the body is CYP2R1 type 1 [01]. And the Vitamin D3 in the immune system is a potent antiproliferative hormone capable of inhibiting proliferation and stimulating cell differentiation [20]. According to studies in neurosciences using Wistar rats [22], Vitamin D3 presents stimulatory actions of modulating neural growth factor and brain development [25].

Vitamin D receptors (VDRs) can be found in some tissues of the body [24], but other actions unrelated to mineral metabolism have been highlighted [23]. As several human brain cells specifically express 1-hydroxylase and VDR [26], some studies [30] claim that vitamin D3 exerts regulatory actions on brain development and functions [30]. However, there is a lack of scientific support for vitamin D3 to be used as adjuvant therapy in the standard treatment of multiple sclerosis [22].

Experimental studies with humans and animals have correlated the mechanism of involvement of Vitamin D3 in MS with differentiated immune modulation of the central nervous system (CNS) [26]. However, Vitamin D3 may interfere with the pathophysiology of Multiple Sclerosis [21], affecting inflamed and healthy tissue [24]. This interference is due to the binding protein of Vitamin D3 (DBP) and Vitamin D receptor (VDR), as well as the presence of metabolic enzymes (CYP27B1) [30] which are present in the central nervous system [28].

VDR and CYP27B1 are expressed in a cellular variety which includes the invading neurons, glial cells and lymphocytes [30]. According to experimental studies, Vitamin D3 plays a modulating role in several pathophysiological processes of Multiple Sclerosis [30], which includes the inflammatory process, demyelination, axonal damage and remyelination [28]. Variations in the risks and benefits to the use of Vitamin D3 have been recorded in relation to the dosage [22]. There is a consensus that the daily intake of 10,000 units (100 ng/ ml in serum) of Vitamin D3 per patient does not present toxic effects in the body [30], which would not cause adverse health effects [24]. In the last decades, neuroscience research has revealed conflicting data on the neurological benefits of Vitamin D3, as well as the amount of vitamin D ingested and the time required for patient recovery [22]. The objective of this study was to perform a systematic review and a metanalysis to assess the effectiveness of the impact of Vitamin D3 supplementation on the health-disease process in Multiple Sclerosis in the central nervous system through immunological studies. This research was registered and authorized by the Center of Journals and Disclosure - PROSPERO with the code: CRD42019121732.

2.0 METHODS

2.1 – Protocol - This Systematic Review and meta-analysis was authorized for publication in the “International Prospective Register of Systematic Reviews” with the following code: CRD42019121732.

2.2 – Eligibility Criteria - The eligible studies included in this systematic review and meta-analysis were articles published in peer-reviewed scientific journals; study with randomized, prospective and longitudinal trials; studies that included patients who were supplemented with vitamin D3 at varying doses (4.000 IU – 50.000 IU); patients diagnosed with multiple sclerosis and hypovitaminosis D; patients aged $\geq$ 18 years, sample size $\geq$ 20 patients, studies that considered a control group and published from 2011 to 2018.

2.3 – Information Sources - The research was carried out in the bibliographic databases Cochrane Library, Medline, US National Library of Medicine and the National Institute Health (PubMed), Latin American and Caribbean Literature in Health Sciences (Lilacs), Scopus, Web of Science and Biblioteca Científica Online (SCIELO).

2.4 – Search Strategy - This research was carried out from March 2018 to November 2018. The research was conducted in the English and Portuguese languages, and the following terms were used [09]: "Vitamin D3" AND ("Vitamin D3 Supplementation" OR "Vitamin D3 deficiency" AND "Epidemiology OR Vitamin ("OR"), and "Multiple Sclerosis" AND (Adult OR Neurogenesis). Duplicate studies were excluded by two researchers (EMR and MDDL) who selected the relevant titles and abstracts to include them in this study.

2.5 - Selection of Data Collection Studies - The studies were independently reviewed by four authors and the data retrieved (EMR, GGF, MDdL, FJMdR and JECG). Duplicate studies were analyzed according to the previous result and the crossing of included data in order to rule out the risk of bias investigation of the residual effects of the specific methods used. An instrument for data extraction was developed in order to collect the relevant information from the studies used, which included the following information: First author, year of publication, Country, number of participants, published journal, dosage used for vitamin supplementation D3 (4.000 IU – 50.000 IU) and study analysis time. When necessary, contact was made with authors in order to clarify doubts regarding the published data.

2.6 – Quality Assessment - In this systematic review and meta-analysis, studies that performed the analysis of results with treatment group and control group were included without systematic differences between the groups analyzed. The dose administered was considered in the Vitamin D supplementation process in a randomized way to the method used by the study (4.000 IU – 50.000 IU), being considered a high quality study indicator. Studies that did not meet quality control according to the established criteria were not included in this systematic review and meta-analysis. Through the instrument “Down and Black (1998)”, a review of the follow-up procedures in the process of oral vitamin D supplementation was carried

out in a randomized way in order to assess whether there was any performance bias in the included study. And it was considered the blinding of the participants in the groups to perform the heterogeneity assessment of the included studies, because these procedures are viable in clinical and randomized research.

2.6 – Data Analysis - The meta-analysis was performed using the random effects model for each outcome variable (vitamin D3 supplementation, clinical improvement and neural regeneration) using the Review Manager 5.3 software. The difference from the standardized average was obtained from the number of participants collected in each selected article and who supplemented vitamin D3. The calculations were performed considering a 95% confidence interval (CI). Inconsistency (I^2) assessed the heterogeneity among the included studies [10]. Heterogeneity was quantified as low, moderate and high, with upper limits of 25%, 50% and 75% [10]. The mean standard deviation in this meta-analysis was obtained using the Software Review Manager 5.3, considering $P < 0.05$ as statistically significant and $P > 0.05$ as non-significant [10]. The analyzes obtained from the studies included in this review on the impact of vitamin D3 supplementation and the intervention period are identified according to Table 1.

2.7 – Judgment of Clinical Improvement in Signs and Symptoms and Immune Cellular Changes - For the judgment of clinical improvement in signs and symptoms, McDonald's Criteria were established, and an improvement in clinical evolution was established with signs and symptoms of improvement in clinical aspects (Fatigue, sensitive paresthesias, visual, motor, ataxia, sphincter, cognitive and mental) associated with CSF analysis with the search for specific biomarkers. The immunological cellular aspects, on the other hand, established a population analysis in the articles inserted in the T lymphocyte cell population which produced a pattern of anti-inflammatory cytokines (IL-04 and IL-05) in patients and pathogens (CD4 + cells and TH1 autoreactives).

TABLE 1 - Included studies on vitamin D supplementation in patients with multiple sclerosis and intervention period (weeks) according to the dosage administered.

Authors	Dosage of Vitamin D3(weekly dose)	Intervention period(weeks)	Year
Holmoyetal	20.000 UI	98	2017
Rolf et al	14.000UI	48	2018
Rolf et al (b)	4.000UI	16	2018
Smoldersetal	7.000UI	96	2011
Rolf et al	7.000 UI	48	2017
Kovenetal	10.000UI	16	2013
Coccoetal	10.000UI	98	2012
Slavovetal	10.000UI	12	2015
Chaudhurietal	7.000UI	180	2018
Rabeahetal	7.000UI	96	2015
Kouchakietal	50.000UI	12	2018
Hashemietal	50.000 UI	12	2018

3.0 RESULTS AND DISCUSSION

3.1 Clinical characterization of studies

Clinical characterization of studies

In our research, a total of 457 articles were selected and identified for analysis. However, 445 studies were excluded because they met the following criteria: insignificant studies, that is, they do not involve the subject of this research ($n = 112$), studies with a sample design of less than 20 patients ($n = 105$), articles whose sample population it was pediatric ($n = 85$), duplicate articles ($n = 75$), studies that did not characterize multiple sclerosis with vitamin D3 deficiency ($n = 60$) and studies without control group analysis ($n = 8$).

On the other hand, the experimental and randomized clinical studies included in our review totaled 12 articles published in English [19-30].

Of the total articles, only 5 were published in 2018 [19-24], 2 articles were published in 2017 [28, 29] and 5 articles were published from 2011 to 2015 [26-30]. It was verified from the selected studies that the diagnosis of multiple sclerosis was made by imaging methods, which totaled 48.8% of the patients ($n = 574$) [24-30] (see Table 2).

It was found that all patients received vitamin D3 supplementation with adjuvant therapy with Interferon Beta-1a [30].

The prevalence of hypovitaminosis D3 in the patients analyzed in the twelve studies selected for analysis was 79.8% ($n = 458$) (TABLE 2).

In the studies evaluated, 88% of patients with multiple sclerosis had a positive response after 12 weeks of vitamin D3 oral supplementation and at a dose equivalent to 50.000 units/week (Figure 03).

Regarding the intervention period with vitamin D3, the benefit of oral supplementation occurred after a frequency of supplementation greater than 12 weeks (Table 1). Seven studies [28-30] had fewer than 50 patients who had no negative implications for the power of the analysis performed by this meta-analysis. Thus, the twelve articles [19-30] were included, totaling 574 patients with multiple sclerosis (TABLE 2).

TABLE 2 - Prevalence of Multiple Sclerosis and Hypovitaminosis D3 in the sample analyzed according to the included studies.

Studies	Adults with EM and hypovitaminosis D3/population Total	Incidence of MS and Hypovitaminosis D3 in Population Sampling.
Holmoyetal	35/48	72,9%
Rolf et al	35/53	66,0%
Rolf et al (b)	25/46	54,3%
Smoldersetal	174/348	50,0%
Rolf et al	30/53	56,6%
Kovenetal	25/30	83,3%
Coccoetal	44/154	28,5%
Slavovetal	23/53	43,3%
Chaudhurietal	56/112	50,0%
Rabeahetal	50/100	50,0%
Kouchakietal	27/53	50,9%
Hashemietal	50//75	66,6%

3.2 Analysis of risk of bias in the included studies

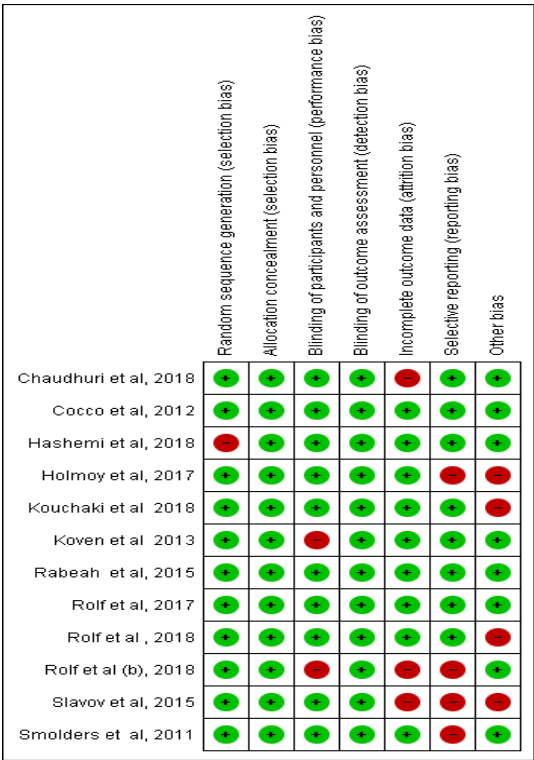
According to Figure 1, it was found that only one study included in this systematic review did not provide adequate descriptions of its methodology used, which did not allow the generation of the random sequence (selection bias) [28].

Ten of the articles included presented a quality bias carried out according to the methodology used in the Refs. [19-24] (FIGURE 1).

Regarding the risk of Cochrane bias, three articles were identified as an obscure risk [19-25], and only one article was considered high risk due to the high dropout rate in the experimental period (FIGURE 1) [30].

The occurrence was observed mainly in the domains: incomplete results, selective reports and other variables (FIGURE 1). It is concluded that, due to the adherence to the quality criteria and the design of the strategic study, the biases in the systematic review process and in the meta-analysis were minimized (FIGURE 1). Some articles included (70%) in this review were from high-income countries [25-30] and, in combination with vitamin D3 supplementation used cholecalciferol (Vigantol) in different doses [19-30].

Figure 1 - Summary of risk of bias assessment.



3.3 Benefits of Vitamin D Use in Multiple Sclerosis and its Anti-Inflammatory Action through Oral Supplementation

Figure 03 - Vitamin D3 and the risk of not presenting clinical improvement in symptoms in multiple sclerosis patients (compared to the control group).

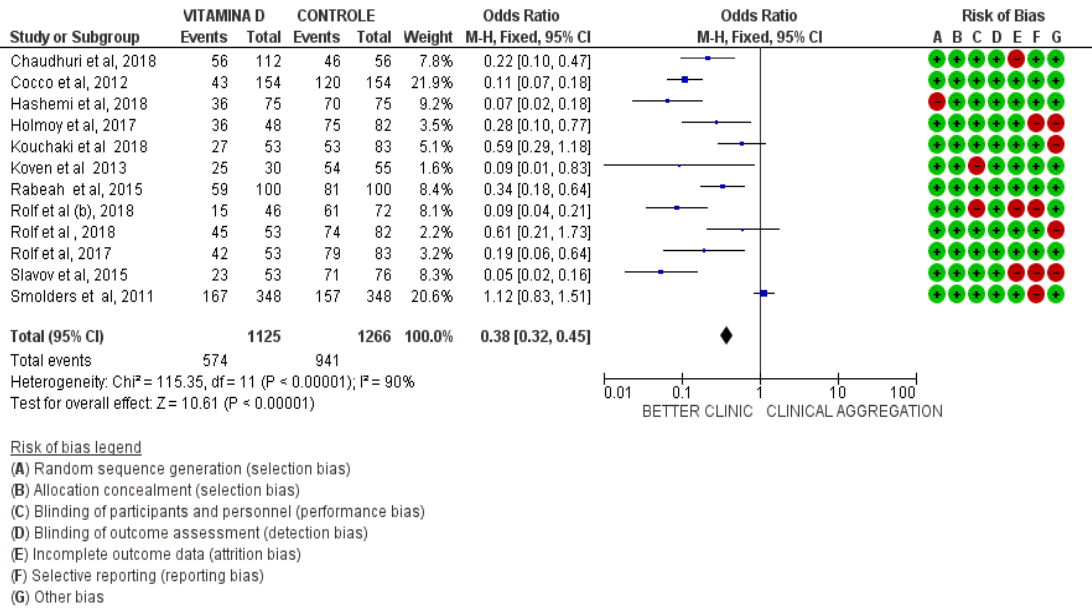


Figure 3 shows a decrease in recurrent episodes of recurrent remission in multiple sclerosis [24-30], totaling 1266 adults evaluated in multiple sclerosis studies (90%), where oral vitamin D

supplementation equivalent to 50.000 IU per week reduced complications related to the disease process ($p < 0.00001$) [25-28].

Vitamin D3 is recognized for its immunomodulatory function and has emerged as an excellent determinant in the etiopathogenesis of multiple sclerosis, considered a chronic and immunomediated disease (Graph 1) [25-30]. In addition, high doses of vitamin D3 reduce CD4 + T cell activation, reporting from direct human data that vitamin D3 may influence cell-mediated immunity [28].

These included studies performed oral vitamin D3 supplementation at different dosages, there were significant differences in the influence of cell-mediated immunity by improving clinical signs with a decrease in recurrent outbreaks (95% CI = 0.38 (0.32 - 0, 45)) [24-30], a significant reduction in IgG levels occurred [21-30], since stimulation of this vitamin D3 receptor causes inhibition of inflammatory cytokines and after 12 weeks of vitamin supplementation D3. In MS patients it is possible to observe and identify the mechanism by which vitamin D3 affects the response of anti-EBNA-1 antibody [22-29]. In addition, there is a significant increase in TCD4 + cells, which correlate with the increase in IL-2RA protein due to vitamin D3 supplementation [23-30].

It should be noted that the use of immunomodulatory treatment does not interfere with the effect of vitamin D3 markers [29], because vitamin D3 in the selected studies was used as adjunctive interferon beta-1a therapy in multiple sclerosis patients [41]. It was possible to detect by magnetic resonance imaging that vitamin D3 associated with Interferon-Beta-1a treatment significantly reduced the activity of multiple sclerosis [28-30], which was verified by comparing a control group with patients who received only interferon-beta-1a alone [22-30].

The serum analyzes in 12 studies [22-29] were performed using high performance liquid chromatography (HPLC) followed by gold standard mass spectrometry for the analysis of vitamin D3 25-OH serum levels [23].

Blood levels below 30 ng / ml vitamin D should be corrected in patients with multiple sclerosis at any stage to prevent worsening of the disease (I2 = 90%) [25-30]. In the studies analyzed [22-27], it was found that the multiple subtypes of multiple sclerosis showed different prevalence of vitamin D3 deficiency [22-26], since vitamin D3 deficiency is one of the environmental factors associated with worsening of the disease ($p < 0.00001$) [22-25].

In fact, high-dose vitamin D3 supplementation in 12-week patients has shown efficacy compared with control groups [28-30]. Treated patients had less remission of outbreaks; On the other hand, a higher proportion of patients had better scale scores, such as the Expanded Disability Statuts Scale [20-26].

3.4 Vitamin D supplementation has benefits in inflammatory biomarkers in preventing neuroimmune changes in the central nervous system.

According to the results of Graph 1, it can be seen that as a result of the gradual increase in the dosage of vitamin D3 supplementation, there was a decrease in the inflammatory process in the development of multiple sclerosis in an intervention period of 12 weeks just as there was an increase in neuroimmunological and protective cells of the central nervous system [20-30].

The randomized trials selected in this systematic review and meta-analysis have shown that Vitamin D3 regulates TCD4+ cell responses, promotes T-helper 2 (Th2) production [19-24] and eliminates

T1 (Th1) helper cell production in turn limits Th1-mediated inflammatory responses and tissue damage, while increasing anti-Th2 cell mediation relative to inflammatory responses [20-22].

In fact, the studies of ref. [19-21], when evaluating the TCD4 + cell, demonstrated a decrease in Th1 (interferon - IFN- γ) cytokines [21-24] and increased production of Th2 cytokines (IL-04, IL-05 and IL-10) [22-27] after vitamin D3 supplementation [27-29]. It is emphasized in this study that TCD4+ cells have the ability to convert inactive 25(OH)D to active 1,25-dihydroxy vitamin D (1,25(OH) $_2$ D) [24-28].

MS patients with vitamin D3 deficiency (25(OH)D) stated that 12 weeks of oral vitamin D3 supplementation at a dose equivalent to 50.000 units per week showed an increase in IL-10 production and a decrease in Th17 cell frequency in parallel with expected increases in serum 25 (OH) D [28-29].

On the other hand, regarding clinical response (Graph 2 and Graph 3) with altered immunological symptoms, vitamin D3 has an additional effect on T cells [24-29], since cytokines tend to improve or increase the pro- inflammation, especially in patients with multiple sclerosis [24-28].

Vitamin D3 modulates the response of major proinflammatory cytokines such as IL-04, IL-05, IL-06, IL-10, IF-10, IFN- γ and TNF- α [22-25]. Thus, this systematic review and meta-analysis confirmed the sensitivity of these inflammatory biomarkers in the prediction of neuroimmunological changes mainly in the central nervous system [22-29], and highlights in graph 2 that there is an increase in serum 25 (OH) D with selective decrease of the groups. T cells typical of multiple sclerosis [29-30], which can only occur due to protective neural stimulation in the process of progression of proinflammatory lesions in the central nervous system [28-30]. By consensus, this study showed that there is an association between immune deficiency and low vitamin D3. [27-29] (chart 3).

In Graph 2, during the 12-week study period, according to the selected articles [28-30], it can be seen that vitamin D3 supplementation has beneficial effects on an acute phase protein that is synthesized by the liver in response to cytokines, which has the functionality to reflect systemic active inflammation, in this case, C-reactive protein (CRP) and this process occurs due to the total antioxidant capacity of blood biomarkers of oxidative stress. Generally, myelinated brain damage occurs when there is an induction of oligodendrocyte apoptosis through increased IFN-gamma production, which is related to fluctuation of anti-myelin reactivity that occurs due to vitamin D3 deficiency within 12 weeks after supplementation of this vitamin, as observed in Graph 2 and Graph 3 [28-29].

In view of the above evidence, the protective role of vitamin D3 in the treatment of MS is biologically plausible [28] since 1,25 dihydroxyvitamin D3 is present in various immune system cells [24] such as macrophages, activated T cells and B, IL-04, IL-06, IL-08, IL-10 [24-29] and myelin specific [30]. Thus, there is a consensus that the increase in immune system cells occurs by stimulating receptors in the production of inflammatory cytokines [30].

It is noteworthy that 80% (n = 09) of the articles [26-29] selected in this systematic review and meta-analysis highlighted the increased production of regulatory T cells due to vitamin D3 supplementation, characterized by the reduction of IL-2 in mRNA levels in peripheral blood mononuclear cells, promoting the development of regulatory T cells [26-28].

In other words, vitamin D3 supplementation in the health and disease process in sclerosis has a protective role against various remission outbreaks [23-27], because there is a significant reduction in the

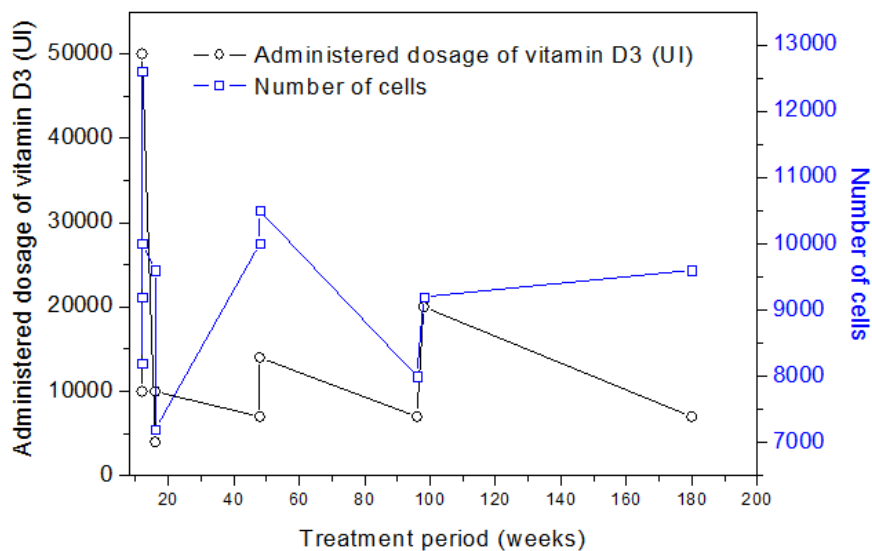
neurofilaments immunopositive axons evidenced in the vitamin D3 supplemented groups when compared to the control group (Figure 3) [27-29].

It is also highlighted in this systematic review and meta-analysis study that high doses of vitamin D3 supplementation influence the axonal regeneration process according to Graph 1 [24-29]. In fact, analyzing the information in Graph 2, it can be seen that the twelve articles analyzed in this review were able to highlight that high-dose vitamin D3 supplementation (50,000 units / week) plays an effective role in immunomodulatory treatment for 12 weeks [22-30] due to reduced inflammatory process in specific immune cells [23-30].

That is, the 12 studies demonstrated the beneficial effect of vitamin D3 supplementation and the intervention time through the chosen dosage [22-24] (Graph 2). In addition, ten articles [24-29] stated that vitamin D3 may influence the process of increased expression of calretinin and calcium binding proteins [29-30]. It should be noted that treatments for multiple sclerosis are immunosuppressive and affect immune function cells that reduce immune activity in the central nervous system [23-28].

The Graph 3 show the effect of Vitamin D3 on serum levels versus dosage administered in patients with multiple sclerosis. It is observed that in the range of 7000 to 20000 (UI) of vitamin D3 dosage there is a decrease in the serum level. However, for dosages above 20000 IU there is an increase in the serum level. This occurs because only supplements with a dosage $\geq 20,000$ IU/week influence the concentration of ultra-sensitive C-reactive protein and thus increase blood biomarkers of oxidative stress [30].

Graph 1 – Dosage of Vitamin D supplemented per week according to cellular changes



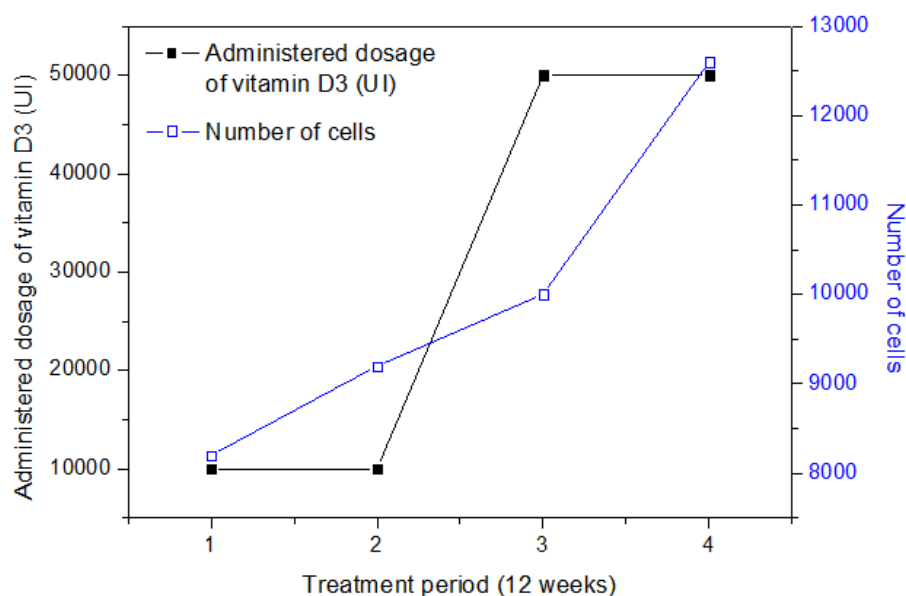
3.5 High dose Vitamin D (50.000 IU/week) in oral supplementation alters TCD4+ cell activation in the central nervous system through immune activity

According to Graph 1, there was no significant adverse event reported in patients assessed in the 12-week period [24-30]. From this review, it was observed that patients with multiple sclerosis treated [28] with doses of 50.000 units (week) of Vitamin D3 reached double the top physiological range without causing hypercalcemia (Graphic 3) [29].

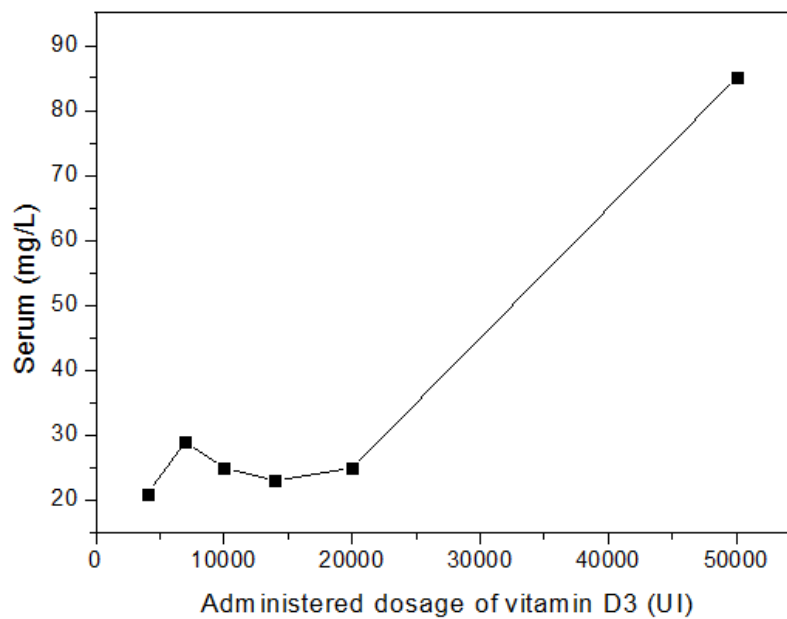
In fact, the results of our meta-analysis prove that Vitamin D3 supplementation promotes phagocytic cell response by stimulating phagocytosis, in Vitamin D3 increases the production of proinflammatory biomarkers such as tumor necrosis factor α (TNF- α) [27-29], interleukin-1 β (IL-1 β) and IL-6 [29-30].

Generally this process of immune regulation in IL-06 increases due to Vitamin D3 supplementation through anti-inflammatory and pro-inflammatory action which is proven by secretion of various cell types such as lymphocytes, macrophages and monocytes [27-30]. When analyzing vitamin D3 supplementation as a protective factor in patients with multiple sclerosis (Graph 2), the expression of the biomarker thyroxine hydroxylase promotes the bioavailability of some neurotransmitters [24-30], such as noradrenaline, dopamine, and adrenaline [24-29]. Only two articles showed that supplementation by 50.000 IU (week) of Vitamin D3 in the 12-week period influences the concentrations of ultra-sensitive C-reactive protein and increases blood biomarkers of oxidative stress [28-30].

Graph 2-Effect of Vitamin D3 on serum levels of pro-inflammatory and anti-inflammatory markers for 12 weeks in patients with multiple sclerosis.



Graph 03 - Effect of Vitamin D3 on serum levels as dosage administered in patients with multiple sclerosis for weeks.



The development process of this review includes characterization of each selected study [22-24], in which treatment with Vitamin D3 was assigned and participants were monitored daily for adherence and collection of biological material for the quantification of T cell. Different periods were established in each selected study [22-25].

Although the sample size selected in the studies analyzed in this systematic review and metanalysis were relatively small [30], it was found that there was a significant difference in T cells according to the studies in Ref. [26-29]. In fact, oral vitamin D3 supplementation can have an effect on TCD4 + cell activation in the immune system, which reflects on the central nervous system in multiple sclerosis patients with sufficient vitamin D3 supplementation [24-29].

Thus, we highlight that the high dose of Vitamin D3 (50.000 UI/weeks) decreases the activation of TCD4+ cells and provides direct scientific evidence of the role of Vitamin D3 in the central nervous system through immunological activity (Graph 03) [24-29].

In the case of a homogeneous metanalysis regarding the investigation of the best evidence for the intended focus of this research, it is found that the enzymes necessary for the synthesis of the active metabolite of vitamin D3 [22-24], 1,25-dihydroxycolecalciferol (1,25 (OH) 2D3) (27-29) as well as the vitamin D receptor (VDR) are present in the human brain at various sites, such as nucleus accumbens, temporal, orbital and cingulate cortex, tonsil, thalamus, neurons of the hippocampus and olfactory system.

It is important to note that for the survival of migration of developing neurons in these specific brain regions mentioned above there is regulation of neurotrophic signaling through glial cell-derived growth factor [32, 34].

Glial cells are modulators of dopaminergic neural development, survival and functionality [24-29] which are stimulated by Vitamin D3 supplementation. Therefore, according to the regulatory properties of neurotrophic factors, Vitamin D3 supplementation acts as a neuroprotective substance [28-29].

CONCLUSION

This systematic review article and meta-analysis, which included evidence from randomized controlled trials conducted with patients with multiple sclerosis, revealed that Vitamin D3 supplementation is effective as an option associated with the treatment of this disease, and that it also has a diffuse protective role against various remission outbreaks in the health. Doses (50,000 IU/week) are appropriate to restore neuroimmunological parameters when used within 12 weeks.

It is concluded that high doses of Vitamin D3 significantly contribute to the decrease of TCD4+ cells. This study of meta-analysis provides statistical evidence of Vitamin D3's central function on the central nervous system through immunological functionality.

These findings highlight the urgent need for further research and guidance for health professionals regarding the dose and duration of intervention to be administered in the treatment associated with multiple sclerosis.

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Analysis of the frequency of pediatric cancer in the Western Amazon (Brazil): the case of Rondônia

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Abstract

Objective: Analyzes the frequency of cancer in children and adolescents in the State of Rondônia / Western Amazon (Brazil), attended by public health services. Method: This is a descriptive, quantitative and cross-sectional study. We used an instrument developed by Paraguassu-Chaves et al [24], semi-structured, containing a series of variables, such as sex, age, histological types, types of cancer by location of the primary tumor, lymphomas, leukemias, clinical stage of the disease, diagnosis and previous treatment, among others. We asked the Research Ethics Committee to waive the Free and Informed Consent Term, because the study did not require patient intervention or collection of biological material and there was no possibility of constraints for patients and their families. Results: From 122 cases, 56 (45.9%) were female and 66 (55.1%) were male. Regarding the distribution of patients according to the age group, 38 (31.1%) were younger than 4 years, 21 (17.2%), 5 to 9 years, 24 (19.7%) from 10 to 14 and 39 (32.0%)

from 15 to 19. The most frequent histological types by gender were myeloproliferative leukemias and myelodysplastic diseases with 39.31% of new cases, reticuloendothelial lymphomas and neoplasms 11.96%, carcinomas and other epithelial neoplasms 11.96% of cases and CNS and several cranial intra-neoplasms and intraspinal with 11.11% of new cases. Leukemia in the hematopoietic and reticuloendothelial system (C42) is the most frequent cancer in children and adolescents, with 46.2% of cancers in the studied period. 20.5% of the cases do not know the stage of the cancer and 79.5% of the patients do not have information about the stage of the disease. 99.38% of pediatric cancer cases are referred by the single public health system - SUS and only 0.11% non-SUS or private health system. 47.6% of children and adolescents who arrive at the cancer clinic of the public health system have no diagnosis or previous treatment. Conclusions: the results presented are similar to the studies carried out in Rondônia, Brazil and other countries and are in agreement with the studies by Paraguassú-Chaves *et al* [24], Paraguassú-Chaves *et al* [27] and Paraguassú-Chaves *et al* [28]. Considering some parameters and indicators, it can be concluded that childhood cancer in Rondônia is a public health problem.

Keywords— Pediatric cancer. Children and adolescents. Neoplasms. Rondônia. Western Amazon.

I. INTRODUCTION

Pediatric cancer (cancer in children and adolescents between 0 and 19 years old) consists of a set of diseases that have specific characteristics in relation to the histological type (cells that make up the tumors) and to clinical behavior [1]. It corresponds to a group of several diseases that have in common the uncontrolled proliferation of abnormal cells and that can occur anywhere in the body. Unlike adult cancer, pediatric cancer generally affects blood cells and supporting tissues.

According to the National Cancer Institute of Brazil - INCA [2], the cancers that most affect children are those of the blood (leukemia, which affects white blood cells), those of the lymphatic system (lymphoma, which affects the ganglia) and those of the central nervous system (tumors that originate in the brain and spinal cord). This group of neoplasms has, for the most part, short latency periods, are more aggressive, grow quickly, but respond better to treatment and are considered to have a good prognosis.

The classifications used for this group of disease are based on morphology, differently from those used for tumors in adults [3].

For didactic purposes, the recognition of the distinction by the age group criterion was adopted in this study, childhood cancer (child aged 0 to 14 years) and cancer in adolescent age (aged 15 to 19 years).

According to Steliarova-Foucher *et al* [4], pediatric cancer is studied and classified by the International Classification of Childhood Cancer - ICCC and that currently the ICCC is used with the new morphological classifications proposed in the ICD-O3.

According to the American Cancer Society [5], [6], [7], [8], [9], Barr *et al* [10], Ferlay *et al* [11], [12] and Magrath *et al* [13] childhood cancer corresponds to 1% to 4% of all malignant tumors, in most populations. In developing countries, where the population of children reaches 50%, this proportion of childhood cancer represents 3% to 10% of the total neoplasms. In developed countries, this proportion decreases, reaching around 1%.

The most common tumors in childhood and adolescence are leukemias (which affect white blood cells), those which affect the central nervous system and lymphomas (lymphatic system). Among the types of pediatric cancer worldwide, leukemia is the most common in most populations (25% to 35%). In developed countries, lymphomas are the third most common type of cancer. In developing countries, on the other hand, this type is in second place, behind only leukemias [14], [15] and [16]. CNS tumors occur mainly in children under 15 years of age, with a peak in age at the age of 10 years.

Neuroblastoma (a tumor of cells in the peripheral nervous system, often located in the abdomen), Wilms' tumor (type of renal tumor), retinoblastoma (affects the retina, fundus of the eye), and germinative tumor (of the cells that originate) also affect children and adolescents. the ovaries and testicles), osteosarcoma (bone tumor) and sarcomas (soft tissue tumors).

It also affects children and adolescents with neuroblastoma (tumor of cells of the peripheral nervous system, often located in the abdomen), Wilms' tumor (type of renal tumor), retinoblastoma (affects the retina, fundus), germinal tumor (of the cells that originate the ovaries and testicles), osteosarcoma (bone tumor) and sarcomas (soft tissue tumors).

In Brazil, the median percentage of neoplasms in the RCBP in the population of children and adolescents (from 0 to 19 years old) was 3%. As in most populations, leukemias were the most frequent (26%), followed by other epithelial tumors (14%), lymphomas (14%) and CNS (13%).

INCA [17] estimated for Brazil, for each year of the biennium (2018-2019), 12,500 new cases of cancer in children and adolescents, 1,200 new cases for each year in the North Region (Brazilian Amazon) where Rondônia is geographically located.

According to Karim-Kos *et al* [18], cancer mortality in children and adolescents has different geographic patterns. While, in developed countries, neoplasia is considered the second leading cause of death in childhood, corresponding to 4% to 5% (children aged 1 to 14 years) of deaths in this age group, in developing countries, this proportion is much lower, about 1%, because deaths from infectious diseases are the main causes of death.

According to the National Cancer Institute of Brazil - INCA [19], cancer among children and adolescents is the second cause of proportional mortality in the age group from 1 to 19 years old.

According to INCA [20], pediatric cancer deaths correspond to 7.9% of all causes, and the second leading cause of death in all regions of Brazil. Only below deaths due to external causes, configuring itself as the most lethal disease.

In Rondônia, pediatric cancer has a lower incidence of cancer in relation to other age groups, with an accumulated frequency of 1.3% (female) and 3.3% (male) in agreement with [21] which concludes that cancer in children and adolescents is considered rare when compared to cancer in adults. However, it must be studied separately because it has different primary sites, histological origins and clinical behavior.

Previous studies carried out in Rondônia point to pediatric cancer as a major public health concern. Among these determinants are late notifications and diagnoses, the stages of the disease, the origin of the referral of pediatric cancer patients to specialized care and the entrance clinic according to previous diagnosis and treatment, the overload of public health units, among others.

The National Cancer Institute of Brazil [21] recognizes that cancer prevention and control in Brazil, a country of continental dimensions and strong regional differences due to its very diverse population of

behaviors, beliefs and attitudes, currently represents one of the great challenges facing public health. The description of the distribution of the most incident types of cancer over time has been one of the main strategies for establishing guidelines in public policies and especially for planning cancer prevention and control actions.

In Brazil, the distribution of different types of cancer suggests an ongoing epidemiological transition. With the recent aging of the population, which projects the exponential growth of the elderly, it is possible to identify a significant increase in the prevalence of cancer, which demands from the managers of the Unified Health System (SUS) an immense effort to offer adequate care to patients.

This perspective makes clear the need for major investment in health promotion, in the quest to modify the patterns of exposure to risk factors for cancer. While there is a clear increase in the prevalence of cancers associated with the best socioeconomic status - breast, prostate and colon and rectum -, simultaneously, we have high incidence rates of tumors generally associated with poverty - cervix, penis, stomach and oral cavity, and cancers in children and adolescents that are identified as a rising problem in an emergency situation.

In this scenario, resources and efforts must be directed to guide cancer prevention and control strategies at all levels (health promotion, early detection, patient care, surveillance of cancer and its risk factors, training of human resources, communication and social mobilization, research and management of the Unified Health System - SUS).

This presupposes quality information on the incidence, mortality and survival of population groups, which will allow a better understanding of its determinants, contributing to the formulation of causal hypotheses and evaluation of the technology applied to the prevention and treatment of the disease [22].

For this reason, the research has as main objective to analyze the frequency of pediatric cancer in the State of Rondônia, Western Amazon (Brazil) from the primary data available in the public health service specialized in cancer in the State of Rondônia.

II. METHOD

The methodological design followed the characteristics of a documentary, transversal and descriptive study, based on the raw data produced and sectorized, according to the methodological model recommended by Paraguassú-Chaves *et al* [23]. The primary data were organized by the Núcleo Hospitalar de Epidemiologia - NHE of the largest public referral hospital in the state of Rondônia, based on the diagnoses made at the Hospital Especializado em Câncer, for a period of three years.

We used an instrument developed by Paraguassú-Chaves *et al* (24), semi-structured, containing a series of variables, such as sex, age, histological types, types of cancer by location of the primary tumor, lymphomas, leukemias, clinical stage of the disease, diagnosis and previous treatment, among others.

These data were inserted in statistical platforms, reviewed, (re) classified, (re) interpreted, (re) analyzed and correlated according to the descriptive and analytical methods, using frequency distribution and proportional percentages in the statistical representations, according to instrument developed by Paraguassú-Chaves *et al* (24).

The research coordinator asked the Human Research Ethics Committee to waive the Free and Informed Consent Term, because the study did not require patient intervention or collection of biological material and there was no possibility of constraints for the patient and his family. The research works with primary data from an official source of the public health service in Rondônia.

III. RESULTS

In the period of 3 years, 122 new cases of childhood and adolescence cancer were diagnosed. Of these, 56 (45.9%) were female and 66 (54.1%) in males, with a predominance of the age group from 15 to 19 with 32.0% and 0 to 4 years with 31.1%.

As for the distribution of patients by age group, 38 (31.1%) were 0 to 4 years old, 21 (17.2%), 5 to 9 years old, 24 (19.7%), 10 to 14 years old and 39 (32.0%) aged 15 to 19 years (table 1). In the period corresponding to 3 years, 48.3% of children with childhood cancer were less than 10 years old.

Table 1: Pediatric cancer, by age and sex /Rondônia / Brazil.

Variables	Female		Male		Total	
	af*	rf%	af*	rf%	af*	rf%
00-19 anos						
00 – 04	14	25.0	24	36.4	38	31.1
05 – 09	8	14.3	13	19.7	21	17.2
10 – 14	9	16.1	15	22.7	24	19.7
15 – 19	25	44.6	14	21.2	39	32.0
Total	56	45.9	66	54.1	122	100.0

Source: RHC / NHE / HBAP / RO. Data referring to 3 years of study.

af*: absolute frequency; **rf%:** relative frequency

The most frequent histological types by gender were leukemias of myeloproliferative diseases and myelodysplastic diseases with 18 (36.73%) cases in females and 28 (41.17%) in males, with an absolute frequency of 46 (39.31%) new cases, lymphomas and reticuloendothelial neoplasms with 6 (12.24%) new cases in females and 8 (11.76%) in males registered a total of 14 (11.96%), carcinomas and other epithelial malignancies with 3 (6.12%) cases in females and 11 (16.17%) in males, with an absolute frequency of 14 (11.96%) of cases and CNS and miscellaneous of intra-cranial and intra-spinal neoplasms with respectively 7 (14.28%) new cases in females and 6 (8.82%) in male, making up 13 (11.11%) of new cases.

Other important histological types found were malignant bone tumors (5.12%), renal tumors (5.12%), in addition to carcinomas and other epithelial neoplasms (5.98%). (table 2).

Table 2: Distribution of the most frequent histological types in the age group 0-19 years, according to sex. Rondônia / Brazil.

Histological Type	Female		Male		Total	
	af*	rf%	af	rf%	af*	rf%
Leukemias, myeloproliferative diseases and myelodysplastic diseases	18	36.7	28	41.1	46	39.31
		3		7		
Reticuloendothelial lymphomas and Neoplasms	6	12.2	8	11.7	14	11.96
		4		6		
Carcinomas and other epithelial Malignancies	3	6.12	11	16.1	14	11.96
				7		
CNS and miscellany of intracranial and intraspinal neoplasms	7	14.2	6	8.82	13	11.11
		8				
Other malignant and unspecified neoplasms	4	8.16	3	4.41	7	5.98
Malignant bone tumors	3	6.12	3	4.41	6	5.12
Renal tumors	3	6.12	3	4.41	6	5.12
Soft-tissue sarcomas	1	2.04	3	4.41	4	3.41
Tumors of the sympathetic nervous system	1	2.04	2	2.94	3	2.56
Neoplasms of germ cells, trophoblastic and other gonadal	1	2.04	1	1.47	2	2.56
Retinoblastoma	1	2.04	0	0.00	1	0.85
Liver tumors	1	2.04	0	0.00	1	0.85
TOTAL	49	100.	68	100.	117	100.0
		0		0		

Source: RHC / NHE / HBAP / RO. Data referring to 3 years of study. **af***: absolute frequency; **rf%**: relative frequency

For current research, the International Classification of Diseases ICD-10, in view of all records in the database used to be classified for medical diagnosis. Thus, leukemia of the hematopoietic system and classified reticulum according to ICD 10, (C42) is the most frequent cancer in both sexes with 46.26% of pediatric cancer cases, twice in male children and adolescents.

The second group of pediatric cancer by primary tumor location is brain carcinoma (C71), with 17.85% and 5.15%, respectively, in female and male children and adolescents. Also in the second group, with the same relative frequency of brain carcinoma, there are C77 lymph nodes (lymph nodes), with 7.14% and 12.89%, respectively, in female and male children and adolescents.

Among the most frequent types of cancer, they are in decreasing order of frequency: reticuloendothelial hematopoietic system - C42 with 46.25% of cases, brain carcinoma - C71 with 10.44%, lymph nodes (lymph nodes) - C77 with 10.44%, kidney - C64 with 5.97%, malignant neoplasm of bones and articular cartilage from other unspecified sites - C41 with 5.97%, connective, subcutaneous and other soft tissues - C49 with 4.47%, thyroid gland - C73 with 4.47%, bones, joints and limb cartilage - C40 with 2.98%, skin - C44 with 2.98%, placenta - C58 with 2.98%, eyes and attachments - C69 with 1.49% and thymus - C37 with 1.49% of cases (table 3).

Table 3: Distribution of the most frequent types of cancer in the 0-19 age group, depending on the genre. Rondônia / Brazil.

Histological types		Female		Male		Total	
Location of primary tumor	CID-0	af *	rf%	af *	rf%	af *	rf%
Hematopoietic and reticuloendothelial System	C42	10	35.71	21	53.84	31	46.26
Brain	C71	5	17.85	2	5.12	7	10.44
Lymph nodes (lymph nodes)	C77	2	7.14	5	12.89	7	10.44
Kidney	C64	3	10.71	1	2.56	4	5.97
Malignant neoplasm of bones and articular cartilage from other sites not specified	C41	2	7.14	2	5.12	4	5.97
Connective tissue, subcutaneous tissue and other soft tissues	C49	1	3.57	2	5.12	3	4.47
Thyroid gland	C73	1	3.57	2	5.12	3	4.47
Bones, joints and joint cartilage of the limbs	C40	1	3.57	1	2.56	2	2.98
Skin	C44	0	0.00	2	5.12	2	2.98
Placenta	C58	2	7.14	0	0.00	2	2.98
Eyes and attachments	C69	1	3.57	0	0.00	1	1.49
Thymus	C37	0	0.00	1	2.56	1	1.49
TOTAL		28	100	39	100	67	100

Source: RHC / NHE / HBAP / RO. Data referring to 3 years of study. **af***: absolute frequency; **rf%:** relative frequency

Precursor Cell Lymphoblastic Leukemia, NOS are the histological types most relevant in the studied period, with an absolute frequency of 20 cases and relative 29.85%, distributed by gender, with an absolute frequency 3 times higher in male children and adolescents.

Tumors of Plasmocytes (973) are in the first group of histological importance, with an absolute frequency of 19 cases and relative frequency of 28.35%, in addition to malignant lymphoma, NOS or diffuse (959), with an absolute frequency of 18 cases and a relative frequency of 26.86% and acute myeloid leukemia, NOS, with an absolute frequency of 18 cases and frequency 26.86%.

In the second group of histological importance, Hodgkin's lymphoma or mixed-cell lymphocytic depletion appears with a relative frequency of 19.40% and chronic B-cell lymphocytic leukemia / lymphocytic lymphoma also with 19.40%, both with a frequency of two, times in male children and adolescents.

Other important histological types are leukemia NOS (980) with a relative frequency of 11.94%, chronic myeloid leukemia, NOS (10.44% relative frequency), followed by Burkitt's leukemia (relative frequency of 7.46%) and large B-cell lymphomas or Burkitt's lymphoma (968) with relative frequency of 5.97%. (table 4).

Table 4: Proportional distribution of lymphomas and leukemias, by gender, according to histological type - ICD-03. Rondônia / Brazil.

Lymphomas and Leukemias	Female		Male		Total	
	af*	rf%	af*	rf%	af*	rf%
Precursor Cell Lymphoblastic Leukemia, NOS	5	17.85	15	38.46	20	29.85
Tumors of Plasmocytes (973)	8	28.57	11	28.20	19	28.35
Malignant, NOS or Diffuse Lymphoma (959)	10	35.71	8	20.51	18	26.86
Acute Myeloid Leukemia, NOS	8	28.57	10	25.64	18	26.86
Hodgkin's Lymphoma Mixed Cellularity or Lymphocytic Depletion	4	14.28	9	23.07	13	19.40
Chronic Lymphocytic Leukemia of B Cell / Lymphocytic Lymphoma	4	14.28	9	23.07	13	19.40
Leukemia NOS (980)	4	14.28	4	10.25	8	11.94
Chronic Myeloid Leukemia, NOS	4	14.28	3	7.69	7	10.44
Burkitt's Cell Leukemia	2	7.14	3	7.69	5	7.46
Large B-cell Lymphomas or Burkitt's Lymphoma (968)	1	3.57	3	7.69	4	5.97
Hodgkin's Lymphoma, Nodular Sclerosis	0	0.00	2	5.12	2	2.98
Lymphoid Leukemia, NOS (982)	0	0.00	2	5.12	2	2.98
Myeloid Leukemia, NOS	2	7.14	0	0.00	2	2.98
Acute Monocytic Leukemia T	1	3.57	1	2.56	2	2.98

Acute Myeloid Leukemia with Multiline Dysplasia	0	0.00	2	5.12	2	2.98
Small B-Cell Lymphoma	1	3.57	1	2.56	2	2.98
Mature B-cell Lymphoma	1	3.57	0	0.00	1	1.49
Acute Leukemia, NOS	0	0.00	1	2.56	1	1.49
Acute Leukemia, Biphenotypic	0	0.00	1	2.56	1	1.49
Lymphoblastic Leukemia of Precursor Cells Type B	0	0.00	1	2.56	1	1.49
Acute Myeloid Leukemia Type M6	1	3.57	0	0.00	1	1.49
Leukemia Cell Type	0	0.00	1	2.56	1	1.49
Acute Myeloid Leukemia with Abnormality	1	3.57	0	0.00	1	1.49
TOTAL	28	100.0	39	100.0	67	100.0

Source: RHC / NHE / HBAP / RO. **af***: absolute frequency; **rf%**: relative frequency

Table 5 presents a summary of the proportional distribution of cancer cases in patients aged between 0 and 19 years, according to the clinical stage of the disease, the origin of the referral of pediatric cancer patients to specialized care and the clinic of entry of according to previous diagnosis and treatment.

According to table 5, in 20.5% of cases it is presented as an indeterminate phase. However, the number of patients without information reached 79.5%.

It is observed that, in Rondônia, the notifications made comprise 99.38% of the Unified Health System Program - SUS and only 0.03%, children and adolescents came on their own. 0.03% of cases do not apply and 0.45% without information. (table 5).

The pediatric oncology clinic was responsible for the first care in 65.3% of pediatric cancer cases. However, 56% of pediatric cancer cases were admitted to the pediatric oncology clinic.

When pediatric cancer is analyzed at the entry clinic, according to previous diagnosis and treatment, the results reveal that 47.6% of children and adolescents entered the specialized clinic without diagnosis and without treatment, 38% with diagnosis and without treatment and only 14.3% with diagnosis and treatment. (table 5).

Table 5. Clinical stage of the disease, origin of referral to specialized care and previous diagnosis and treatment.

Clinical stage of câncer	rf%
No information	79.5
Undetermined phase	20.5
Referral for treatment at the pediatric oncology clinic	rf%
SUS	99.38

Not SUS	0.11
Came on his own	0.03
Not applicable	0.03
No information	0.45
Previous diagnosis and treatment	rf% (cases)
With Diagnosis / With Treatment	14.3
With diagnosis / without treatment	38.1
Without diagnosis / without treatment	47.6

Source: RHC / NHE / HBAP / RO. **rf%:** relative frequency

At the pediatric oncology outpatient clinic, the time between enrollment (patient record) and diagnosis of the disease was 4.24 (days), from diagnosis and start of treatment (2.52) days and registration of the child and teenager to treatment (3.25) days. (table 6).

Table 6: Time interval (in days) elapsed, according to the median, between: 1st consultation-1st diagnosis; 1st diagnosis - start of treatment; 1st consultation and start of treatment, according to the clinic responsible for the first care.

Description of the Oncology Entrance Clinic	Pediatrics MEDIAN

Registration/Diagnosis	4.25
Diagnosis/Treatment	2.52
Registration/Treatment	3.25

Source: RHC / NHE / HBAP / RO

Table 7 shows the proportional distribution of cancer cases among patients in the state of Rondônia, according to the treatment received in hospitals in the single health system.

Other isolated therapeutic procedures showed relative frequency with greater prominence, 44.36%, after surgery with 15.22%, chemotherapy with 5.99%, other isolated therapeutic procedures + surgery with 2.63% and surgery + chemotherapy with 1.04 %.

These data refer to the procedures in all cases of cancer assisted by the public health program and not only for childhood and youth cancer,

Table 7: Proportional distribution of cancer according to the 1st treatment.

First Treatmen	rf%
Other Isolated Therapeutic Procedure	44.36
Other Isolated Therapeutic Procedures + Surgery	2.63
Other Isolated Therapeutic Procedures + Chemotherapy	0.60
Quimioterapia	5.99
Chemotherapy + Radiotherapy	0.32
Chemotherapy + Surgery	0.27
Chemotherapy + Other Therapeutic Procedures	0.21
Surgery	15.22
Surgery + Chemotherapy	1.04
Surgery + Isolated Therapeutic Procedures	0.21
Surgery + Chemotherapy + Other Procedures	0.05
Surgery + Radiotherapy	0.05
Radiotherapy	0.87
Radiotherapy + Chemotherapy	0.16
Radiotherapy + Therapeutic Procedures	0.05
Immunotherapy	0.10
No procedure	26.93
No information	0.21

Source: RHC / NHE / HBAP / RO. **rf%:** relative frequency

IV. DISCUSSION

In the Rondônia study, there was no statistically significant difference in relation to the sex of children and adolescents. As predicted by most national and international literature, there was a higher frequency in males (54.1%). Several studies published in international pediatricians, report that a higher incidence of cancer in general occurs in males, corroborating the findings in the research in Rondônia, western Brazilian Amazon. Among the most important researches are Epidemiology of childhood cancer [25], Cancer Incidence and Survival among Children and Adolescents [16] and Cancer incidence among children and adolescents in the United States [26]. 48.3% of cancers were found in children under 9 years old, 19.7% in children 10 to 14 years old and 32% in adolescents (15 to 19 years old).

Paraguassú-Chaves *et al* [24] in their article Analysis of histological frequency and pediatric cancer in Rondônia, Western Amazonia (Brazil), published in International Journal of Advanced Engineering Research and Science (IJAERS) found 42.7% in females and 57, 3% in males, with 44% in children under 9 years of age and 33.33 in adolescents from 15 to 19 years of age.

The most frequent histological types by gender were leukemias of myeloproliferative diseases and myelodysplastic diseases with 18 (36.73%) cases in females and 28 (41.17%) in males, with an absolute

frequency of 46 (39.31%) new cases, lymphomas and reticuloendothelial neoplasms with 6 (12.24%) new cases in females and 8 (11.76%) in males registered a total of 14 (11.96%), carcinomas and other epithelial malignancies with 3 (6.12%) cases in females and 11 (16.17%) in males, with an absolute frequency of 14 (11.96%) of cases and CNS and miscellaneous of intra-cranial and intra-spinal neoplasms with respectively 7 (14.28%) new cases in females and 6 (8.82%) in male, making up 13 (11.11%) of new cases.

These findings corroborate the results found by Paraguassú-Chaves *et al* [23] in the Epidemiological Profile of Rondônia, Paraguassú-Chaves *et al* [27] in the Epidemiological Profile of Cancer in Rondônia: Brazilian Amazonia, Paraguassú-Chaves *et al* [28] in Epidemiology cancer in Rondônia and Paraguassú-Chaves *et al* [24] in the analysis of histological frequency and pediatric cancer in Rondônia, Western Amazon (Brazil).

The sequential order of the highest frequencies found in this study, appear with their nuances differences in results when compared to the national study of the Population Based Cancer Registry (RCBP) and of other States and other regions of Brazil. These frequencies have already been pointed out in the study by Da Luz [3] in the Clinical-Demographic Profile of Patients Attended at the Pediatric Oncology Service of Hospital de Clínicas de Porto Alegre and in the study by De Camargo *et al* [29] Cancer incidence among children and adolescents in Brazil: first report of 14 population based cancer registries.

In the present study, leukemia of the hematopoietic and reticuloendothelial system (C42), is the most frequent neoplasia in both women and men, with 46.26% of cancers in children and adolescents. Hematopoietic and reticuloendothelial System. In a combination of two systems, we can define the hematopoietic and reticuloendothelial system as: hematopoiesis - it is a physiological process that guarantees the renewal of blood cells and that are produced daily in the body. It is classified into three types: erythropoiesis for red blood cells; leukopoiesis for leukocytes (which is located in the bone marrow) and thrombocytopoiesis to manufacture platelets [28].

A hematopoiesis defect can cause diseases such as hemopathy - leukemia, lymphoma - or aplasia of red blood cells. The hematopoietic system is formed by a complex made up of bone marrow and other hemoforming organs and blood. Blood cells are constantly produced in the bone marrow: erythrocytes neutrophils and platelets, with strict control of growth factors. In order for their physiological function to be fulfilled, the cellular elements of the blood must circulate in an appropriate number and structure [28].

The reticuloendothelial system (SRE) or mononuclear phagocytic system is the organic system made up of cells that, located in different parts of the organism, have reticular and endothelial characteristics and are endowed with phagocytic capacity, thus intervening in the formation of blood cells, in the iron metabolism, in addition to performing defense functions against generalized infections [28].

The studies by Paraguassú-Chaves *et al* [24] in the same place as the research on the distribution of the most frequent types of cancer in children and adolescents in Rondônia, had already pointed out the need for a deeper and more detailed investigation on the location of the primary tumor. His proposal aims to clarify the reason for the high frequency of neoplasms of the hematopoietic and reticuloendothelial system in this child and youth population in the Amazon.

The proportional distribution of lymphomas and leukemias, by gender, according to the histological type - ICD-03, identifies the Precursor Cell Lymphoblastic Leukemia, NOS, Plasma Cell Tumors (973),

Malignant Lymphoma, NOS or Diffuse (959) and Acute Myeloid Leukemia, NOS as the most relevant histological types in the studied period.

Paraguassú-Chaves *et al* [24] in this same research source found the following sequence in decreasing order of frequency: Acute Myeloid Leukemia, NOS, Precursor Cell Lymphoblastic Leukemia, NOS, Malignant, NOS or Diffuse Lymphoma (959) and Mixed cellularity of Hodgkin's lymphoma or Lymphocytic depletion.

Kaatsch's study [25] "Childhood Epidemiology" states that leukemias are the most common type of pediatric cancer in the world and that they account for 34.1% of all childhood cancers up to 15 years of age, followed by CNS tumors (22.6%) and lymphomas (11.5%). Parkin *et al* [15], in a survey "International Incidence of Cancer in Childhood", describe that among all cancers in childhood, leukemias represent the most frequently diagnosed, being responsible, in most diseases, by 25% to 35% of all pediatric neoplasms.

In Brazil, the research by De Camargo *et al* [29] "Incidence of cancer in children and adolescents in Brazil: first report of 14 population-based cancer registries", a national study that gathered 14 population-based cancer registries (RCBP) showed that Goiânia, capital of the state of Goiás, Manaus, capital of the state of Amazonas and Curitiba, capital of the state of Paraná, were the three capitals of Brazil with the highest leukemia incidence rates. Another reference research in Brazil is the study Pediatric cancer: analysis of a hospital record ", by Silva, Pires, and Nassar [30] who, in studies carried out in hospital services in the states of Santa Catarina and Rio Grande do Sul, found 36.6% and 26.9%, respectively, of incidence for leukemia.

Braga, Latorre, Curado [31] when analyzing childhood cancer, made a comparison of the incidence, mortality and survival of children and adolescents in Goiânia (Brazil) and other countries and concluded that in most countries, children less than five years old are the most frequently affected by leukemias and that among the types of leukemia, the most common are acute and, among these, acute lymphocytic leukemia (ALL), totaling, in the white populations of North America, Oceania and Europe, from 75% to 80% of all leukemias. Sharp, Cotton and Little [32] in "Descriptive epidemiology, in: Epidemiology of Childhood Cancer" when studying the same regions highlight acute non-lymphocytic leukemia (LNLA) with 15% to 17% of cases, while chronic myeloid leukemia (CML) rarely exceeds the proportion of 4%. In Brazil, according to the study by Braga [33] carried out in the city of Goiania (State of Goias), these frequencies were 66% for ALL, 20% for LNLA and 1.4% for LMC.

According to Ries *et al* [16] leukemias are more frequent from 1 to 9 years. For the ALL subgroup, there is a peak between 2 and 3 years, which occurred in 66% of the cases analyzed in their study. In the second group of histological importance, Hodgkin's lymphoma or mixed cell lymphocytic depletion appears with a relative frequency of 19.40% and chronic B-cell lymphocytic leukemia / lymphocytic lymphoma also with 19.40%. The result of the research identifies Hodgkin's lymphoma or mixed-cell lymphocytic depletion and chronic B-cell lymphocytic leukemia / lymphocytic lymphoma, both with twice the frequency in male children and adolescents.

In the research by Paraguassú-Chaves *et al* [24], the second group of cancers in children aged 0 to 19 years was brain cancer (C71), with 13.6% of new cases. C77 lymph nodes (lymph nodes) better represent the second group of cancers, with 9.1% and 12%, respectively, in the period, according to Paraguassú-Chaves *et al* [24].

According to De Camargo *et al* [29], in Brazil, lymphomas appear as the second most common cancer in childhood. Paraguassú-Chaves *et al* [24] also corroborates this confirmation. Magrath *et al* [13] in their study “Pediatric cancer in low-income and middle-income countries”, point out in their research that lymphomas were the second most frequent neoplasia, followed by retinoblastoma and CNS tumors.

According to Braga, Latorre and Curado [31] lymphomas, following tumors of the central nervous system, constitute the third type of neoplasia with the highest incidence in developed countries, covering 7% to 18% of cases of childhood neoplasia.

According to Howlader *et al* [14], Parkin *et al* [15] and Reis *et al* [16] in developed countries, lymphomas correspond to the third most common type of cancer. For these same authors in developing countries, this type is the second most incident, behind only leukemia.

The proportional distribution of lymphomas in histological terms is quite different in different regions of the world. Greenberg, Shuster [34] in “Epidemiology of cancer in children” state that approximately 45% of all lymphomas in children are represented by Hodgkin's lymphoma and its incidence is, more commonly, more accentuated in populations with a worse socioeconomic level, such as Kuwait, Brazil and Costa Rica, corroborated by Parkin *et al* [15]. In the studies by Braga, Latorre and Curado [31] and Latorre and [35], performed in Brazil, 44% of lymphomas were from Hodgkin.

Staging can be defined as the process by which the extent, shape and location of cancer in a person's body is determined, based on the verification of possible survival rates.

The classification of malignant neoplasms in groups obeys different variables: location, size or volume of the tumor, direct and lymphatic invasion, distant metastases, histopathological diagnosis, substance production, systemic manifestations, duration of signs and symptoms, sex and age of the patient, etc [20]. Consequently, it is essential for physicians to know the extent and location of decision making regarding their treatment behavior and to calculate the possible directions of the disease.

The data and information on the staging of cancer in children and adolescents is not sufficient for a more secure and accurate analysis. 20.5% of the cases are presented as an indeterminate phase. However, the number of patients without information reached 79.5%. Paraguassú-Chaves *et al* [24], Paraguassú-Chaves *et al* [27] and Paraguassú-Chaves *et al* [28] had already warned about this inefficiency in the health system.

The National Cancer Prevention and Control Policy guarantees comprehensive care to any cancer patient, through the High Complexity Assistance Units in Oncology (UNACON) and the High Complexity Assistance Centers in Oncology (CACON) based on laws and specific Ordinance.

In Rondônia, the notifications made comprise 99.38% of the Unified Health System Program - SUS and only 0.03%, children and adolescents came on their own. 0.03% of cases do not apply and 0.45% without information.

Other studies carried out in Rondônia have already called attention to referrals for treatment at the pediatric oncology outpatient clinic. According to Paraguassú-Chaves *et al* [23], everything suggests that private plans and non-governmental hospitals do not provide the essential services needed by cancer patients and their sick associates.

The pediatric oncology clinic was responsible for the first care in 65.3% of pediatric cancer cases. This means that 34.7% of children and adolescents have access to specialized clinical diagnosis and

treatment in other types of cancer. 47.6% of children and adolescents entered the specialized clinic without diagnosis and without treatment, 38% with diagnosis and without treatment and only 14.3% with diagnosis and treatment. One of the main cancer-related problems in children and adolescents is found in late diagnosis. These undiagnosed and untreated children and adolescents are part of the imminent risk group of death.

Paraguassú-Chaves *et al* [24], [27], [28], have already warned that cancer in children and adolescents is more aggressive and develops more quickly. For this reason, tumors are rarely identified and treatment cannot be done with surgery. This is another problem faced by children and adolescents in Rondônia.

The average cure rate for pediatric cancer in Brazil is around 70% - some types of the disease have even higher rates. However, in order to obtain these numbers, it is essential that the diagnosis be made early, with treatment carried out in specialized centers. This has not happened in Rondônia. The disease is not always discovered in its initial stage, mainly because some symptoms - such as persistent fever, rocky spots on the body, ganglia and pain in the bones or abdomen - can be confused with those of other very common ailments in childhood. This situation is an alert for public health managers.

The period of days between the patient's registration and the start of treatment attracted attention. At the pediatric oncology outpatient clinic, the time between registration (patient record) and diagnosis of the disease was 4.24 (days), from diagnosis and start of treatment (2.52) days and registration of the child and adolescent until treatment (3.25) days.

This information had a significant improvement compared to the research by Paraguassú-Chaves *et al* [24].

The data referring to the first types of procedures in cancer cases assisted by the public health program are universal and not only in childhood and youth cancer. Which, according to Paraguassú-Chaves *et al* [27], [28], is a limiting factor for a more precise analysis.

The studies by Reis *et al* [16] "Incidence and survival of cancer in children and adolescents" Kaatsch [25] "Epidemiology of childhood cancer" are similar to the present study. However, these surveys specify the frequencies of leukemias and lymphomas with more rigor and detail in some variables.

The research by Hada, Gaete and Pianovski [36] "Childhood cancer epidemiological profile of patients referred to the hospital of clinics of UFP pediatric oncology unit", also corroborate an essential part of the results of this research in Rondônia. The results found in the research are in accordance with the projection presented by Paraguassú-Chaves *et al* [24].

v. CONCLUSIONS

In three years, 122 new cases of cancer in childhood and adolescence were diagnosed. of these, 56 (45.9%) were female and 66 (54.1%) were male. 48.3% of children with pediatric cancer were less than 10 years old.

The most frequent histological types by gender were leukemias of myeloproliferative and myelodysplastic diseases, lymphomas and reticuloendothelial neoplasms, carcinomas and other epithelial neoplasms and the CNS and several intracranial and intraspinal neoplasms.

Leukemia of the hematopoietic system and the reticulum classified according to ICD 10, (C42) is the most frequent cancer in both sexes, with 46.26% of pediatric cancer cases, twice in male children and adolescents.

Precursor cell lymphoblastic leukemia, NOS, plasma cell tumors (973), malignant lymphoma, diffuse NOS (959) and acute myeloid leukemia, NOS, are the most relevant histological types in the studied period. 20.5% of cases are presented as an indeterminate phase and without patients without information it reached 79.5%. The notifications made comprise 99.38% of the Unified Health System Program - SUS.

The pediatric oncology clinic was responsible for the first care in 65.3% of pediatric cancer cases. 47.6% of children and adolescents entered the specialized clinic without diagnosis and without treatment. A worrying indicator.

Other isolated therapeutic procedures showed relative frequency with greater prominence, 44.36%, after surgery with 15.22% r chemotherapy with 5.99%. These indicators refer to the procedures in all cases of cancer assisted by the public health program, and not only in childhood and youth cancer.

The results presented are in agreement with the data of most studies carried out in Rondônia, Brazil and other developed and developing countries. What is expected is that this research can serve as a basis for the systematization of essential data for the planning, execution and evaluation of actions for the promotion, prevention, control and treatment of pediatric cancer in Rondônia, Brazil.

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Factors Influencing Household's Solid Waste Classification Management: The case of HANGZHOU.

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Abstract

Households' contribution in solid waste classification and recycling of municipal household solid waste is one of the essential factors influencing municipal solid waste management. We identify and investigate the factors influencing solid waste management classification as well as mechanism used by households to dispose waste in their communities. Based on the survey data of households in Hangzhou China in three different communities, factors that affect household disposal and their degree of influence have been analyzed, followed by discussion on decision-making mechanisms. The results show that household behavioral selection has been linked to several key factors which are Environmental attitude, knowledge and education, classification facilities and services, and policies. The research has also determined to reveal the response of the people to solid waste classification, and the combined effect of the factors is almost twice that of the former. In addition, environmentally friendly facilities and programs are most successful in encouraging the involvement of household in identification and recycling. Finally, the research put forward applicable policy suggestions for the comprehensive management of municipal Household Solid Waste classification and recycling.

Key words: Solid waste management; household's Solid Waste classification; Hangzhou

1. Historical background

China has been practicing Municipal solid waste management source classification in different areas since the year 2014. China's municipal solid waste management was initiated in the late 1980s, when China's municipal solid waste consisted mainly of small-scale lime soil. Due to the growth of the municipal economy and the improvement in the utilization mode of households, the types and total amount of municipal waste were greatly increased in the late 1980s and early 1990s. During this phase, domestic waste research focused on facilities for processing, transportation and treatment of waste. The management system and domestic waste policy research in China gradually increased in the late 1990s and the positive transition of waste classification abroad.

The situation of solid waste classification management has concentrate on how to deal with the increase of garbage in which the results accounted to reduce the garbage generated from the source by measures, categorized collection and recycling. Moreover, solid waste classification has been practiced in china for many years, but still there are problems that are not yet to be solved, example, The problem of mixed

loading and transport in the waste classification and disposal system has not been resolved in Beijing, and the waste classification of the entire city, Shanghai, the category of garbage is faced with hot government cold citizens, In Guangzhou, 781 households introduced a "fixed-time" classification system, with only 46.16 % of the city's community population participating in the "fixed-time" classification mode. The contribution of people is not strong, and the actual impact is not good. Classification of garbage is still in the stage of encouraging and promoting.

Hangzhou is the capital city of Zhejiang Province, which is at the forefront of Chinese practice. In Hangzhou there was an introduction of a mode of classification which took part in helping to managing and maintains the waste control.

In 2014, The Zhejiang provincial government announced the 'Notice on the Pilot Project of Waste Reduction and Resource Treatment', As in the year 2013, Hangzhou exceeded 3 million tons/a of the total Municipal Solid Waste generation, which was far in excess of its expected dumping capacity. The Hangzhou municipal government established a number of pilot projects for decreasing the Domestic Waste sent to municipal dumping facilities based on the '2 + T' source classification method (biodegradable waste, other waste, and toxic waste) and waste resource treatment. In 2015, the Hangzhou government published the 'Three-year Action Plan for Classification and elimination of Domestic Waste'. After four years of development, Hangzhou formed a series of systems for the classified deposit, collection, transportation and disposal of garbage in cities. Additionally, effective source classification and resourcing treatment patterns were developed in some districts of Hangzhou. However, no systematic studies have been conducted on the performance of typical source classification and resourcing treatment patterns systems, although it was important to do because of the size of cities and dividing them into patterns increased efficiency.

2. Literature Review

Solid waste management is the most threatening and critical problems affecting the environment especially in municipal areas of developed and developing countries of the entire world. The trends of solid waste generation are to be related to the development of urbanization, industrialization and economic development at large. As from 1998–2017, there was an increase of urbanization in China at an average annual growth rate calculated to be of more than 1%. As of 2017, 58.52% of China's a total population are living in urban areas (National Bureau of Statistics of China, 2018). This environmental problem remains to be a threat to the environment and the public health if measures are not taken and efficiently implemented (UNEP, 2010). Solid waste management and disposal have overcome serious challenges, in developing countries due to the rapid increase in population, economic development and waste generation, and this proven day by day, as the communities develop the solid waste also increases, this means the relationship is rational (Diaz and Otoma, 2014; Taghipour et al., 2016). A number of cities are facing a problem of Garbage Siege, which means the cities are bounded by garbage heaped up in suburban areas (Hu et al., 2012; Liao et al., 2018).

As well as China has been one of the victims of this tragedy but to solve that the government have pledge much money into solving the problems by creating garbage system in each and every community starting

with few selected cities according to the ministry of housing of housing and Urban- Rural Development of China. A total of 21.3 Billion yuan will be invested to build more waste disposal facilities in 46 cities that are in a basic classification and disposal system pilot program, allowing them to reach their target by the end of 2020 (Gao Yang, Yang Qiang 2017). Two thirds of big and medium cities in china are covered in waste, approximately more than 500 million square meters of land nationally intruded due to the dumping around of household solid waste (Fei et al., 2016). Municipal disposal facilities lack the ability to process the solid waste made from urban and rural areas because of the rapid increase in municipal solid waste. A number of cities are facing a problem of Garbage Siege, which means the cities are bounded by garbage heaped up in suburban areas (Hu et al., 2012; Liao et al., 2018). Keramitsoglou.M.K et.al. , 2013 argued that a recycling program is usually imposed from top to down by the municipal authorities without public participation, the authorities playing a role of decision-making and implementation it's not enough. To accomplish the recycling goals, the waste management problem should as much as an issue and responsibility of the local community rather than of the local council waste services. The thing that matters is component materials that the community people are willing to recycle, and what collection system would be more convenient for them. In some communities, most studies are centered on a general image of the status of solid waste management (Ying, 2014). The rest of the aspects of recycling received less attention. The study investigates the practice of recycling among households and, in particular, the demographic profile and the influence solid waste management, conditions for active participation and options for improving solid waste collection services. This report is valuable regarding household waste dumping, recycling planning, as well as overall waste management. Many reports have revealed that the composition of Rural Domestic Waste is not similar from that of urban waste, and that the recyclable components of Rural Domestic Waste account for 50% and above of the total garbage (Guérin et al., 2018; Han et al., 2018; Kumar and Samadder, 2017; Saidan et al., 2017). It has been confirmed that the recyclable components can be significantly reduced in site by biological treatment (He, 2012). Nevertheless, there are no standard methods on Rural Domestic Waste reduction and resource utilization systems based on source classification.

3. Hangzhou mode

Hangzhou municipal solid waste classification research has developed the whole system of Hangzhou mode, that incorporates policies and regulations, classification methods and implementation plans," headed by the government and included all levels of departments and social forces, and has traveled along the path of garbage classification management according to its own attributes.

The physical waste composition in Hangzhou has led to an observation that the recyclable material is more than 50% of the garbage collected. %. Recyclable waste referring to include, plastics, paper, metals, glass, and textiles, comprised of 13.86 to 52.06% of the components.

There are special collection and dumping procedures for toxic waste in the communities which is been handled in a special way, it consists of 0.45 to 1.96% of the components. biodegradable waste and recyclable materials are the most focused source reduction and recycling targets. Although, the domestic waste moisture component is generally high due to the biodegradable waste component that usually

contaminates the recyclable materials and leads to pollution during tr

however, requires high knowledge, ability, and implementation of classification of household waste.

4. Empirical research of factors influencing household waste disposal behaviors

The study reviewed and summarized a large number of similar researches on the influence factors of the waste disposal behavior of households in order to suggest rational hypotheses of the initial measurement method. In previous years, relevant research has been carried out by domestic and foreign scholars (Boonrod et al., 2015; Borthakur and Govind, 2017; Guo et al., 2016).

This paper is based on literature reviews, sums up factors that occur frequently and have a major impact. Recent studies have shown that the household disposal behaviors can be indirectly affected by four key aspects, including attitude, education and knowledge, policies, facilities and services for the environment. This study presents an initial concept of the factors and measure of influencing factor of household waste disposal behaviors. (as figure 1)

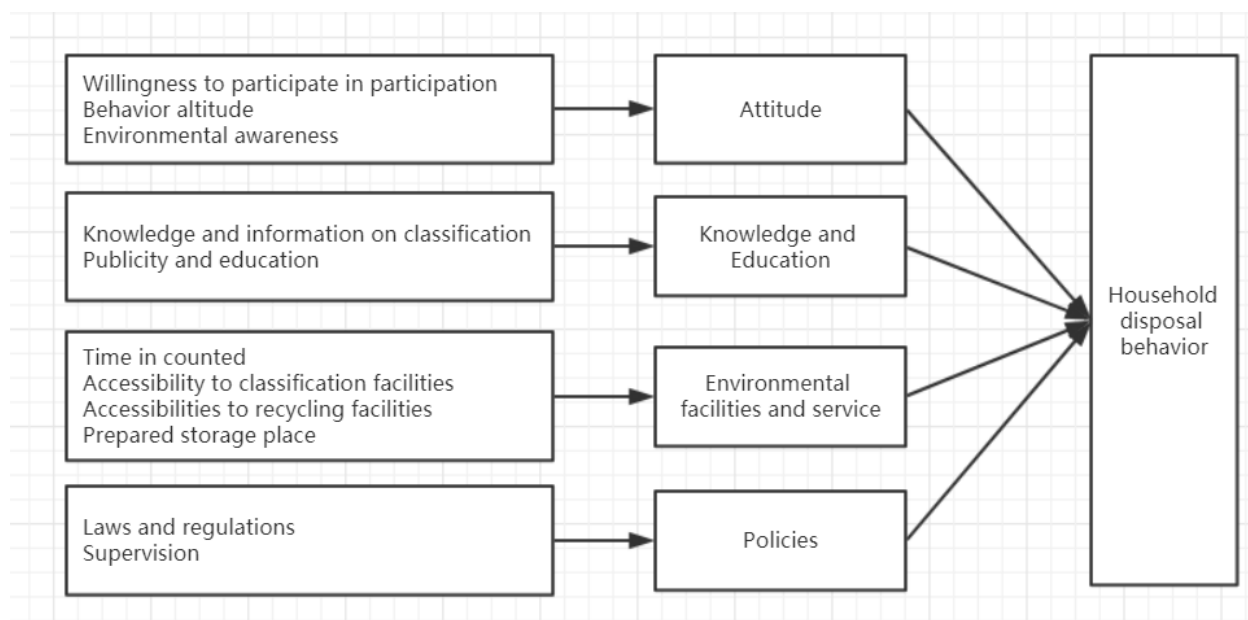


Figure 1. The conceptual model of household waste disposal behaviors.

it is reasonably to explore the kind of factors that will play an important role in developing the household's solid waste classification in developing countries. For this reason, a questionnaire survey was designed and investigated in the three communities in Hangzhou. It is believed that demographic structure and education level will affect the quality of garbage classification in rural areas (Bhawal Mukherji et al., 2016; Martinez-Pena et al., 2013; Song et al., 2016; Wang et al., 2018).

The study used a questionnaire to investigate the households and their influencing factors depending on the basis of the initial conceptual model the research has proposed. The questionnaire consisted of two parts: (1) the demographic and social attribute information of the respondents, including gender, age, education level, income and occupation. (2) The second part covers questions investigating response of the people on the classification of solid waste, views on the intensity of the factors influencing the solid waste

classification, the availability of services in the community as well as the equipment. Items measuring the initial research hypotheses and the conceptual model, all measures were reported on 1 to 5 point scale from “Strongly Agree”, “Agree”, “Moderately”, “Disagree” to “Strongly Dis- agree”. The data was analyzed by OLS model to get the result of the research.

The research had distributed 210 questionnaires but only 159 questionnaires were collected and valid in which among the questionnaires 85 male and 74 female. These valid questionnaires helped to get results of the study.

It may be concluded that public participation has an important effect on the households in the Hangzhou. Furthermore, the different identified factors would result in considerably different results. It is stated that public classification willingness and attitude rather than advanced equipment or mandatory regulations are the most vital factors influencing garbage classification management in developed countries (De Feo and De Gisi, 2010; Junquera et al., 2001). Table 1 shows the gender, age, and education distribution in the investigated districts, and the respondents covered different gender, age, and education levels.

Table 1. Descriptive statistics

	Classification	Number	Percentage %
Gender	Male	85	53.5
	Female	74	46.5
Age	< 20	7	4.4
	20 -30	99	62.3
	31 -40	32	20.1
	41 -50	18	11.3
	>50	3	1.9
Income	4000	45	28.3
	4000-6000	44	27.7
	6000-8000	46	28.3
	8000 >	24	15.1
Education level	< Senior education	17	10.7
	Bachelor or collage	120	75.5
	> Bachelor or collage	22	13.8
Occupation	Government workers	19	12.0
	Private enterprises	36	22.7
	Public Enterprises	11	6.9
	University research	14	8.8
	Professional	24	15.1
	Student	55	34.6

In this study, 159 valid samples were tested by factor analysis, and the factor load of each factor corresponding variable was tested to determine the structural validity of the model. The KMO value is 0.845, which is greater than 0.7, indicating good effect. Bartlett statistic was significantly different from 0

(< 0.001), which indicated that the model had good structural validity and applicability of exploratory factor analysis.

To construct multiple regression models, its basic form is as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \epsilon$$

Among them, y is the willingness of residents to garbage classification, β_0 is a constant, X_1 is the residents' garbage classification cognition, X_2 residents' garbage behavior perception, X_3 is the publicity of government and society, X_4 is the government's reward and punishment, X_5 is the supporting measures of society, x_6 is the social demonstration force, and ϵ is the residual item.

In this paper, stata15.0 is used to regress the data step by step, and then six models are formed, which are residents' garbage classification cognition, garbage behavior perception, government and social publicity, government rewards and punishments, social supporting measures, and social demonstration force.

Table 2. Representing valuables Model results

Explanation Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Personal cognition	0.3849*	0.4232*	0.2718*	0.1440	0.2681*	0.2523*
Cognitive behavior		-0.2053**	-0.2257*	-0.3088*	-0.2511*	-0.2363*
Government and			0.2994*	0.2076**	0.0513	0.0138
The government				0.3591*	0.2502**	0.2067***
Social facilities					0.3111*	0.2631*
Social demonstration						0.1675***
R2	0.1311	0.1635	0.2397	0.2856	0.3721	0.3872
Adjusted R2	0.1256	0.1528	0.2250	0.2670	0.3516	0.3631
F value	23.69	15.25	16.29	15.39	18.13	16.01

Note: *, **, *** are significant at the level of 0.001, 0.5 and 0.1 respectively

The model results are shown in the table 2. It can be seen that with the increase of variables, R2 values also increase, indicating that the selected explanatory variables have better explanatory ability to the variables to be interpreted. In model 1, the residents' personal perception will improve the willingness of garbage classification, which indicates that the more concerned about environmental protection, the higher the willingness of garbage classification, which is consistent with our cognition. In model 2, there is a negative correlation between residents' behavior perception and garbage classification intention. It may take a lot of time and physical strength to classify garbage, and accordingly residents may reduce their willingness to classify garbage. Model 3 and model 4 study explanatory variables at the government level. Among them, model 3 is to test the explanatory variable of government and society publicity. The results show that government and society publicity will improve the willingness of residents to carry out garbage classification. Therefore, the greater the government publicity, the more residents may support the garbage classification policy, thus reducing the resistance of government policy. Model 4 discusses the government's reward and punishment measures. It can be seen that the variable passes the test at a significant level of 1%, and has a positive impact on the willingness of garbage classification. Therefore, the government needs to formulate strict reward and punishment policies to reward the residents who carry out garbage classification and punish the residents who do not carry out garbage classification, which can

improve the willingness of garbage classification of residents. Model 5 and Model 6 are tested from two variables at the social level, and social supporting measures and demonstration forces are positively correlated with garbage classification willingness. In model 5, the supporting measures pass the test at the significance level of 1%. For every 1 increase in social supporting measures, the residents' garbage classification willingness will increase by 0.3111. Therefore, it is necessary to provide complete supporting measures for garbage classification, such as formulating detailed garbage classification policies, providing classified garbage cans in the community, etc. In addition, the residents' garbage classification willingness will also be affected by the social demonstration force. The garbage classification behavior of neighbors, relatives and friends will improve the residents' garbage classification willingness. Therefore, it is necessary to give full play to the power of role models, encourage party members and advanced elements to actively participate in garbage classification and play a leading role, so that more people will participate.

5. Conclusion

The results of this study proposed the behavioral decision making mechanism which takes into account the involvement of both residents in origin identification and resource recycling, the main factors observed have a significant effect on the household solid waste disposal behaviors of residents and their degree of control. The classification system for solid waste management will manage waste origin separation for reduction environmental affect.

Among some of the household categorized deposits in doorway and gate-to-door biodegradable as well as other waste collection, there was the best solid classification and quality involvement, apart from operating costs. Research has demonstrated that the most significant factor affecting the conduct of origin identification is the public attitude. Factor results had a positive association with the accuracy and involvement in the identification of the origin. It is of great importance to somehow improve the efficiency and elimination of the category of urban solid waste management.: Develop suitable classification techniques and patterns to improve classification and reduction effects and cultivate positive social attitudes, improve publicity and education to increase public awareness of classification methods, maintain stable supervision of source classification behavior, and provide adequate financial assistance to encourage the popularization of waste classification.

The effect of laws and regulations on citizens' behavioral selection of solid household waste administrators does not achieve a statistically meaningful level, as current Hangzhou waste classification and recycling laws and regulations are predominantly encouraging and useful, with no compulsory restraint policies yet authorized. In other words, the effect of legislation, laws and regulations on real-life communities is typically very limited on whether or not residents are interested in waste collection and recycling. It is not developed the hypothesis direction that unused storage space has a negative impact on the existing environmental factor, infrastructure and services of residents. Hopefully, the government should emphasize the planning and construction of solid waste classification and recycling facilities for municipal households, carry out extensive advertising and education events on waste classification and recycling among residents through multiple channels, and strengthen laws and regulations in long term comprehensive municipal

management.

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E-Portfolio as an alternative assessment tool for students with learning differences: a case study.

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Abstract

The unprecedented technological and social changes, caused by the Fourth Industrial Revolution, demand that nobody be left behind, and all learners be catered for equally, respecting the principles of inclusion (Collins & Halverson, 2018). However, worldwide, more than 700 million people with dyslexia and learning differences experience failure and marginalization due to standardized testing, which tends to devalue their out-of-the-box mindset (Washburn et al., 2011). According to the National Research Council (2001), an effective way to promote equity in education and optimize learning as well as equip students for their future challenges, is to reflect on and restructure the assessment methods. In this vein, the purpose of the present research is to explore the impact of alternative assessment in the provision of holistic learning conditions. Therefore, e-portfolio was introduced as a research tool in an afternoon EFL class for students with learning differences (n=20 students) in Greece. The learners' active engagement in the self-evaluation processes, the ongoing conferences between the teacher and each student gave insight into the learning progress, and the in-time, constructive feedback comprise the strategies followed in this pilot study, aiming at investigating the learners' emotional reinforcement, change of attitude towards learning English as well as their improvement in the target language. Given the research findings, the e-portfolio enabled the students to employ both cognition and metacognition to prove their level of knowledge, adopt self-regulation strategies to boost their learning curves, and enhance their self-development, indicating the efficiency of the tool.

Keywords: EFL; dyslexia and learning differences; e-portfolio; holistic impact;

1. Introduction

'Everybody is a genius. But if you judge a fish by its ability to climb a tree, it will live its whole life believing that it is stupid', is a statement adhered to Einstein according to Gribbin and Gribbin (2005).

Successful teaching is closely connected with identifying and implementing the suitable individualised assessment tool to the students, a tool that will match their profile, and embrace their uniqueness while employing the best way to make it an asset as it is stressed in Einstein's quote above.

The purpose of this research is to explore the perspectives of portfolio, used as a means of alternative assessment, which differs from the traditional, standardised tests, showcasing the development and implementation of an e-portfolio for students with Specific Learning Difficulties (SpLDs). In addition, it aims to provide insights into its impact on the target population in terms of the employment of cognition, metacognition, and self-regulation strategies, which can not only boost their learning curves but also enhance their self-development.

The adopted approach to assessment was made in acknowledgement of the fact that formal, ongoing, and flexible types of evaluation, such as portfolios, are believed to be tailor-made for students with learning differences, who need differentiated approaches in their schooling in order to unlock their full potential, and be equally appreciated (Hirvela & Pierson, 2000). Especially in the field of special educational needs (SEN), the students benefit from the parameters of equity in education since all the learners are provided with equal opportunities to succeed (Darling-Hammond, 1995), and from the active participation in their assessment process, which positively appreciates every effort they make (Gomes & Mendes, 2007). It should be noted, that the "self-portrait" of the students' work in a portfolio leads to constant self-reflection and self-improvement, which contribute to building both cognition and metacognition, and are identified as necessary features for the next generation citizens (Veenman et al., 2006). In addition, alternative assessment tools, such as portfolios, have the potential to instill not only academic but also study, and life skills, such as higher-order thinking, self-regulation, self-awareness, compassion for others, empathy, ingenuity, risk-taking strategies among others, creating, thus, a holistic impact on students with learning differences (Gipps, 2002).

2. E-Portfolio as an alternative assessment tool

2.1 Defining e-portfolio

Embracing the pedagogical use of Information Communication Technology (ICT) in educational contexts, electronic Portfolios or e-portfolios can be regarded as a major innovation brought about by advances in technology to promote both learning and assessment (Woodward & Nanlohy 2004). According to Lorenzo and Ittelson (2005, p.2), it can be defined as "a digitized collection of artefacts including demonstrations, resources, and accomplishments that represent an individual, group, or institution". What is more, an e-portfolio can be identified as a web-based collection of students' works, which includes their responses or reflections to tasks, highlighting the skills they acquired, and their achievements in various contexts for a certain period of time (ibid, p. 2). On the same line, Gray (2008, pp. 6-7), defines it as "a purposeful aggregation of digital items" including ideas, evidence, reflections and feedback, and emphasizes the potential of e-portfolios to provide a record of the learners' "experiences, achievements, and learning," which can be of use to different stakeholders, i.e. teachers, administration, parents, and students (ibid, 2008). It should be noted, however, that the development of an e-portfolio is closely related with "complex processes of planning, synthesizing, sharing, discussing, reflecting, giving, receiving, and responding to

feedback” (JISC, 2008, p. 6).

2.2 Types and purposes of portfolios

The portfolio is a multidimensional construct which can be employed for different purposes depending on its type. According to Apple and Shimo (2004), three types of portfolios can be identified: (1) The documentation portfolio which includes the collection of all the student’s works throughout a course. (2) The assessment portfolio involving a systematic selection of the works produced on the part of the students based on criteria, which have been clearly communicated by the teacher, and are believed to be of major importance in assessing the students’ performance. (3) The showcase portfolio which involves a selection of the best samples of the students’ work to be included in their portfolio.

Researchers (Hamp-Lyons & Condon, 2000; Burner, 2014) agree that in order to be efficient, a portfolio should display procedures of collection, selection, and reflection, which means identify with the assessment portfolio type highlighted above, and as Moya and O’Malley (1994) point out, it comprises of important pieces of students’ work to be shared with various stakeholders.

2.3 The benefits and drawbacks of E-portfolio as an assessment tool

Reviewing relevant literature, the benefits and drawbacks of E-portfolio as an assessment tool have been identified (Aliweh, 2011; Britten et al., 2003; Burner, 2014; Cambridge, 2010; Chau & Cheng, 2010; Fox, 2008; Gebric et al., 2011; Hung & Huang, 2012; Love & Cooper, 2007; Nunes, 2004; Yin, 2013; Ziegler & Moeller, 2012). According to Brown and Hudson (1998), a portfolio can be beneficial in terms of the following aspects, enhancing student’s learning, providing information to teachers, and facilitating the assessment process. Drawing from the findings of empirical studies, Yin (2013), highlights that portfolio assessment overcomes the problematic aspects of traditional tests, and can be aligned to the aims of the curriculum goals. In addition, it can promote the learners’ language development, self-reflection, autonomy, cognition, metacognition, and motivation (ibid). Britten et al., (2003) report that as students engage in portfolio assessment student reflection can be enhanced offering useful insights into their progress over time. Hung and Huang (2012) on their part, identify its influence on cultivating a sense of ownership, and a sense of community while Nunes (2004) pinpoints its potential to develop students’ reflection.

According to Love and Cooper (2007), the benefits from the use of portfolio assessment are creating the conditions for meaningful learning which is linked to real-world experiences and is self-directed, with students assuming responsibility for their own learning. Burner (2014) highlights the positive impact of portfolio assessment on promoting authenticity by providing the chance for authentic language use. He also comments on further beneficial aspects such as promoting and facilitating interaction not only in the language classroom but also beyond it, introducing anxiety-free conditions for learning compared to traditional testing approaches, besides increasing students’ motivation and time spent on the tasks (ibid). Ziegler and Moeller (2012), on their part point out that portfolio assessment as a formative assessment tool can promote intrinsic motivation, and improve the accuracy of self-assessment of learning. On the same line, Cambridge (2010) underlines the merits of the learners evaluating their knowledge and skills as it can provide valuable insights into how they will be able to transfer them in further settings. Aliweh (2011) indicates that the portfolio can be a powerful tool for developing the learners’ responsibility for learning

along with their awareness for their literacy and skills. The positive impact of portfolio assessment in helping learners become more independent is also identified by Chau and Cheng (2010) and Gebrie et al., (2011).

However, according to criticism, alternative assessment tools lack reliability and validity since it is difficult to pass judgement, and produce stable or consistent results, compared to standardized tests (Mason et al., 2004). This issue can be overcome by means of coherent, consistent, and systematic collection of evidence, which take place over a long period of time, and provide data representative of the teaching practices and the learners' performance, reflecting the underlying skills measured (Baume, 2002; Berk, 2002; Hamp-Lyons & Condon, 2000). Besides, it should be noted that by assimilating assessment to the process of teaching and learning and by tackling norm, linguistic, and cultural issues related to traditional testing approaches, alternative assessment tools, such as portfolios, can gain in terms of both validity and reliability (Huerta-Macias, 1995, p.10).

Another estimated shortcoming of designing portfolios as an assessment tool is its utility and practicality (Lo, 2010). Portfolio development demands more time on the part of the teacher, according to Harmer (2007), with Barrett and Knezek (2003) as well as Birgin and Baki (2007) agreeing that the process of creating a portfolio is time-consuming and costly, necessitating loads of materials, such as books, photocopied materials, folders, colored paper, among others. A further issue of introducing portfolio assessment is that various stakeholders, including parents or administration, may object or disapprove of its use due to rooted beliefs on traditional testing, and lack of knowledge concerning the particular tool (Mokhataria, 2015).

The spread of technology has led to the emergence of e-portfolio tackling shortcomings of portfolios as assessment tools, such as utility and practicality (Hung, 2008). The process of creating a digital portfolio is no longer as time-consuming and costly as it used to be, necessitating materials such as books, folders, and colored paper, among others as in the case of paper portfolios (Barrett & Knezek, 2003; Birgin & Baki, 2007); rather the collection, organization, and storage of students' work in various formats is greatly facilitated by technology (Barret, 2000).

3. The study

3.1 Teaching context

The implementation of the intervention employing e-portfolio as an alternative assessment tool for an EFL course for students with SpLDs and other challenges, took place in a weekly Kids' English Art Workshop in a private educational organization. The class consisted of 20 mixed-ability students with an age range from 9-12, aiming at A2 level certification, according to the Common European Reference for Languages (CEFR) (Council of Europe, 2002) at the end of the school year. The EFL teacher has specialised knowledge for teaching the target group of students as all are identified with both mild and severe learning difficulties. In particular, most of the students are diagnosed with dyslexia and ADHD, while two of them belong to the autism spectrum disorder. They are all monolingual students, whose mother tongue is Greek, and are learning English as a foreign language; hence, they are identified as belonging in the expanding Kachruvian circle (Kachru, 1985), in which English is learnt as a medium for international communication.

Having suffered the effects of marginalization and the disheartening effect of unfair stereotypes due to their different way of learning, the students seem to consider schooling as an unbearable burden (Manoli, 2018). Their main difficulty is the refusal and negativity towards learning while they appear to be overwhelmed with anxiety and frustration concerning their educational performance, which, in turn, is affected by the way they feel.

3.2 The aim and objectives of the EFL workshop

According to the limbic system theory, the connections between emotions and learning are bidirectional and conducive either to success or failure (Chen et al., 2008). Thus, the teacher set her priority to unlock these students' academic potential by building their psycho-social development, and empowering their creativity, self-regulation, self-awareness, and critical thinking skills. By extension, the teacher's main goal is to modify the students' attitude towards learning and progressing, not only in English but in other school subjects as well (Rogers, 2002). What is more, particular emphasis was laid on the development of the students' soft skills, such as communication and cooperation skills, empathy and positivity, ideation and implementation of innovative solutions for real-life problems, patience and perseverance, which are regarded as essential for a well-rounded citizen with holistic cultivation in the modern society (Kolb, 2014). Transmitting life skills to the students does not connote to ignoring language perfection and towards the goal of mastering English as a foreign language, as the students are exposed to genuinely valuable opportunities to use English replicating authentic language cases (Gidley, 2010).

3.3 The teaching intervention: a descriptive account

The teacher provided the students with differentiated, one-to-one tutoring of the English language for three hours per week, along with the two-hour, weekly workshop for an academic year. The students' needs were catered for holistically; in other words, both language competency and emotional growth was built (Kolb & Kolb, 2009), while they were attending the individual and team sessions respectively. The syllabus of the workshop was global, citizenship-oriented, and every week's sessions included hands-on, experiential projects. Indicatively, some of the modules the students elaborated on were: 'Paving towards Sustainability', 'Establishing Global Quality Education', 'Global Peace' and 'Climate Super Heroes'. Through out-of-the-box activities, and involvement with real-life global problems, which tend to boost learning curves and promote reasoning, puzzle-solving, abstract way of learning, effective, fruitful cooperation, compassion, empathy, EQ and CQ building, it was aimed that the students would practice the target vocabulary by building their own mnemonic strategies, employ functional language in dialogues, enhance their listening and presentation skills while presenting their work in front of their peers and their teachers.

Student-based and project-based art-empowered learning, in combination with jigsaw and collaboration strategies, contribute to the students' moving from formalistic, exam-centered learning environments to experiential, transformative ones, which concentrate on formative rather than summative ways of assessment (Brown et al., 2008).

3.4 The rationale for introducing portfolio assessment

In consideration of the numerous benefits of portfolio assessment (see section 2.3), its efficiency to

accommodate the learners' needs in various learning contexts needs hardly be argued. In addition, taking into consideration the emotional barriers provoked to students with SpLDs by traditional tests (Pappa, 2013), the rapid technological and societal changes, which impose that nobody be left behind (Bloem et al., 2014; Gidley, 2014), and the need for inclusion (Collins & Halverson, 2018), a portfolio is regarded as an advantageous method of assessment to be employed (Webb et al., 2003).

Along with the pedagogical benefits of introducing e-portfolio (see section 2.3) and the parameters mentioned above, the need for the cultivation of soft skills, rather than solely focusing on the hard ones, in line with the demands of the Fourth Industrial Revolution path (Bloem, et al., 2014), calls for a diversified approach to assessment, as such skills are not easily measured or proven like the typical qualifications or certificates deriving from the standardized types of testing. In this respect, portfolio assessment was considered as an efficient approach to assess the students' development of communication and cooperation skills, empathy and positivity, ideation and implementation of innovative solutions for real-life problems, patience and perseverance, which are identified as necessary features in which students of the 21st century should be trained (Schulz, 2008).

3.5 The procedure for developing the e-portfolio

The procedure of developing the e-portfolio, which can be identified as an assessment portfolio, following the categorisation by Apple and Shimo (2004), took place in three phases, collection, selection, and reflection (Burner, 2014). During the previous academic year from September until May, the teacher kept a record of the students' projects in all of their stages until their completion, by taking pictures and videos of them using a tablet while she also kept an observation diary. Both the parents and the students were informed about the photo shooting, and their consent was given in a written form despite the fact that the former tended to be quite negative about the effectiveness of this type of assessment. The students eventually had a big number of both individual and group pictures of their work, therefore, in order to enhance the students' involvement in their self-assessment process, each one of them negotiated with the teacher about which photos presenting their effort should be included in the collection of their work. The screening of the photos and the decision over which were the most suitable ones to represent the learners' end-product took place at the end of each project after the students had completed an evaluation checklist with ten items, given in Greek to ensure comprehensibility (see Section 3.8, Table.1).

The teacher intending to familiarise the learners and their families with cutting-edge technology decided to make the portfolios digital on a presentation platform system (<https://prezi.com/dashboard/next/>). She worked closely with the students, and in the last five minutes of each workshop session, they negotiated about which images, proof of evidence, should be saved and which ones should be erased. At the end of each syllabus module, about once in a month, the teacher interacted with each learner on a decision-making process, and they designed together the format and content of each slide of their portfolio presentation. The link of each student's portfolio was saved in a public mode, but the student's name was written in a jumbled order to secure the student's online protection, and lack of inappropriate exposure (J@\$on instead of Jason, which is the student's real name). The links were rendered into a Qr code (<https://www.qrstuff.com/>) (Appendix 1), and placed on a 3D paper suitcase, which represented the students' journey of knowledge, self-exploration, and self-achievement, making the portfolio more vivid and powerful (Pasareti et al., 2011;

Wojciechowski & Cellary, 2013). Extra emphasis was placed on the presentation of the portfolio to an audience other than their peers. This is why it was not given to the students and their families as a CD or sent as a link via a typical e-mail; instead, all the students had the opportunity to present the end-product of their hard work during the end-of-the-year celebration.

3.6 The research tools used to complement portfolio assessment

To overcome the alleged limitations of alternative assessment, deal with parents' disapproval of the unfamiliar tool, and their demand for data concerning their children's progress, the teacher employed observation diaries, keeping detailed record files for each individual student's performance. It should be noted that many parents were especially reluctant to accept the explanation provided by the teacher so as to comprehend how portfolio would be beneficial for the learners. Additionally, a self-evaluation checklist was completed every trimester by the students upon the completion of the modules with the aim to provide further insights into the positive impact of the implementation of the e-portfolio.

3.7 The findings from the teacher's diaries

Throughout the academic year, the teacher closely observed the students' performance in terms of communication strategies, oral interaction, and written production, and kept observation diaries, which recorded the students' progress, and were translated into line graphs to highlight the efficiency of the adopted approach in helping the learners make progress despite the absence of data from traditional testing. As presented in figures 1-4, which depict the average group progress attained throughout the academic year in relation to specific descriptors of the (CEFR), by the end of the school year, the students had reached the level, which was as set at the beginning of the course, that is, A2, and in many cases even A2+ according to the (CEFR), (Council of Europe, 2002).

Concerning their communication strategies, which are presented in Figure 1, addressing audiences was the one in which the highest development was identified, followed by asking for clarification, taking the floor or turn-taking, and cooperation strategies. Of them, it is interesting that addressing audiences and turn-taking followed a more dynamic pattern of development.

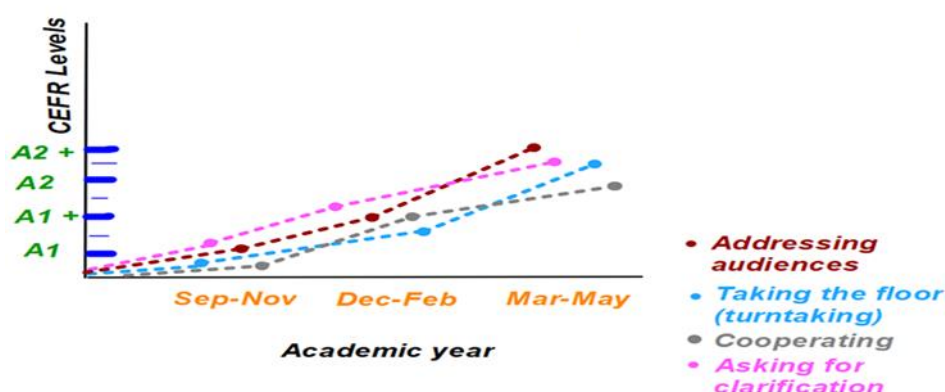


Figure 1. The students' progress in terms of communication strategies

Concerning the students' improvement in terms of oral interaction, as shown in Figure 2, informal discussion among friends was identified as the most improved strategy, information exchange for a variety

of purposes came next while the overall amount of spoken interaction followed. It should be noted, however, that over the last trimester, the development of all three followed a parallel pattern.

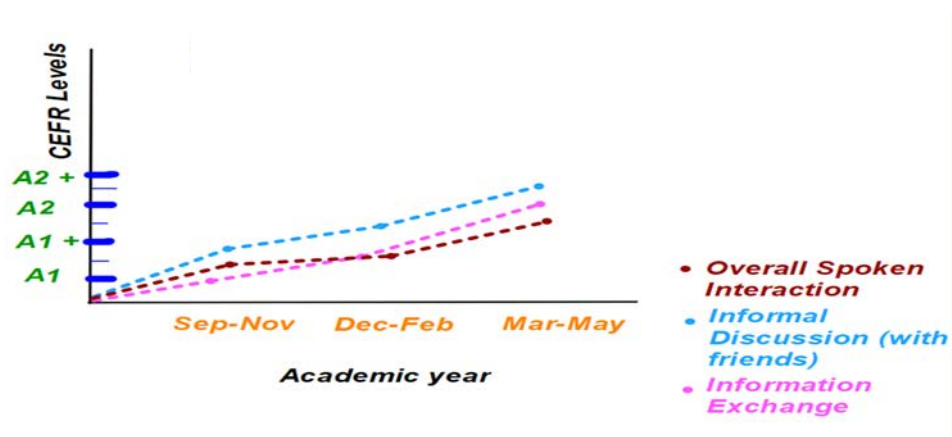


Figure 2. The students' progress in terms of oral interaction

When it comes to written production, which is an aspect of language learning which presents major difficulties for students with SpLDs, the students' performance in goal-oriented cooperation was highly improved, creative writing was next in terms of development along with reading for orientation, all following an almost parallel development, as shown in Figure 3. The latter, reading for orientation, was a little below A2 level.

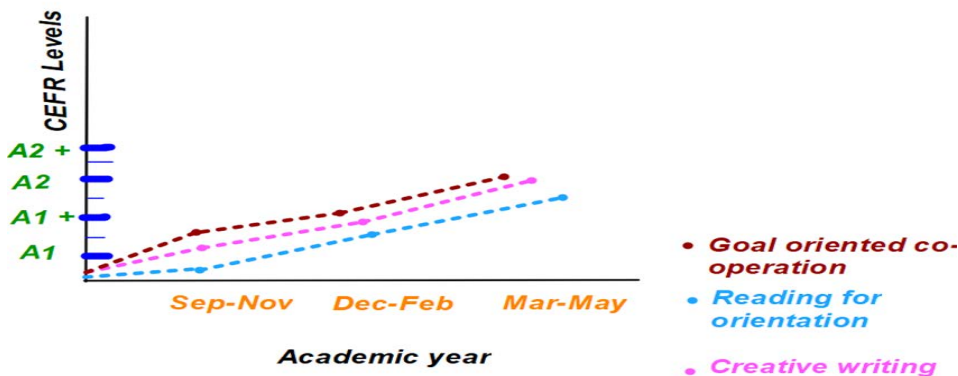


Figure 3. The students' progress in terms of written production

In terms of their performance concerning listening comprehension, as shown in Figure 4, the learners developed listening as a member of a live audience mostly; they also improved their overall listening comprehension skills, besides listening to announcements, and instructions reaching A2 level, which had been identified as the goal.

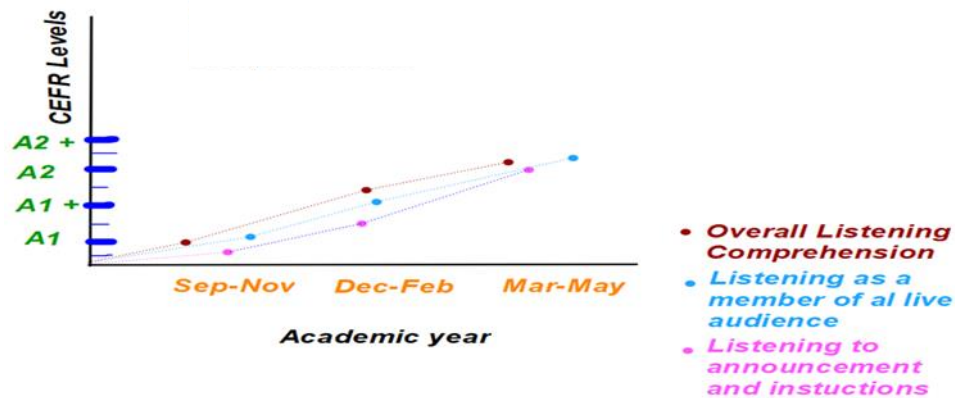


Figure 4. The students' progress in terms of listening comprehension

3.8 The findings from the students' self-evaluation checklists

Upon the completion of each trimester, the students' completed a self-evaluation checklist, comprising in total ten items, given in Greek to secure comprehension and enhance the reliability of the data produced. They were asked to provide a response indicating their performance and conditions of learning in the workshop sessions, on the basis of a Likert scale from 1 to 5; 1(Not at all), 2 (to a small extent), 3 (to a moderate extent), 4 (to a large extent) and 5 (to a great extent). The mean scores of the students' answers in the three self-evaluation checklists are presented on Table 1.

Table 1. Average results of the students' self-evaluation checklists

	Checklist 1 September- November	Checklist 2 December- February	Checklist 3 March- May
1. I understand the teacher's instructions in class.	2.4	3.2	4.7
2. I use English as much as possible when I want to express my intentions in class.	1.9	2.8	4.2
3. I am willing to use written language in my projects.	1.8	2.4	4.3
4. I find the projects in the workshop appealing.	3	4.4	5
5. I can cooperate harmoniously with my classmates.	2.8	3.9	4.8
6. I feel confident enough to express my opinion in front of everyone at the workshop.	1.6	3	4.6
7. I learn interesting things at the workshop useful for my life as a global citizen.	2.8	3.7	4.7
8. I feel the workshop has nothing to give me.	3.1	2	1
9. I feel too tired during the-two-hour lesson.	3.2	2	1.4
10. Keeping a record of my work helps me understand the best strategies to follow.	1.8	3.7	4.6

The mean scores highlight the positive impact of the adopted approach in the EFL workshop as the students' mean scores reveal their perceptions concerning their considerable improvement in terms of the aspects presented in the self-assessment checklist. It is interesting that the scores recorded at the end of the first trimester improved significantly at the end of the second trimester, and even more at the end of the third one, indicating the efficiency of the approach to fulfill its goals.

4. Reflection on the holistic impact of alternative assessment

The teacher decided to create an eco-friendly, digital portfolio in order to overcome issues of utility and practicality (Lo, 2010), and avoid the paper load and the cost of buying the necessary materials for a paper one (Barrett & Knezek, 2003; Birgin & Baki, 2007; Mullen, et al., 2005). Following the process previously described (see section 3.5), the students managed to build 21st century skills (Schulz, 2008), which no pen and paper test could equip them with (Yin, 2013). This eco-friendly and technologically advanced testing tool enabled them to view a different perspective of learning, appealing to their age, needs, and preferences. The ingredient of technology grabbed their attention (Eynon & Gambino, 2018); the fact that both their learning and assessment were incorporated in it, helped to create coherence and continuity in this process (Huerta-Macias, 1995), purging it from all their previous assessment experiences related to failure.

Their weekly active involvement gave the students the time needed to reflect on their progress and make the appropriate connection between previous knowledge and materials currently taught (Britten, 2003). What emerged through the students' self-reflection was that they were encouraged to reset their learning goals by carefully monitoring their own progress and observing their way of learning (Nunes, 2004; Reinders & Cotterall, 2001; Yin, 2013). Hence, learning was made visible, and the students became aware that the assessment outcome was the result of their work (Aliweh, 2011; Kohonen, 2000). This element strengthened their self-awareness and self-monitoring abilities, since they were given the chance to review and reflect on their accomplishments (Little, 2007), which were further enhanced by the three self-evaluation checklists devised upon the completion of each trimester (see section 3.8).

The use of the e-portfolio as an assessment tool led to learning to use the target language in a real-life context, assessing the learners on the basis of what they know, and need to do in real-life situations (Lynch, 2001; Love & Cooper). Besides, it provided all the learners with equal opportunities to succeed (Darling-Hammond, 1995), it supported their motivation to achieve their goals (Burner, 2014; Yin, 2013; Ziegler & Moeller, 2012), and appreciated their effort to learn, along with their creativity (Gomes & Mendes, 2007). In addition, the e-portfolio proved advantageous concerning the emotional growth and self-confidence of the learners providing non-judgmental assessment, which is based on the principles of respect towards diversity of learning as well as the transmission of significant life skills in each student, which are regarded as essential for the shaping of a well-rounded personality (Bell, 2010; Little, 2009). Through their active participation in the assessment process, the learners noticed their step-by-step progress and reflected on it, week after week, until they eventually reached their end-product. In doing so, the students learnt to embrace their different way of perceiving reality, mainly in a right-brained fashion, and understood the extent of their potential, since their self-acceptance and self-respect were reinforced.

In contrast to the features of traditional testing, which tend to block the students' concentration and

comprehension (Shohamy, 2014), portfolio assessment released their creativity, and provided the appropriate conditions for learning not just mere testing, as the Aristotelian educational paradigm indicates. By taking into account the low-self-esteem the students used to have before being involved in this program of cognitive, meta-cognitive, and limbic-brain system empowerment, their multi-level transformation was considerable, and worth mentioning. Not only did they manage to break all the stereotypes previously reigning in their mind and heart by eliminating the stigma of dyslexia, and other learning differences, but also, they modified their mindset towards learning (Durlak et al., 2011; Nichols & John, 2009).

Their progress is more than obvious in comparison to their entry level, as evidenced by the data of the students' own responses in the three self-assessment checklists, which were delivered one every three months (Table 1). By self-evaluating their work, the students managed to have a clear picture of their performance (Ziegler & Moeller, 2012) in a number of fields, such as cooperation with their classmates, creativity, a combination of synthetic, and analytical thinking, unimpeded use of the target language, development of self-confidence, and emotional growth. The holistic impact of alternative assessment on the learning progress is further evidenced by the data from the teacher's observation diaries, which provided a detailed record for the achievement of each student, and was translated into four line graphs depicting the average group progress throughout the academic year, in relation to specific descriptors of the CEFR (see section 3.7).

The students managed to make use of the feedback they got from the teacher while utilizing constructively the conclusions drawn from their self-evaluation. In their first projects, they did not use to apply the principles of self-monitoring and no strategy of 'learning how to learn' was implemented (Bellanca & Brandt, 2010). Nevertheless, they gradually understood what could make them more efficient in terms of communication strategies while the techniques they employed improved as well (see section 3.7, Figure 1). Their presentation skills were enhanced by watching themselves on videos, and their written language and listening skills were strengthened (see section 3.7, Figures 2-4). They, also, practiced applying design thinking elements in inventing solutions to real-life problems (English & Kitsantas, 2013; Koh et al., 2015). What at first, was considered as too hard to accomplish, finally, was manageable and feasible. The portfolio as an assessment tool acted beneficially upon the students' mindset since it unblocked their motivation and gave prominence to their strong potential (Huerta-Macias, 1995). Once this happened, the students devised their own successful practices for acquiring knowledge and skills, which can be effectively transferable to various learning environments (Cambridge, 2010). The learners started considering the English lessons as the means to their goals-fulfillment, instead of a hindrance; the factors of learning commitment and ownership strengthened those learners' positive feelings towards the target language (Libbey, 2004).

By presenting their e-portfolios, the students felt proud of their hard work while demonstrating the perfect proof of their constant progress in comparison to previous years. Such feeling of ownership (Hung & Huang, 2012) added to the learner's self-confidence, self-love, and self-acceptance enhancement, which contributed to creating the ideal conditions of self-growth and evolution (Chen et al., 2008; Dörnyei & Schmidt, 2001). They were proud of their hard work and enjoyed their opportunity to prove their value to their teacher and family in a practical way. Their sense of accomplishment derived from the freedom they experienced to include and showcase the artifacts which represented their best moments (Bender, 2012).

In consideration of all the above, e-portfolio can be efficiently employed as an alternative assessment tool

in the EFL classroom, overcoming the adverse attitude of potential stakeholders concerning its supposed drawbacks or limitations, which can be transformed into advantages and success stories, enhancing its usefulness and multiplying its learning benefits for students with learning differences.

5. Conclusion

The e-portfolio provided the learners with holistic learning conditions to succeed and further develop their language competence, strategies, and skills in the target language, in line with the set objective, to reach A2 level according to the CEFR (Council of Europe, 2002) while boosting their learning curves. In addition, by catering for the students' needs holistically, they benefitted in terms of enhancing their emotional growth as well. Concluding, the implementation of the e-portfolio was efficient in promoting the learners' cognition, metacognition, and self-regulation strategies, which identifies it as a valuable tool that has earned its place in the EFL classroom, serving the needs of students with learning differences. After all, it should not be ignored, that the most brilliant and intelligent students do not shine in standardized tests because they do not have standardized minds (Ravitch, 2001).

6. Limitations of the study & suggestions for further research

The primary limitation of the study can be regarded the limited number of participants. The same study should be repeated with a larger group of students in order obtain a larger amount of data that would allow generalizability of the results. What is more, the case study took place in an English Art Workshop in a private educational organization, so it would be interesting to investigate the impact of the implementation of an e-portfolio in a public school or other context to gain further insights into the matter. Besides, e-portfolio can be used as an assessment tool to investigate further aspects of students' learning gains in terms of skills and strategies. On the same line, a longitudinal study could be initiated to explore long-term achievement factors of implementing e-portfolio.

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Appendices

Appendix 1



Beyond Orthodox Approaches to Education Reform: Innovative Strategies for Accelerating Education for All in The Republic of South Sudan

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INTRODUCTION AND BASIC ARGUMENTS

Introduction

This paper looks at how the Republic of South Sudan (RSS) can accelerate the catch up in education by adopting disruptive innovations to implement its well-articulated educational plan modeled on EFA, MDG and SDG. The main argument of the paper is that the prevailing orthodox education strategies and tools currently being utilized will take long to provide all children with good quality education. These work well enough in stable environments, but is ill equipped to deal with fragile and volatile environments. RSS presents a continuous conflict environment full of complex and adaptive challenges with a very new and weak state. RSS has to think out of the box or even no box to fashion out implementation strategies that will deliver her citizens with the education dividend that they have been historically denied of.

Everything in RSS is new. The educational challenges presented by the new country demand innovative approaches to (a) building state capability (b) building partnership (c) expanding tools for delivery of educational services and (d) providing measures for quality control. RSS must challenge itself to imagine innovative paths to delivery of education, which diverge from business as usual and attempt to create things that are sustainable. This calls for 'thinking out of the box'.

To its credit, the government and peoples of the RSS has put in place an education strategy that holds out the promise of a better future. However, it lacks the capacity (financial, technical and institutional) to overcome the vast backlog in education provision. The challenges confronting RSS, cannot be overstated. Deprived during the successive colonial periods by Turkey, Egypt and Britain, recovering from Africa's longest and most devastating civil war, building the foundations for good governance that will coordinate the delivery of social services generally and education in particular will require many years of innovative out of the box thinking and commitment to delivery of services.

Some Basic Arguments

One, the current status of education in RSS cannot be isolated from the long history of political vulnerability and exclusion that has been experienced by the people of Southern Sudan during (a) Turkish/Egyptian era; (b) Anglo-Egyptian era; (c) Northern Sudanese era (internal colonialism)'.

Two, empirical evidence suggests a concentration of civil wars in countries with little education like RSS. Conversely, in a country with a higher proportion of its youth in school, the risk of conflict is significantly reduced (Collier, 2000). The lack of formal education opportunities constitutes a structural source of relapse to conflict in RSS.

HISTORICAL ANTECEDENTS OF EDUCATION DEVELOPMENT IN RSS.

Historically, Sudan was once a center of a flourishing indigenous civilization in which the following kingdoms – Nubia, Kush and Funj. In fact, the ancient Sudan civilization pre-dates Pharaonic Egypt and the rise of Christianity and Islam (Deng, 1995). The early civilization successes, plus its geographical location made the area very attractive to external contacts and invasions. The peoples making up the current RSS have heard a long history of conquest, colonialism (internal and external), giving rise to political vulnerability and exclusion in which education was increasingly used as an instrument for perpetual domination. These are illustrated in the following policies and epoch below.

The Colonial Policies on Education

Sudan went through two main colonial experiences: (i) The Ottoman-Egyptian (1821-1885) and (ii) Anglo-Egyptian (1899-1955). During the Ottoman period, very little in education was done. The focus was on slave trade and pillaging of the resources of Sudan. The semblance of nation building and modernization was only witnessed during the Anglo-Egyptian Condominium. The concept of condominium in international law refers to a joint dominion over a certain territory by two or more states, which jointly exercise their sovereignty over it.

Trying to control half of the world at the time, the British did not have the force to occupy Sudan. Like in other colonies across Africa, they had to institute the "divide-and-rule" policy in Sudan. They had two separate policies for the north and south. While the northern policy encouraged modernization through Islamization; the southern policy sought to strengthen the indigenous cultures and beliefs and divided the south into informal chiefdoms. The "divide-and-rule" policy separated southern Sudanese provinces from the rest of the country and slowed down their economic and social development. At the same time, the British heavily invested in the Arab north, modernizing and liberalizing political and economic institutions and improving social, educational, and health services (Metz, 1992; O'Ballance, 2000); while doing relatively nothing in the south

The implementation of the two separate policies for the north and south did set the stage for political vulnerability and exclusion of Southern Sudanese from the institutions of modernization including education. By denying the peoples of Southern Sudan access to modern education, it could be argued that the British imperial government, and later the ruling northern elites, used education as a tool for the perpetuation of socio-economic and political marginalization of both rural communities and Southern Sudan in particular. Within the framework of the 'southern policy', the British colonial authorities put in

place a 'language policy' that allowed vernacular languages to be taught in primary schools and English was designated as official language, while Arabic was excluded from schools and government offices in southern Sudan. These policies, it is important to note enabled the south to develop a sense of identity based on indigenous culture and Christian cultural norms.

The problem with the British policies was that they did not foster economic and social development in the south. The British officials blocked government and private development efforts in the south. The limited number of Missionary schools did not meet the education needs in the south. The consequence of the two separate policies was the creation and widening of the inequities between the north and south. In the 1940's South Sudan's educational infrastructure was comprised of a number of missionary schools, few elementary government schools, one teacher training center, one commercial school and one senior secondary school (Deng, 2006).

At the end of World War II, the unity of Sudan took greater impetus, due to pressure from Egypt, causing the British to address the need to accelerate economic and educational development so as to reduce the regional inequity in education and development (Deng, 1995). The policy response was for the government of Sudan to in 1957 to take over mission schools in South Sudan, and in 1962 expelled Christian Missionaries from the south for allegedly inciting South Sudanese against Arabization and Islamization of schools. The expulsion of the Missionaries from South Sudan wiped out the little educational services being provided and further curtailed their access to schooling and consequently generated negative externalities for Southerners.

During the four years preceding Sudan's independence, less than 8% of children in the South were in school, while the share of girls was almost zero, compared to 20% of the girls in the North who were enrolled in primary education.

Post-Independence Policies of Sudan

At independence (1956), the British merely handed over southern Sudan to the new northern colonial power. This marked the era of internal colonialism which in most cases is worse than external colonialism. The period of internal colonialism was marked (a) promotion of Islamic ideology by the government dominated by northern elites and (b) resistance by the oppressed south. It could be argued that the policy of Islamization contributed to the agitation for Southern independence with the aim of establishing a more equitable and inclusive society. Two different education policies increasingly guided the development of Sudan -Islamic education policy by the north versus a secular educational policy by the south

Islamic Education Policy by the North

The northern elites and the Sudan central government effectively continued the promotion of Islam through educational processes. Guided by the ideology of Arabo-Islamism, the educational system was used to undermine the religious and cultural diversity of Sudan. Some of the educational policies pursued to further Islamization of the country include: (i) Replacement of English with Arabic as the language of instruction leading to intense widening of the gap between north and south; (ii) Rewriting the history of Sudan with the aim of erasing of the South Sudanese indigenous history (Deng, 2006).

The Northern education policy orientation was based on Islamic values. The thrust of the education policy can be summed up as follows: the use of one national curriculum throughout the education system; the use of Arabic as the sole medium of instruction, with English taught as a subject; the full control by the government over all schools in the country; and the consolidation of region and religiosity in, and through the educational system (Kenyi, 1966, p.15). The policy was for the educational thought to be grounded in the Quran. The Quran was to lay the foundation for education aims and principles.

Southern Resistance and Formulation of Secular Education Policy

Southern resistance to Northern domination became pronounced with the civil war. The civil war in Sudan between the North and the South lasted, with certain intermissions (e.g., the cease-fire between 1972 and 1983), from 1955 to 2005. The resistance by different Southern Sudanese liberation movements against the various Khartoum regimes was due to what was perceived as oppressive policies against the South. Educational policies were found to be very critical. Within this period, the North wanted to further its political interests of subjugating the South using education as instrument of subjugation. The South resisted by using education as an instrument of liberation. The conflict between the educational policies and aspirations of the North and the South could not be reconciled or resolved. During the war, the SPLM/A fiercely resisted the imposition of an Islamist ideology in the education system. The Secretariat of Education (SPLM's Ministry of Education) introduced a more, modernist education policy in the liberated areas in the South. A much-detailed description of SPLM's education policy is made below. It is important to note that South Sudanese communities supported primary schools during the war. However, the longevity of the conflict made the running of these schools very difficult (Nicol, 2002). Suffice to say that the education system in the South was secular, Western and modernist in nature. It was initially based on the curricula and textbooks from Uganda, Kenya and Ethiopia, but gradually, a South Sudanese curriculum was introduced. The development of a modernist, Western educational discourse contributed to a strengthening of the division/conflict between the South and the North since it contradicted the non-secular, Islamist policies and practices of the North.

Within this period, the long-standing inequalities in education between the north and south persisted (Deng, 2002). The south ravaged by long periods of civil war, failed to receive adequate resources transfer from central government, and the average realized budget for the southern regional government during this period barely covered 20 percent of the planned budget (Deng, 2003). As a result of inadequate resourcing, social and economic services particularly access to education deteriorated in the south relative to the north. With a population of 20 million during the inter-war period, the primary school enrolment rate was about 40 percent in the north but less than 12 percent in the south.

The civil wars and the government neglect of the south gave rise some international development humanitarian assistance. In 1989, a UN/NGOs consortium known as Operation Lifeline Sudan (OLS) was formed (Deng, 2003). This provided the framework of a tripartite agreement between the SPLM, the GOS and the UN that would ensure the flow of humanitarian assistance to the needy civilians wherever they are. The OLS emergency education program in southern Sudan started in 1993 to support community initiatives to rebuild southern Sudan's education system (UNICEF/OLS, 2002). Despite limited resources and absence

of policy guidance and central organization authority in the 1990's the local communities with support from OLS and NGOs managed to open their own primary schools across some areas in southern Sudan.

SPLM Education Policy

In 2002, SPLM came up with Education Policy documents, which clearly spelt out the mission, national goals, guiding principles and implementation strategies. The SPLM education policy had three main policy goals: (i) With respect to UPE, education shall be the right of every child regardless of ethnicity, culture, gender, religion and social economic status; (ii) On Adult Literacy, education shall be accessible to any citizen of the New Sudan; and (iii) On Gender Equality, emphasis shall be placed on girls' education in order to achieve equality in education (SPLM, 2002). The thrust of these policy goals was to make education by intent inclusive. This undoubtedly supplanted the old exclusive education policy that contributed to the causation of the recurrent conflicts in Sudan.

EDUCATION DEVELOPMENT UNDER THE GOVERNMENT OF SOUTH SUDAN

The Government of the Republic of South Sudan (GRSS), created with the signing of the Comprehensive Peace Agreement in 2005 and established as a nation in July 2011, inherited none of the institutions associated with a modern state (Brown 2012). Given the long history of marginalization and exclusion, it is understandable why its human development indicators are among the worst in the world. The human capital and physical infrastructure are limited. Insecurity remains a major challenge. However, independence unleashed a wave of hope, and expectation in which education has been correctly identified as a crucial dividend of independence. There is no question that more than any sector, education has the potential to deliver a large and highly visible peace dividend.

The peace settlement in 2005, ushered in good progress in education and other social services. Between 2005 and 2009, the number of children enrolled in primary school doubled, from 0.7 million to 1.4 million and enrollment levels in secondary education increased significantly (Brown, 2012). These achievements reflect the strong drive of parents to get their children into school. The key challenge is how South Sudan can adequately meet up with parental and community demand for education. Supply is a challenge. In many other African countries demand of education seems to be an issue

Main Challenges of Education Development in RSS

Given the global frameworks of EFA, MDGs, and SDGs, the Republic of South Sudan has daunting educational challenges.

One, is provision of access to school for a whole generation of primary school children, many of whom are currently out of school. South Sudan is a young country not just by virtue of its recent independence, but also in terms of its age profile. One third of its population is aged between 5 and 16 years old.

Two, is improvement of quality of education and learning outcomes. This is complex and not unique to South Sudan. Most countries globally are wrestling with this problem. Education outcomes reflect the

combined effects of household poverty, untrained and unsupported teaching staff and limited access to learning materials.

Three, is gender equity in the provision of education. South Sudan's girls face a triple disadvantage. The girls in most cases are: the last in; the first out; and the least likely to make it to secondary school.

Current Threats to Education Development

Education in RSS has for long been constrained by the following factors

One, is violence and armed conflict. Frequent occurrence of civil warfare and violence have increasingly devastated the educational prospects in RSS through school closures due to general insecurity, destruction and occupation of school facilities by armed soldiers, and kidnapping of young boys to be used as soldiers. Two, cost and distance have mostly been reported as constraining factors for children's' access to schooling though GRSS has a policy of free basic education. However, parents face indirect costs associated with the purchase of uniforms and books. Distance is especially problematic in states, -such as Western Bar Ghazal, Western Equatorial and Jonglei -with low population densities.

Three, is poverty and hunger. These are great obstacles to schooling in RSS. Evidence from many countries has shown that maternal malnutrition and micro-nutrient deficiency, coupled with malnutrition in early childhood has devastating and largely irreversible consequences for cognitive development and learning achievement.

Four, is the low quality of the teaching force. Most of the teachers do not have the requisite qualification to teach. This is compounded by the shortage of professional staff to (a) train teachers (b) develop a cadre of education professionals and (c) build national/regional center of excellence. The South Sudanese diaspora that is highly educated can play a major role here.

Five, is shortages of learning infrastructure. These include: (a) classroom shortages; (b) shortage of toilets and safe drinking water; (c) short supply of textbooks and learning materials.

SUGGESTED INNOVATIVE OUT OF THE BOX IMPLEMENTATION STRATEGIES

The Government of RSS in collaboration with the Development Agencies has successfully put in place sufficient education policies, which provide the framework for giving all Sudanese basic education. The Education Act of 2012 includes the provision for: two years of pre-primary school, eighth years of compulsory, free primary education, four years of secondary school -both academic, technical and vocational education, provision of the alternative education system including basic adult education programs, promotion of gender equity through all levels of education, and a set of standards for quality education. It could be argued that South Sudan's education policies and plans are coherent with the global planning template. The main issue is the mechanisms and capacity to deliver the promises

The RSS is a country that should be in a hurry with respect to the provision of education. It has complex challenges of establishing democratic institutions, fighting corruption and upholding the rule of law with the coordination of a weak state. To accelerate the provision of education to all citizens will demand innovative approaches. South Sudan's government and its citizens must challenge themselves to imagine

out of the box paths to education provision which diverge from business as usual orthodox strategies that have trapped most African countries from succeeding in leaping frogging educational advancement.

Let's look at the institutional capacity of RSS. At independence, everything is new. Its national sovereignty is still under 10 years old. And yet as the new country struggles with corruption, insecurity and political instability, just like most countries in the continent, many things about RSS are not new. The country often seems to be falling into the same age-old traps that have beset countless other post-conflict, resource-rich developing countries such as Nigeria, DRC, Venezuela, to mention only these three. With the Comprehensive Peace Agreement (CPA) in 2005 and independence in 2011, the world's leading donors arrived in RSS, carrying with them the tools, materials and blueprints to develop the country. The education policy and plan followed this process. If you look very closely to the education policy and plan of RSS, it looks exactly like the ones of other developing countries. That should not be the case. The contexts are different. One could argue that in the formulation of the RSS education plan, South Sudanese context/s were overlooked in order to pursue the international donors preferred EFA agenda. Without any history of South Sudanese self-governance, no predecessor institutions, and starting essentially from the scratch, the temptation to transplant strategies from other areas was hard to resist. The Development Partners arrived in RSS with a pre-formulated education strategy. The education strategy looks very good on paper. But messy at implementation because of the complex challenging factors in fragile post conflict environments that has been marginalized for over centuries by the Turks, Arabs, British and Sudanese.

Most African countries after independence followed this path. They, like RSS made education a priority sector for national development and implemented endless reforms based on the education fads/or strategies popular at that time. They made some progress; but not significant enough to make the continent globally competitive (Agu, 2015). The question has always been and is still how we can prepare African children to compete very effectively with children from other continents in the twenty first century? The same question is very relevant for RSS. We argue in this paper that Technology can be of enormous benefit in the quest for African generally and RSS in particular to prepare the children for the twenty first century skills. African educators should always keep this question at the back of their minds: what year are they preparing the students for? 1950? 2020? Or 2030? Are we preparing them for yesterday, today or for the future? Dewey was right in asserting that "if we teach today's students as we taught yesterday's we rob them of tomorrow" (Dewey, 1944: 167). The same was also differently said by the renowned Bangladesh Rabindranath Tagore: "Don't limit a child to your own learning, for he was born in another time" (cited by Khan, 2012: vii). The RSS children should be given the education that will enable them function in the future.

Moving forward since RSS has adopted the educational policy developed; there is a need to look at creative/innovative strategies for delivery. As the world's newest country, RSS offers an opportunity to try new things in education delivery. Moreover, new technologies offer hope for more effective ways of teaching and learning. Technology when deployed fully in the education process in RSS has the power to make education far more portable, flexible and personal to foster initiative and individual responsibility. It is important to note that today's RSS child lives in a technological era in which cell phones, Internet and Google and Text Messaging are normal. Technologies have made it possible for almost everyone in particular children to know things very easily. Technology is fast redefining the land scape of education

and what will eventually be the important future life-skills. The core life-skills will include: (a) creativity and innovation; (b) critical thinking and problem solving; (c) communication; (d) information management; (e) effective use of technology; (f) lifelong learning; (g) initiative and entrepreneurialism.

Some of the technological innovative ways that can be used to increase access to quality education will include:

Provision of One Laptop per child computer (OLPC)

Educators in the 21st century are increasingly realizing that students entering the classroom today are much different from those who have come before. Today's students are demanding a change in the classroom because of their ability to gather information faster than any previous generation (Sheskey, 2010). Understanding the concept of the *digital native* and the *digital immigrant* (Prensky, 2005/2006) will help us understand the modern student's engagement with technology. The famous "One Laptop per Child" project, (OLPC) by Nicholas Negroponte of MIT Media Lab which is bringing inexpensive laptops to disadvantaged students around the globe is an innovation that puts the challenge and opportunities of learning in the hands of students. It enables the students to be engaged in the searching process

The objective of OLPC in RSS is to build and supply a low-cost lap top computer for children and young people in the country. The main argument is that engaging students with tools that they use outside of the classroom everyday will help teachers make strong connections. The OLPC initiative has latterly found itself continuing to be one of the most substantial –and certainly most visible –global educational technology projects of recent times (Selwyn, 2013). The program is fast being adopted in many countries and lauded as an example of innovative international development –to the point of calls "for the OLPC program to be designated by the UN as a new Millennium Development Goal". (Tabb, 2008: P.337) According to the CEO of Google, Eric Schmidt: "Search is so highly personal that searching is empowering for humans like nothing else; it is about self-empowerment; it is antithesis of being told or taught". It is empowering individuals to do what they think best with the information they want.....Search is the ultimate expression of the power of the individual; using a computer, looking at the world, and finding exactly what they want, everyone is different when it comes to that (Friedman, 2005, p.156).

Advanced Academics in Brick Town District of Oklahoma USA

The school in a small renovated warehouse in Brick Town District, provides public education over the internet to students in 29 states, 140 school districts and seven virtual schools from California to New Jersey and Alaska to Texas (Moe and Chubb, 2009). Sixty thousand high school students took courses there during the 2006-07 school year. The warehouse is home to a top-notch team of technologists. They create the platform on which courses are delivered, tests administered and scored, and grades reported to state and local school systems. The warehouse is also home to about thirty teachers in all. Every course is supported by a teacher who is fully certified.

The teachers instruct their students as they work through digital lessons or complete assignments. Some of the instructions come through written "instant messages"; some occur via white-board correspondence, with both teacher and student sketching ideas on the same electronic surface; some involve internet phone

calls. The teachers typically support four to five students at a time from their computers, providing a level of individual attention they could never offer to a regular high school class.

Teachers like the informal atmosphere of the warehouse, where they easily interact all day long, sharing student challenges, and brainstorming strategies. They enjoy the flexible hours. They can choose from a variety of hours, as students take their online courses around the clock, day and night.

The Khan Academy

The Khan Academy is a non-profit educational website created in 2006 by educator Salman Khan, a graduate of MIT and Harvard Business School (Paul, 2013: 110). The stated mission is to provide “a free world-class education for anyone anywhere.” (Khan, 2012: 7).

The website supplies a free online collection of more than 4,000 micro lectures via video tutorials stored on YouTube teaching Mathematics, history, healthcare, medicine, finance, physics, chemistry, biology, astronomy, economics, cosmology, organic chemistry, American civics, art history, macroeconomics, and computer science. Khan Academy has delivered over 240 million lessons; it is now the premier teaching site on the Web.(Paul, 2013). The Khan Academy which started with one student –Nadia –the cousin of Salman Khan now is helping to educate more than six million unique students per month. The videos had been viewed over 140 million times and students had done nearly half a billion exercises through the software (Khan, 2012).

Innovative School Access Program (SAP) in Nigeria

Nigeria historically has been offering free primary education for the past half a century (Agu, 1986). But the country’s education system has not been able to provide access to good quality education to all school-aged children. Only 44 percent of children in grades 7-12 attended school in the years 2007-2011. To address these challenges, Intel Education created the comprehensive School Access Program (SAP) education solution, which facilitates learning through modern digital technology.

SAP’s objective is to entrench the use of ICT as a tool for teaching and learning, and to serve as a model for future programs that will also use technology to advance education within the country. The five main components of the program are:

1. Strengthening the technological infrastructure with supply of PCs and related hardware, as well as internet connectivity.
2. Enhancing schools ICT readiness through refurbishing classrooms and deploying technology infrastructure including electricity and other sources of energy.
3. Creating relevant integrated software with local education content using e-learning solutions as well as sample lesson plans from Intel.
4. Professional development of teachers through a five-day training period.
5. Training and support for suppliers and engineers to ensure proper delivery, installation, and ongoing maintenance.

Intel first piloted SAP in a single Nigerian government school in 2007. The lessons learned from the pilot were used to guide the national rollout, which has reached 3,000 schools in 2013. An assessment of the impact of SAP in 2012 showed positive outcomes on students and teachers. One of the most significant

improvements seen in the schools was a rise in Senior Certificate Examination scores in English and Physical Sciences (Takang, 2012). The study also found that SAP program had strong impact on schools: (a) half the schools made additional investments in Intel Education Solution (b) outside of class, 74 percent of teachers use the Intel Education Solution for research and (c) teachers expressed confidence in their ability to use the Intel Education Solution.

Mexico,' Television Assisted Telesecundaria Programme

Telesecundaria was designed to meet the educational needs of hard to reach rural areas in Mexico, mostly communities of under 2,500 inhabitants. The main characteristics of Telesecundaria have always been: (a) using television to carry most of the teaching load, and; (b) using one teacher to cover all subjects, rather than the subject matter specialists used in general secondary schools. At first it was offered in a few states (there are 31 plus the national capital), with a little over 6000 students. In 2000, the program was available at 13,851 locations nationwide, and served over 1,043,000 students and employed over 46,000 teachers. Educational television has been the mainstay of the program throughout the years of operation. However, the mode of use of television has gone through three evolutions. The first stage, involved a regular teacher delivering lectures through a television set installed in classrooms. Books and workbooks were provided to follow television program with exercises, revisions, applications and formative evaluations. The second generation improved on this process and created programs with greater variety. The third stage/generation, which began in 1995, deployed a satellite to beam the program throughout the country and used a wider range of delivery styles. Telesecundaria is now an integrated and comprehensive program providing a complete package of distance and in-person support to students and teachers. Telesecundaria has proved to be cost effective. The flow rates of Telesecundaria are found to be better than those of general secondary schools.

Interactive Radio Programme For Pastoralists in Nigeria

The nomadic population in Nigeria accounts for 9.4 million people, out of total population of 148,980,000 including 3.1 million school age population (UNESCO, 2010). The participation of the nomads in regular national education systems used to be extremely low. Access to radio and television as information and communication tools is very high in Nigeria, especially in Northern Nigeria. Through the National Communication for Nomadic Education, Interactive Radio Programmed (IRI) was launched in 1992 to provide open and distance education to pastoral nomads (Adeosun, 2010). Using the Federal Radio Corporation of Nigeria (FRCN), Kaduna, particular hours of the day are dedicated to air participatory instructions on basic functional literacy, numeracy, health and environmental education, modern techniques of animal husbandry, and civil responsibilities.

The objectives of using the radio for nomadic education were to (a) mobilize and sensitize the nomadic pastoralists to appreciate the value of modern education (b) encourage nomads to contribute meaningfully towards the education of their children (c) motivate nomads (both men and women) to enroll in adult literacy programs (d) improve the quality of teaching and learning, particularly where performance is low and teachers are poorly trained.

The radio program is participatory, making it widely accepted by the nomads. They listen to this program which contains weekly news, interviews, discussion, music, drama etc. There are also school based IRI programs to improve quality of teaching and learning where performance is low and teachers are having challenges. As a result of the innovative strategies adopted by the Commission, there have been great improvements in the quality of curriculum content delivery, with overall improvement in the learning achievement of nomadic school children and adults. The program is successful that USAID adopted it as a strategy to improve literacy and numeracy skills of pupils in Lagos, Nasarawa and Kano states in its Community Participation for Action in the Social Sector's (COMPASS) program

CONSTRAINTS TO THE USE OF TECHNOLOGY FOR IMPROVING EDUCATION QUALITY

There is no question of the use of technology to improve the quality of education in an information age. There is almost a consensus that the use of new technologies in the classroom is essential for providing opportunities for students to learn to operate in the global information age. We will argue that countries that do not incorporate the use of new technologies in schools cannot seriously claim to be preparing their students for life in the twenty-first century. However, getting school system to adjust and change in the direction of ICT integration with schooling processes like any change has been and will be difficult. There are a lot of constraints with respect especially on the integration of ICT into teaching and learning. The constraints could be categorized into two: (a) teacher level constraints and (b) school level constraints.

Teacher Level Constraints

These constraints are capability issues and are specific to the teacher/s. They will include: (i) lack of teacher competence; (ii) lack of teacher confidence.

Lack of Teacher Competence

Many teachers especially in developing countries lack the knowledge and skills to use computers. A worldwide survey conducted by Pelgrum (2001), of nationally representative samples of schools from 26 countries, found that teachers' lack of knowledge and skills is a serious constraint to using ICT in primary and secondary schools.

Lack of Teacher Confidence

A key constraint that prevents teachers from using ICT in their teaching is lack of confidence. Lack of teachers' confidence could be as result of limitations in teachers' ICT knowledge about using ICT in the classroom of children who perhaps know more than they do.

School Level Constraints

The school-level constraints are institutional in nature including: (i) lack of time; (ii) lack of effective training; (iii) lack of accessibility; and (iv) lack of technical support.

Lack of time

Time is a big constraint for teachers as the time for schooling is already allocated. How time impacts on teachers' efficient and effective use of computers in teaching and learning depends on the stage of ICT education integration. For the school systems that have computers in schools, the issue could be the difficulty in scheduling enough computer time for classes, and the time for teachers' to explore the different internet sites, or look at various aspects of educational software. For the teachers in the school systems that are at the basic stage, the time issue could be time to learn and understand the concepts and techniques that accompany the use of technologies. Use of technology in education will require initial time allocation to understand, plan and interact with the program.

Lack of Effective Training

Lack of effective training is a constraint. The success of ICT integration in the schooling process depends on the adequacy of the training. The issue of training is certainly complex because it is important to consider several components to ensure the effectiveness of training. For the trainings to be adequate, they should include: (i) training in digital literacy; (ii) pedagogic and didactic training in how to use ICT in the classroom.

Lack of Accessibility

Inadequate access to resources in schools, including home access, is another complex factor constraining teachers from integrating new technologies into education. Inaccessibility of ICT resources could be as a result of (a) non availability of the hardware and software or other ICT materials within the school and home for a many of the developing countries and (b) poor organization of resources, inappropriate software and poor quality hardware. Accessibility of ICT resources may not guarantee its successful implementation in most African schools because of the main issue of adequate electricity supply to power the utilization of the resources.

Lack of Technical Support

One of the top barriers to ICT use in education is lack of technical assistance (Pelgrum, 2001). The new technologies have quite some naughty technical problems such as: websites not opening when needed; failing to connect to the internet; printers not printing; malfunctioning computers. These problems are constantly being faced by most organizations including the international organizations working in most African countries. Consequently, these organizations tend to employ technical computer experts to assist in solving these endless re-occurring problems. ICT integration in schooling will definitely encounter these problems. These barriers have impeded the use of ICT in schools that have been trying it and will increasingly constrain its introduction in many African countries given the state of the maintenance culture in Africa which is low. This will be compounded by the fact that teachers in Africa will definitely have to work with donated computers which in most cases will be old.

THE ROLE OF THE DIASPORA IN ACCELERATING THE EDUCATIONAL CATCH UP.

In South Sudan, the conflict between the North and South forced a great number of young people to leave their country. Some walked for hundreds of miles in an attempt to escape the violence around them. The

strongest of these made it to the neighboring countries and to USA and many European countries. These people joined the diaspora, witnessing the independence of their country from a distance. How can these South Sudanese diaspora be partners in developing the education sector?

The concept of diaspora means many things to many people. Generally, it is commonly used to indicate religious or national groups living outside their homeland. Ionescu (2006) has defined diaspora as members of ethnic and national communities, who have left, but maintains links with their homelands; this paper adopts the later definition. Belonging to a diaspora entails a consciousness of or emotional attachment to commonly claimed origins and cultural attributes (Vertovec, 2010). It is a population group that retains a material allegiance to another country from where it originated at some point in the past.

Very many diaspora organizations have emerged in the last few decades to mobilize assistance. Their emergence is perhaps nowhere more noticeable than on the internet. Websites have been set up to advertise jobs back home for emigrants. They have also organized social and economic conferences for their various groups. The RSS diaspora members like the other diasporas from the developing countries have contributed to the development of their countries in various ways, such as: transfer of financial remittances; shared human and social capital. The transfer of these from the diaspora to their countries of origin tend to make little or no impact because of issues of coordination. The agenda of the diaspora are not always consistent with the ones of the home country. For RSS, the General Education Strategic Plan 2012-2017 could serve as the basis for coordinated collaboration between diaspora and the government. One of the key areas that the diaspora has leverage on the government is on the use of technology on education development. The diaspora can look at the above models of technology driven approaches to education and see how these can be used to accelerate education in RSS.

Some RSS Experiences of Diaspora Involvement in Education

There is no question that the diaspora is needed in the reconstruction of education in RSS. In fact, the General Education Strategic Plan (2012-2017) had this to say: *“Decades of neglect and years of civil war have left the country with a shattered infrastructure, a large diaspora of some of its best talents, and generations of youth who never had the opportunity to attend school (MGEI, 2012: 13).* There are examples of Some South Sudanese diaspora involvement in the reconstruction of education. However, most of the initiatives in education by the diaspora did not succeed. The assessment of three cases: (i) supporting primary education; (ii) education and home for street children; (iii) vocational training for women and youth started after independence found the first and second case at the level of planning and fund raising, while the third case has managed to establish a Centre with the help of some Churches and NGOs and having sustainability challenges (van der Linden et al, 2013).

Diaspora involvement face very difficult challenges. One is the issue of trust. The South Sudanese diaspora and the South Sudanese living in South Sudan will look at things very differently. The agendas of both tend not to be consistent with each other. The mindsets of both the diaspora and the nationals are different. The later think that the former is just trying to take the leadership and the spoils of war from them after fighting for over 20 years. Two, coordination of diaspora activities is very difficult. Some of the activities are isolated efforts as in the cases reviewed and lack a long-term strategic vision. The General Education Strategic Plan (2012-2017) could provide the vision which hitherto was missing. Three, is accountability

of the national actors. Diasporas will find it difficult to monitor the activities from a distance. Most diasporas find it difficult to go back for obvious reasons. Diasporas getting correct feedbacks from home front could be difficult.

Mechanisms for Diaspora Engagement in Education

Guided by the General Education Strategic Plan, the following mechanisms could be utilized for effective engagement. **One**, is for top RSS professional diaspora members who have voices in education matters persuade the educational organizations, universities where they are affiliated to engage with the education development in RSS. **Two**, RSS diaspora members to use their knowledge and invest back home in some innovative strategies for education. **Third**, diaspora members to be identifying new strategies, customize them and inform home for use/and advice.

As an example, the Khan Academy can be replicated in the various communities of RSS as described below.

AN EXAMPLE OF OUT OF THE BOX THINKING FOR RSS DIASPORA.

Community Based ICT School Centers

This is based on the Khan Academy Model. The mission of the school houses could be: To provide a free, world class education for anyone, anywhere. We now live on a small planet, in a world that, as Thomas Friedman put it, is hot, flat, and crowded. Thanks to technology that has accelerated everything we can think of; including education. Whether you are talking of the nomads in Northern Nigeria, Uganda, Somali, Afar, South Sudan or the fisherman in Lake Victoria or the river Nile, one common possession is a mobile phone. They are all connected to the world; thereby making it flat. This reality enabled Salman Khan to develop a computer-based, self-paced learning.

Let's go to the cell phones that everyone in RSS (including the soldiers with AK47) own. They have changed lives everywhere; and they have positively revolutionized lives in the developing world including RSS. Given all the challenges in providing education to RSS children -poverty and malnutrition, shortage of school buildings, distance from schools, violence, shortage of textbooks, poorly trained teachers; however, reaching people possessing cell phones cuts off most of the obstacles. Good teachers with the correct logistics can engage the children in a learning process from Juba, Uganda, Kenya or even from Dallas virtually free.

How can this be done? If you think of it within the box there will be no solution. However, if you take out of the box thinking process, you will start seeing the possibilities. If you travel into rural Africa one thing they all love is Nigeria movies. How about if we use the mechanics of Nigerian movies plus the Khan Academy principle to develop community based ICT learning centres. In the most remote rural villages, there is almost someone with a first-generation DVD player and television set. We can for a start put quality lessons in Math's, English etc. into Videos for educating children in a community safe environments.

CONCLUSION: TECHNOLOGY FOR THE AFRICAN SCHOOLS OF THE FUTURE

In a very short time, the world changed; became flat and increasingly changing very fast and changing the skills that used to be important for our survival. There is no question that the socialization agencies-family, schools –should adapt very quickly to be able to cope with the new realities. With respect to schools, we argue that the methods of teaching and learning must adapt to these changes: (i) All students need skills to thrive in a global knowledge economy; (ii) In the age of the internet, using new information to solve new problems matter more than recalling old information; (iii) Today’s children and youth are differently motivated when we compare them to previous generations.

Over the next 20 years, RSS will experience huge growth in the number of young people in its society. These young people will need to be healthy and educated in order to be competitive and productive. Investment in quality education that targets the poor and hard to reach groups will be very critical in influencing the direction RSS will take. In the RSS, almost everyone believes education provides hope. But it has to be a transformative education process that equips RSS citizens with 21st century skills that will enable them to be productive citizens of the world.

In RSS, it will take many decades to improve the existing public school system to an acceptable level, if we follow the traditional orthodox school improvement model/s. As a conclusive argument and suggestion, the most relevant strategies could be to exploit the opportunities of new technologies, particularly the mobile phone, to make learning possible in new ways. In that way, RSS will be teaching today’s students for tomorrow and not yesterday (according to Dewey). This will entail RSS adopting the policy of “*Going beyond Education for All to Education Above All*” as recommended by Professor Emeritus Pai Obanya.

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Optimization and synthesis of multilayer frequency selective surfaces via bioinspired hybrid techniques

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Abstract

In this study, two bioinspired computation (BIC) techniques are discussed and applied to the project and synthesis of multilayer frequency selective surfaces (FSS) within the microwave band, specifically for C, X and Ku bands. The proposed BIC techniques consist of combining an general regression neural network to a genetic algorithm and a cuckoo search algorithm, respectively. The objective is to find the optimal values of separation between the investigated FSS. Numerical analysis of the electromagnetic properties of the

device is made possible with the finite integration method and validated through the finite element method, utilizing both softwares CST Microwave Studio and Ansys HFSS respectively. Thus, the BIC-optimized devices presents good phase / angular stability for angles 10° , 20° , 30° and 40° , as well as being polarization independent. The cutoff frequencies to control the operating frequency range of the FSS, referring to transmission coefficient in decibels (dB), were obtained at a threshold of -10dB . Numerical results denote good accordance with measured data.

Keywords: hybrid optimization methods; FSS; GRNN; MOGA; MOCS.

1. Introduction

Bioinspired computation (BIC) consists of a new computer science paradigm inspired by certain behaviors of living beings. These ideas, extracted from natural systems, is already being successfully utilized for the development of technological tools capable of solving high-complexity general problems in engineering and industry [1–2].

This theme possesses a multidisciplinary character and an abundance of applications. The growing interest of researchers within the electromagnetism community is due to BIC's adaptability, as well as its self-organization tendencies and tolerance to random defects [2–4]. Examples of widely applied, successful algorithms are the classic genetic algorithm (GA), artificial neural networks (ANN) and particle swarm optimization (PSO) [5].

With the intent of combining the main advantages of these classic algorithms researchers are proposing new meta-heuristic techniques, aiming to both accelerate project development or enhance the characteristics of projected devices such as: gain, bandwidth, antenna radiation diagrams or physical parameters for the synthesis of antennas or frequency selective surfaces (FSS). Hence, hybrid optimization solutions are developed – among which the cuckoo search (CS) algorithm proposed by Yang and Deb deserves to be highlighted [6].

By exploring the potential of these computational tools, researchers plan ANNs to work paired to optimization algorithms, thus creating the so-called hybrid methods [3, 4, 7–9]. That is, after training with numerically calculated electromagnetic (EM) data, the ANN generates a search space denominated as the region of interest (ROI), in which optimization algorithms look for the best solutions, i.e. the ones that can attend to a designated objective function (or cost function). This process allows greater flexibility and robustness to the project, warranting more precise results and, in some cases, substantially minimizing the demanded processing time for EM properties calculations. Such qualities are the main cause for the employment of these techniques in microwave applications [10].

In the states of art there is a vast literature with the most diversified projects of FSSs for application in microwaves. In [11], e.g., the authors proposed a three-layer broadband FSS for applications in that system, however, many iterations were necessary to achieve satisfactory geometric shapes in each of the three layers, and thus to achieve operation in broadband, the BIC could have helped.

In this context, the authors in [12] proposed a double-sided broadband FSS - approximately 4GHz - for operation in the X band. However, the design of the structure is too complex, due to the geometric shape

of the unit cell that resembles a fractal, the substrate of the device is made of filaments that form a metallic grid and no optimization process has been proposed to enable the optimization of the design steps.

As at [13] a wide-band frequency FSS based on double-layered hexagonal unit cell was presented. The project also requires several interactions until the desired geometric shape is achieved in each of the unit cell of the layers, making it difficult to reproduce the filter by people interested in the work, and no automatic optimization process is presented to overcome this difficulty.

The proposed geometry of the FSS presented in [14] consists of a square loop and a triangle conductor which are etched to a single layer dielectric substrate, for X and Ku bands applications. Several geometric parameters had to be adjusted in the project to achieve a satisfactory result, which can generate excessive time for the calculation of the EM properties of the device, as well as high effort because it is a trial-and-error method.

FSS can be employed, for example, to make the antenna reflector more efficient [15–20]: reducing reflections and undesirable radiations; by adjust the wave polarization and propagation, as well as bandwidth control; and allowing the simultaneous application of more than one source in the same reflector. As previously explored, although discussed works presents satisfactory results, there are some difficulties to be overcome if any person interested in the project wishes to reproduce it, either by the complexity of the geometries of the unit cells presented, or by the high number of iterations required. A viable solution would be to introduce some automatic process to obtain the desired parameters – e.g., through some computational intelligence technique or by the use of BIC optimization techniques – i.e., the trial and error method would be easily overcome, which would result in a drastic reduction in the time required for the project conclusion, as well as would avoid failures that may occur throughout the process because once the calculations of the EM properties of the device, these would feed the processing applied for data processing and the geometric parameters would be calculated according to the objectives configured in the cost function, as desired in the project.

With this in mind, two multiobjective hybrid BIC techniques are presented in this study for the design and synthesis of a of a multilayer FSS of simplified geometry unit cell and low-cost manufacturing. The objectives for the optimization process are the control of lower and upper cutoff frequencies that limit the operational bandwidth of the devices, which are in turn set to the reference threshold of –10 dB. A reduction of optimization and processing time of calculated EM data is also desired. Furthermore, after the optimization and synthesis of said FSSs, angular stability tests have been executed for angles: 10°, 20° and 30° and 40°, as well as proof of independence of incident wave polarization. It has been verified that the devices herein presented denote good angular stability and polarization independence.

This paper is structured as such: Section 2 discusses details about the design of the FSSs. Section 3 details the employed BIC techniques. In Section 4, the hybrid method proposed by the authors is further discussed. Section 5 displays the study's results and in Section 6 conclusions are discussed.

2. Patch-type FSS Design

Frequency selective frequencies (FSSs) are planar and periodical structures composed by metallic components of either slot or patch type, capable of reflecting (bandstop) or transmitting (bandpass)

electromagnetic waves in frequencies that are proximate to the device's resonance [21]. These periodic arrays behave similarly to radiofrequency circuit filters [22]. The influence exerted by physical parameters such as the substrate's depth, permittivity and isotropic behavior is observed in the bandwidth and resonance characteristics of an FSS [23, 24].

In this study the design of a double-layer FSS separated by an air gap is discussed, in which the first layer's unit cell conductors are triangular loops and the second layer ones are solid lozenges, inspired by the usage presented in [7] and [3] respectively. A schematic of the structure is displayed in Figure 1.

In computational simulations, the FSS have been considered as printed in glass epoxy substrate (FR-4), possessing relative permittivity of

3. Bioinspired Computing

Bioinspired computing (BIC) is an important tool in Computer Science, in which techniques based on Biology and behavior of living beings are then transcribed into coding. Such techniques have been successfully modeled over the years, being capable of solving complex general problems related to optimization in engineering and industry [5].

The proposed hybrid technique, applied to optimize the devices shown in this study, includes a general regression neural network (GRNN) [25] combined with the multiobjective genetic algorithm (MOGA) [8] and the multiobjective cuckoo search (MOCS) [26]. The FSSs have been designed to possess simplified and low-cost geometries, in order to obtain two bandstop filters: the first filter is applied to the X band (8 – 12 GHz) and the second one to C and Ku bands (4 – 8 GHz and 12 – 18 GHz, respectively).

The following sections present greater detail on BIC techniques developed in this paper.

Despite being remodeled in 1991 by B. Specht [25] to realize general regressions (be it linear or non-linear), the concept of a GRNN was first introduced in 1964 by Nadaraya [27] and Watson [28]. It is a type of Radial Base Neural Network (RBNN), based on non-parametric estimation and advantageous in needing only a small part of the database to conduct the network's training. Likewise, it has the capacity to rapidly converge to a satisfactory data function, making retropropagation unnecessary – also turning itself into a useful tool for system performance prediction and / or comparison [7].

Figure 2 presents the developed network's schematic.

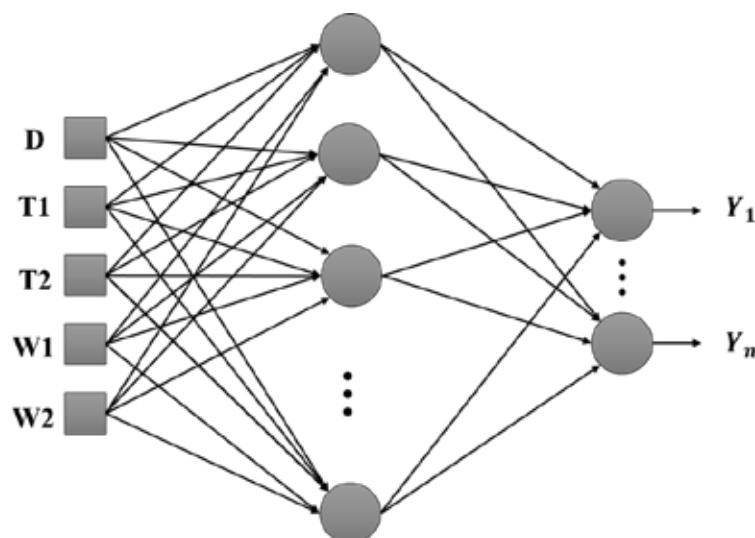


Figure 2. Configuração da GRNN utilizada.

A GRNN has been created herein carrying five inputs and two outputs, according to the specifications for the formation of the ROI. That said, the network recognizes the patterns of the samples inserted into their inputs at the moment of the training. Thus, the number of intermediate layer (also called “hidden layer”) neurons varies according to the number of data utilized at the learning phase.

The inputs and outputs of the GRNN can be represented by vectors, keeping in mind that the outputs differ according to the filter that is analyzed. Therefore, the entrances for both filters are to be represented as:

(1)

in which D is the distance between plates, T_1 is the periodicity of plate 1, T_2 is the periodicity of plate 2, W_1 is the unit cell conductor dimension on plate 1 and W_2 is the unit cell conductor dimension on plate 2. For the first filter, the output is represented by:

(2)

where LCF is the lower cutoff frequency and UCF stands for the upper cutoff frequency in filter 1.

For the second filter, the output is:

(3)

where UCF1 is the upper cutoff frequency for band 1 and LCF2 is the lower cutoff frequency for band 2 in filter 2.

Genetic algorithms (GAs) are natural selection and genetic-based search procedures, with applicability in general optimization problems and, particularly, in automatic learning. This algorithm was introduced by Holland [29] in 1975 and popularized by his pupil Goldberg [30] in 1989. They follow the principles of “survival of the fittest” and natural selectivity as declared in 1859 by the biologist and physiologist Charles Darwin in his book “The Origin of the Species”. Holland was the first researcher to utilize the concepts of selection, crossover and mutation in the study of artificial adaptive systems [29].

GAs belong to the stochastic, natural selection algorithm category [31, 32], operating with a population of candidate solutions to satisfy mono or multiobjective criteria. These solutions go through operator with the intent of keeping the populational variability and are analyzed by selections that evaluate the better-adapted individuals in a given environment – that is, the problem’s search space [33, 34].

In this work, the implemented technique is based on the non-dominated sorting genetic algorithm II (NSGA II), as it differs from its counterparts by the manner in which the fittest chromosome is selected. During the selection stage, the algorithm classifies the total population in fronts, according to the degree of dominance, and the individuals who reside in the first front are considered the best solutions of that generation, while the ones at the last front are considered the worst [35].

According to this premise, it is possible to find results that are better suited to the problem in question. Some important aspects in multiobjective problem-solving are:

- Divide the population in different levels (or fronts) with the aid of a dominance criterion;
- The i -th front individuals are better than the ones in front $i + 1$;

In this manner, the algorithm classifies the total population in different quality categories by employing a dominance criterion, permitting the prioritization of those amongst the better classified. NSGA II’s operation is peculiar for possessing two important mechanisms in the selection process, which are: 1) non-dominated sorting (NDS) and 2) crowding distance (CD).

The concept of dominance is given by P_1 and P_2 , which are considered same-population individuals, however P_1 dominates P_2 in case P_1 does not have any objectives with an inferior quality than P_2 . That way, initially, there is a non-classified population that shall go through an attribution process with a dominance degree

given to each individual in relation to all of the others in the total population. After this step, they are placed in fronts, and the best individuals are allocated in the first front, as previously said.

After going through the NDS process, the population is to be classified by the density operator, that is, the CD mechanism, aiming to order each individual in relation to its distance to other neighbor dots within the same front (for each objective). Hence, the more distant to the central dot the greater is the probability of being chosen, allowing for better scattering of results along the front and avoiding solution clustering over the same dot. The next steps are the crossover and mutation processes, which are identical to a conventional GA.

Figure 3 presents a multiobjective GA operation flowchart.

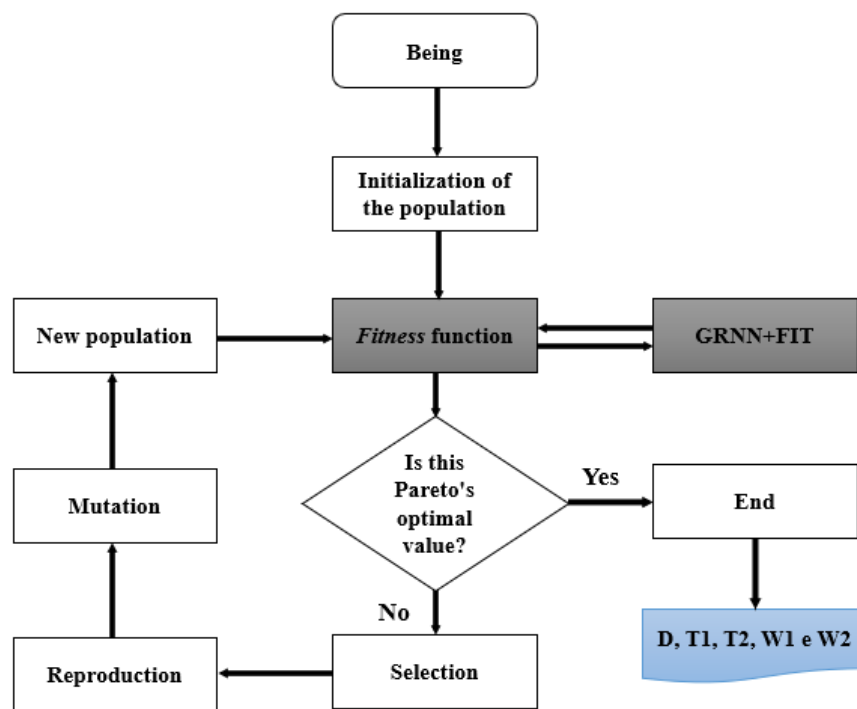


Figure 3. Operation flowchart of a multiobjective GA.

One of the most recent nature-inspired metaheuristic algorithms, the Cuckoo Search (CS) is part of the swarm intelligence algorithm group and was first proposed by Yang and Deb in 2009 [6]. Its applications aim at solving multimodal problems, and its biological inspiration is based on an interesting and aggressive characteristic of reproduction of some species of cuckoos – the so-called nest parasitism.

There are two basic types of parasitism: intraspecific nesting, cooperative reproduction and nest acquisition. Generally, cuckoos choose a nest where the host Bird has already deposited its own eggs. Given that the cuckoo's eggs hatch faster, once the parasite hatchling leaves the eggshell it instinctively throws the other eggs away from the nest, thus augmenting its participation in the quantity of nourishment provided by the host bird. In addition, some hatchlings can also imitate the call pattern of the host to gain access to feeding. Sometimes, optimization problems involve more than a single objective. Therefore, by utilizing the

multiobjective cuckoo search (MOCS) in multiple objectives, there is a need to alter the first and last rules of the original CS code in order to incorporate multiobjective operation [36]:

- Each cuckoo lays eggs at a time, putting them in a randomly chosen nest. The egg corresponds to the solution of the i -th objective;
- The best nests with high-quality eggs (solutions) are chosen to be carried on into future iterations;
- The number of available nests is constant and the host bird may discover an “alien” cuckoo egg with a probability of $p_a \in [0,1]$. In this case, the host bird can get rid of the egg or abandon the nest altogether to build another one in a new spot.

For the last rule, it is presumed that instead of a fraction of nests be abandoned, they are outright substituted by novel nests (containing new random solutions in another place within the search space).

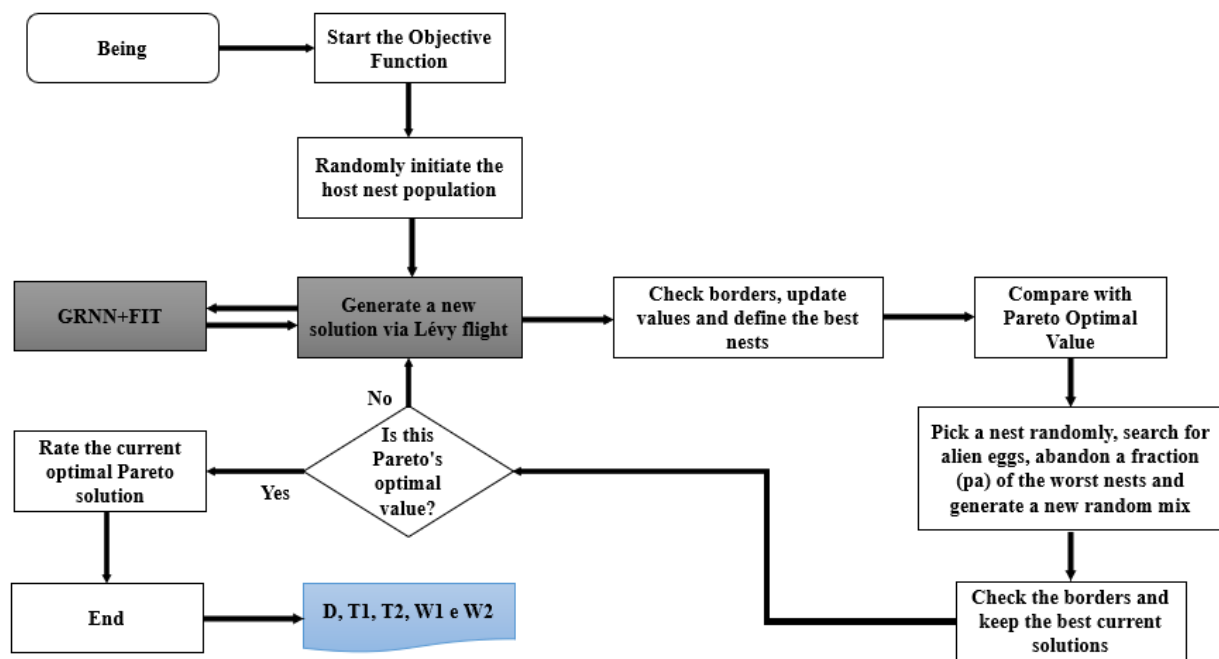


Figure 4. Multiobjective cuckoo search (MOCS) algorithm flowchart.

Figure 4 presents a flowchart covering the functioning principles of MOCS. The algorithm is composed, structurally, by two main operations. One is a direct search based on Lévy Flights [6], and the second is a random search based on the host bird's probability of finding in its nest an “alien” egg. Just as in other metaheuristic populational algorithms, MOCS utilizes population elitism in order to find an optimal solution to the outputs – in this case, each nest is considered a different solution.

4. Hybrid Optimization Technique

The objective of the implemented optimization algorithms is to minimize the cost function and synthesize the proposed filters, and can be defined as [4, 7—9]:

(4)

in which Δ and Δ_{GRNN} represent the difference between results given by the GRNN and the values

specified at the cost function.

The ideal solution is to find values that would turn the variables of the cost function into zero or very proximate to it. However, in non-convex problems, the function's values may not converge to a null figure. Therefore, a Pareto front is created containing non-dominated solutions, generating a set of solutions that are not strictly dominated in each iteration.

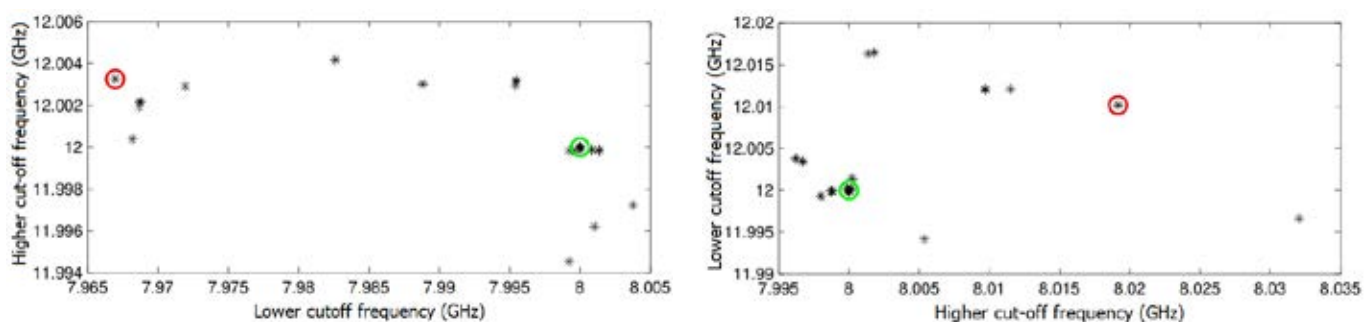
For the relation of dominance, if $e \in R$ when R is a region of viable solutions that, e.g., dominates e if e is considered partially greater or greater than e , that is:

(5)

and

(6)

In case no R exerts dominance over e , so e is assumed to be the optimal Pareto solution. Figure 5 presents the relation of dominance, for one iteration, of both filters investigated in this study. The asterisk markers are the best responses that satisfy the objectives for each filter along the Pareto front during the algorithm's execution. Furthermore, the red circular markers represent the worst (dominated) solution and the green ones denote the best solutions (non-dominated).



(a) Filter 1.

(b) Filter 2.

Figure 5. The Pareto front.

After calculations of the EM properties of the structures by the FIT complete-wave technique, by varying the structural parameters of proposed devices (see Table 1), the hybrid techniques GRNN+MOGA and GRNN+MOCS have been applied to substitute the necessity of new computation simulations and, thus, minimizing computational cost. Along the simulations, it is possible to perceive that little variations in the parameters of the FSS result in greater in the frequency response, so rendering necessary a greater refinement in parameter variation, elevating the computational costs even more.

With this impasse in mind, the optimal values localized at the Pareto front are assumed as reference points to the creation of a new dataset, utilizing a lesser step size of each of the analyzed parameters. Thus, it is possible to make mappings at the ROI only taking into consideration values that can fulfill the specified objectives for each filter – and this is purpose of the proposed optimization algorithms.

Table 2 present optimal values for both filters according to the developed hybrid techniques.

Table 2. Structural parameters for the multilayer FSS

Filter	Hybrid Technique	Parameters				
		D	T1	T2	W1	W2
1	GRNN – AG Multi	3.3804	12.8741	13.7894	9.7615	12.8668
	GRNN – MOCS	2.5	13.8160	14.3130	9.5108	13.3630
2	GRNN – AG Multi	2.5	14.7502	12.1658	13.3905	9.2197
	GRNN – MOCS	2.5719	14.1448	12.2795	13.8515	9.1425

Cutoff frequency values for the control of bandwidth have been obtained at the threshold of -10dB. Numerical validation of results has been made by FEM calculations, with the aid of software Ansoft HFSS. Percentual deviation, relative to FIT-calculated results compared to FEM-calculated ones, are defined as such:

$$\text{Dev} = \frac{|O_{\text{sim}} - O_{\text{fit}}|}{O_{\text{fit}}} \quad (7)$$

in which O_{sim} is the value of the simulation-returned objective according to optimized parameters, O_{fit} is the objective value and O_{fit} are the analyzed objectives.

Figure 6 shows fitness evolution in the sythesis process through multiobjective GA for filter 1. Along the iterations, the cost function value gradually diminishes, in which the dotted line represents the fitness average for the the cromossome population and the solid line represents the average of best individual solutions. A population of 100 cromossomes had been considered, and the number of elite cromossomes was limited to a fraction of 0.25 of the Pareto front. A total of 102 iterations and, approximately, 110.076 seconds were necessary for optimization convergence.

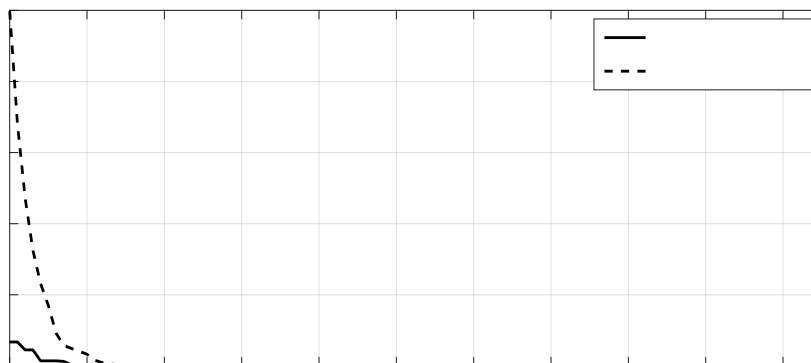


Figure 6. Fitness evolution of the multilayer FSS sythetic process for filter 1 via MOGA.

Figure 7 displays fitness evolution of the synthesis through multiobjective GA for filter 2. In this case, it has been considered a population of 75 cromossomes, and the number of elite cromossomes has also been limited to a fraction of 0.25 of the Pareto front, for a total of 322 iterations and 306.796 seconds for the code to converge.

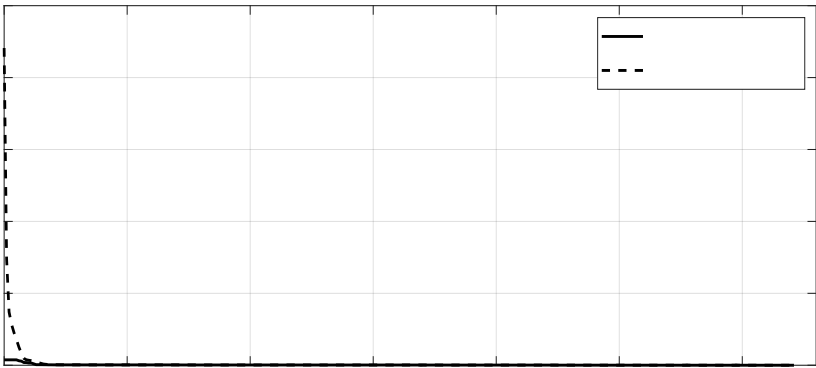


Figure 7. Fitness evolution of the multilayer FSS synthetic process for filter 2 via MOGA.

Figure 8 shows fitness evolution this time through MOCS for filter 1. A set of 100 nests and probability = 0.25 has been utilized, with scalar vector The code has converged in around 500 iterations and approximately 1181.159 seconds.

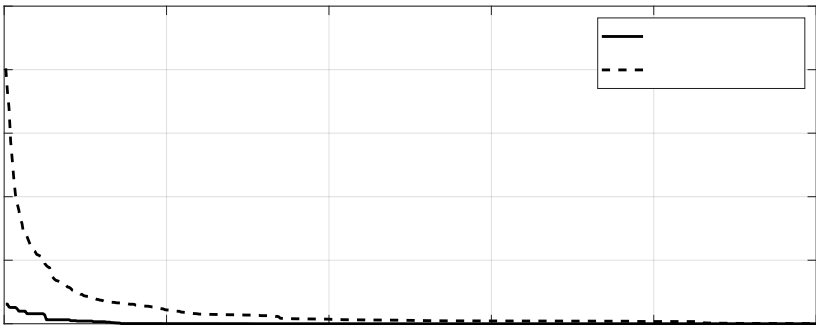


Figure 8. Fitness evolution of the multilayer FSS synthetic process for filter 1 via MOCS.

Figure 9 shows fitness evolution this time through MOCS for filter 2. A set of 100 nests and probability = 0.75 has been utilized, with scalar vector The code has converged in around 500 iterations and approximately 1198.346 seconds.

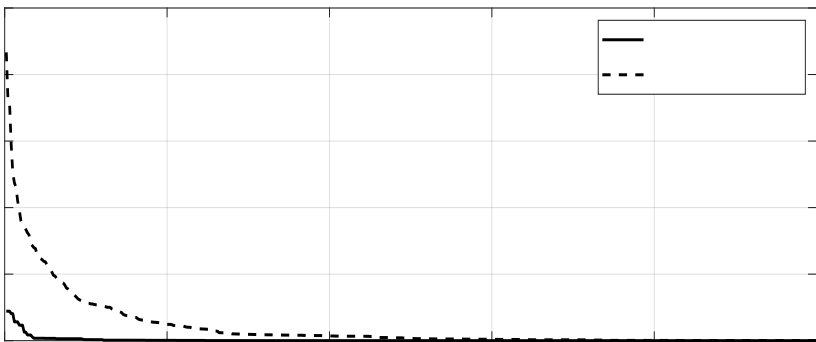


Figure 9. Fitness evolution of the multilayer FSS synthetic process for filter 2 via MOCS.

5. Results

For filter 1, the proposed GRNN contains 5 first-layer entrances, an intermediate layer containing 768 neurons and 2 exit nodes representing the lower and upper cutoff frequencies. Table 3 displays the structural parameters, as well as input data for the learning and training of the GRNN.

Table 3. Structural parameters for filter 1

Parameters	Values
Distance between plates, D (mm)	[2, 2.5, 3, 3.5]
Periodicity of plate 1, $T1 = Tx1 = Ty1$ (mm)	[12.5, 13, 13.5, 14]
Periodicity of plate 2, $T2 = Tx2 = Ty2$ (mm)	[14.5, 15, 15.5]
Conductor element dimensions on plate 1, $W1 = Wx1 = Wy1$ (mm)	[9, 9.5, 10, 10.5]
Conductor element dimensions on plate 2, $W2 = Wx2 = Wy2$ (mm)	[12.5, 13, 13.5, 14]

Figure 10 presents results for the transmission coefficient calculated via FIT and FEM utilized for result validity. The applied hybrid technique consists of a GRNN+MOGA configuration. The obtained optimal parameters are $D = 3.0682$ mm; $T1 = 13.7336$ mm; $T2 = 15.3977$ mm; $W1 = 9.92$ mm and $W2 = 13.7594$ mm.

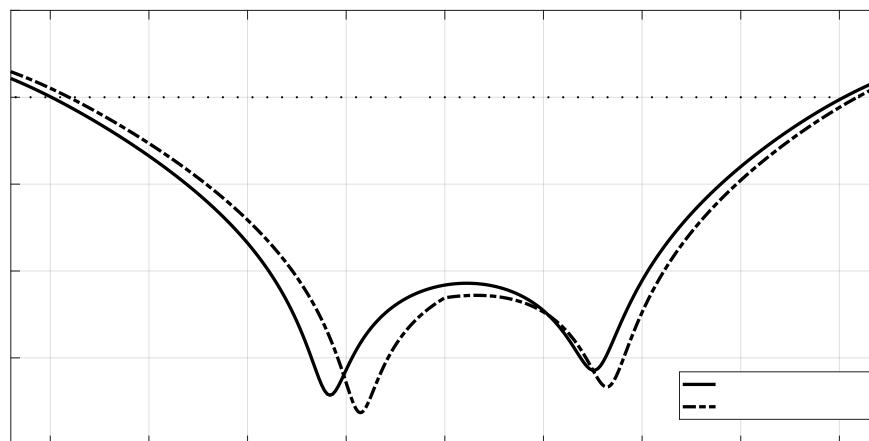


Figure 10. Transmission coefficient of the multilayer FSS for filter 1 via MOGA.

The objectives for the filter were set as 1: 1) lower cutoff frequency at 8 GHz, and 2) upper cutoff frequency at 12 GHz. With this, the frequencies belonging to the X band are rejected and the transmission of the frequencies belonging to the band C (4 - 8 GHz) is made possible, as well as the Ku band (12 -18 GHz). When analyzing the results presented in Figure 10, it is observed that the values obtained in relation to the lower cutoff frequency and the upper cutoff frequency are, respectively, 8,005 GHz and 12,023 GHz for results calculated by FIT, which represents a relative error in relation to the configured objectives in the BIC code of about 0.25%. Then, when verifying results calculated by FEM, the values obtained for the lower frequency and the upper cutoff frequency were, respectively, 8,095 GHz and 12.09 GHz, which

corresponds to a relative error of 1.94% regarding the objectives of BIC.

Figure 11 presents the results for the transmission coefficient referring to the multilayer FSS corresponding to filter 1. These results were calculated from the optimal structural parameters returned by the hybrid technique GRNN + MOCS, consisting of the following values: $D = 3.2433$ mm, $T1 = 13,893$ mm, $T2 = 15.2829$ mm, $W1 = 9.9828$ mm, and $W2 = 13.5089$ mm.

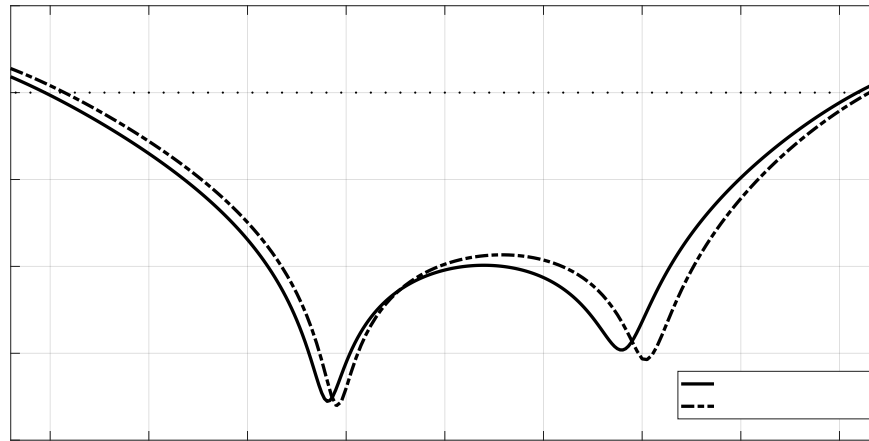


Figure 11. Transmission Coefficient for Multilayer FSS of filter 1 via MOCS.

When analyzing the results presented in Figure 11, it is observed that the values obtained in relation to the lower cutoff frequency and the upper cutoff frequency are, respectively, 7,971 GHz and 12,091 GHz for results calculated from FIT, in which represents a relative error in relation to the objectives configured in the BIC code of around 1.12%. Then, when verifying the result calculated by the FEM method, the values obtained for the lower cutoff frequency and the upper cutoff frequency were, respectively, 8,075 GHz and 12.15 GHz, which corresponds to a relative error of 2.19% in relation to the objectives of BIC.

Regarding filter 2, the developed GRNN contains 5 inputs in the first layer, an intermediate layer containing 216 neurons and two output nodes referring to the upper cutoff frequency of the first band and the lower cutoff frequency of the second band, which sets up the device as dual-band. Table 4 presents the structural parameters and values for filter 2, which were inserted unto the GRNN training and learning entries.

Table 4. Parâmetros Estruturais das FSS Multicamadas para o Filtro 2

Parâmetros	Valores
Distância entre as placas, D (mm)	[1.5, 2, 2.5, 3]
Periodicidade da placa 1, $T1 = Tx1 = Ty1$ (mm)	[14, 14.5]
Periodicidade da placa 2, $T2 = Tx2 = Ty2$ (mm)	[11.5, 12, 12.5]
Dimensões do elemento condutor da placa 1, $W1 = Wx1 = Wy1$ (mm)	[12.5, 13, 13.5]
Dimensões do elemento condutor da placa 2, $W2 = Wx2 = Wy2$ (mm)	[8.5, 9, 9.5]

Figure 12 denotes the results for the transmission coefficient calculated via FIT versus calculated via FEM. For this optimization the hybrid technique GRNN + MOGA was used, considering the multilayer FSS

referring to filter 2. The optimal structural parameters obtained were $D = 2.1068$ mm, $T1 = 14.4721$ mm, $T2 = 12.2558$ mm, $W1 = 13.1044$ mm, and $W2 = 8.9673$ mm.

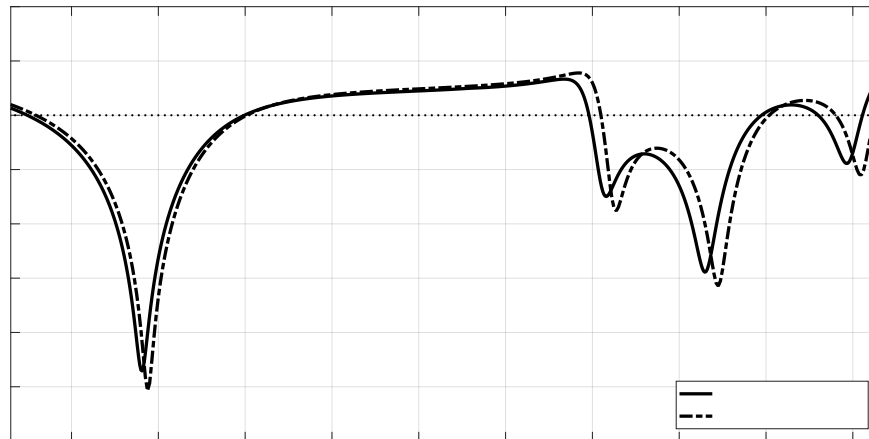


Figure 12. Transmission Coefficient for Multilayer FSS of filter 2 via MOGA.

The objectives of filter 2 are to tune the upper cutoff frequency for the first operating band at 8 GHz, and the lower cutoff frequency for the second operating band at 12 GHz. With this, the X band is transmitted and the C and Ku bands are blocked, which also characterizes the device as dual-band.

Still according to Figure 12, it is observed that the values obtained concerning the lower cutoff frequency and the upper cutoff frequency are, respectively, 7,995 GHz and 11,961 GHz for the result calculated from the FIT, which represents a relative error in relation to the objectives configured in the BIC code of about 0.39%. Then, when verifying the result calculated by FEM, the values obtained for the lower cutoff frequency and the higher cutoff frequency were, respectively, 8.02 GHz and 12.1 GHz, corresponding to a relative error of 1.08% to the objectives of BIC.

Figure 13 presents the results for the transmission coefficient calculated via FIT versus the calculated via FEM, when considering the optimal structural parameters returned by the hybrid technique GRNN + MOCS for the multilayer FSS referring to filter 2. The optimal parameters obtained were $D = 1.7845$ mm, $T1 = 14.5$ mm, $T2 = 12.3419$ mm, $W1 = 12.9119$ mm, and $W2 = 8.785$ mm.

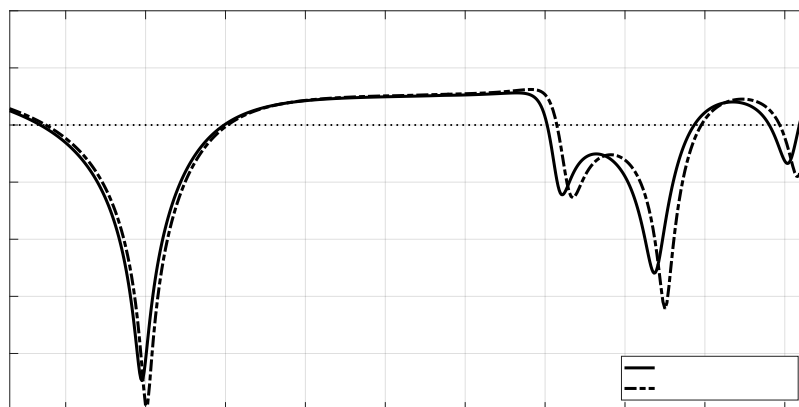
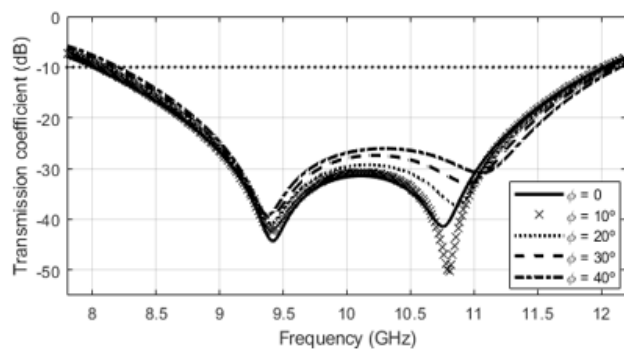


Figure 13. Transmission Coefficient for the Multilayer FSS of filter 2 via MOCS.

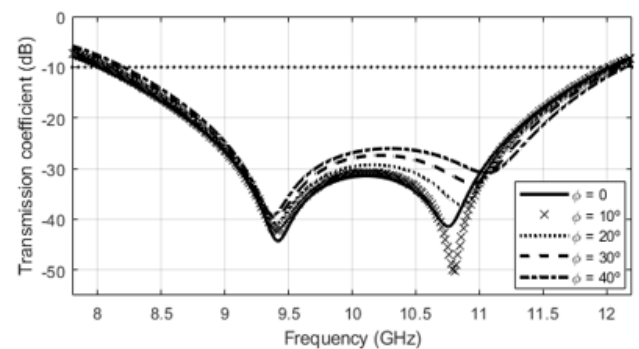
When analyzing the results presented in Figure 13, it can be noted that the values obtained in relation to the lower cutoff frequency and the upper cutoff frequency are, respectively, 7,983 GHz and 12,026 GHz, for the result calculated from FIT, the which represents a relative error in relation to the objectives configured in the BIC code of about 0.43%. Then, when verifying the result calculated by FEM, values for the lower cutoff frequency and the upper cutoff frequency were, respectively, 8,025 GHz and 12.15 GHz, which is equal to a relative error of 1,562% in relation to the objectives of BIC.

A characteristic that must be taken into account when analyzing FSS, be it single layer or multilayer, is the angular stability of the device, given that this aspect allows the analysis of the capacity that the FSS has to operate effectively in the filtering of electromagnetic waves with oblique incidence coming from multiple paths. However, an evaluation of FSS response for the two main types of polarization, horizontal and vertical, should be considered.

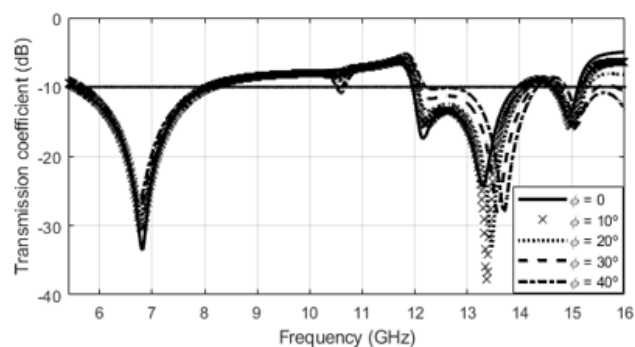
The angular phase stability calculated from FIT is shown in Figure 13 for both filters optimized via MOGA. These results were considered because this technique has shown a higher degree of precision in meeting the project's objectives.



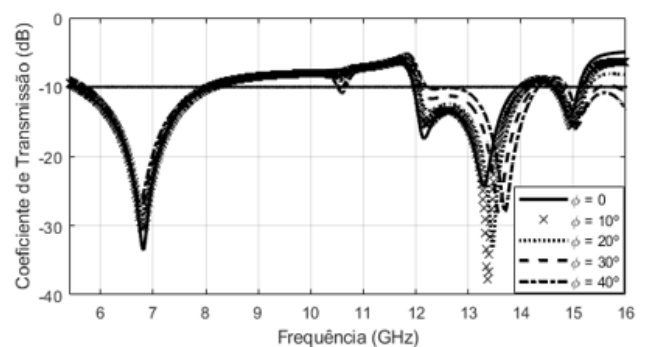
(a) Filter 1 – TM polarization.



(b) Filter 1 – TE polarization.



(c) Filter 2 – TM polarization.



(d) Filter 2 – TE polarization.

Figure 14. Angular stability of filters 1 and 2 for horizontal and vertical polarizations.

Figures 14 (a) and (c) show the calculated results for filter 1, while Figures 14 (b) and (d) show the calculated results for filter 2. When analyzing these results, it is verified that the behavior of the devices

remains unchanged regardless of the incident wave polarization, confirming that the multilayer FSS are independent of the incident wave polarization. According to the consensus found in the literature, the proposed FSS is characterized as having an independent polarization.

With regard to angular stability, specifically in Figures 14 (a) and 14 (b), it is noteworthy that for the incidence angle of 40° the lower and upper cutoff frequencies have a deviation of approximately 160 MHz and 75 MHz, respectively, in relation to the normal incidence angle. As the application of filter 1 consists of a rejection of X band frequencies, these values of deviation in the cutoff frequencies meet the prerequisite of a maximum deviation of 2% in relation to the normal incidence wave. This ensures that the device operates with good angular phase stability for waves with an oblique incidence of up to 40° .

For Figures 14 (c) and 14 (d), when analyzing the critical angle of incidence of 40° , the lower and upper cutoff frequencies for the first rejection band show deviations of about 147 and 140 MHz, respectively, in normal incidence angle. However, it is observed that the frequencies belonging to the Ku band (12–18 GHz) suffer greater distortions when subjected to different angles of wave incidence, which can be justified by the wavelength being shorter for this band – which makes it more sensitive to these variations and fatally contributes to the formation of reflected waves between filter plates with phases that cancel each other out, thereby distorting the frequency response of the device. However, for the first rejection band, the deviation values at the cutoff frequencies meet the prerequisite for a maximum deviation of 2% with respect to the normal incidence wave.

Table 5 presents a summary of the synthesis process of the filters designed in this work.

Table 5. Summary of obtained data

Filter 1							
Hybrid Technique	Iteration Count	Convergence Time (in seconds)	Numerical Tecnhique	Objectives		Error (%)	Angular Stability
				LCF1 (8 GHz)	UCF1 (12 GHz)		
GRNN + MOGA	102	110.037	FIT	8.005	12.023	0.254	Up to 40°
			FEM	8.095	12.09	1.937	
GRNN + MOCS	500	1181.159	FIT	7.971	12.091	1.121	
			FEM	8.075	12.15	2.187	
Filtro 2							
Hybrid Technique	Iteration Count	Convergence Time (in seconds)	Numerical Technique	Objectives		Error (%)	Angular Stability
				LCF1 (8 GHz)	UCF2 (12 GHz)		
GRNN + MOGA	322	306.796	FIT	7.995	11.961	0.387	Up to 40°
			FEM	8.02	12.11	1.083	
GRNN + MOCS	500	1198.396	FIT	7.983	12.026	0.429	
			FEM	8.025	12.15	1.562	

6. Conclusion

This study discussed two BIC techniques that combine GRNN with the optimization algorithms MOGA and MOCS, respectively, applied in the design of multilayer FSSs. The calculation of the electromagnetic properties of the proposed devices was performed using the FIT numerical technique, and the computational results were validated by the FEM numerical technique.

The hybrid techniques proved to be fast and accurate. However, when confronted, the technique that combines GRNN + MOGA proved to be superior to GRNN + MOCS. The precision and speed in the convergence of MOGA can be attributed to the fact that the code's heuristic process is metapopulation, which makes the optimization process intuitive, especially when the number of parameters to be optimized is relatively large, since operations that occur during the optimization guarantee high variability among the possible solutions for the objective function of the problem.

The proposed devices were also subjected to independent polarization tests of incident-wave in TE and TM, as well as an angular phase stability test for both filters. Both multilayer FSSs were independent of the incident-wave polarization. However, only filter 1 showed good angular stability up to the critical angle of 40° for the entire operating range of the filter. Whereas filter 2, which has a dual-band filtering operation, proves stable up to the critical angle of 40° for the first filtering band in band C, however, the results for the frequencies of the second operating band, band Ku, were not satisfactory regarding the deviation criterion employed of about 2% in relation to the normal incidence in the plane of the structure. The geometries of the unit cells that make up the multilayer FSSs were chosen due to the geometric simplicity and the ease of reproducing the models, as shown in Figure 1.

Finally, it is noteworthy that in the state of the art GRNN-type networks, as well as hybrid techniques, had only been employed in the single layer FSS optimization process – this being another contribution of this study, i.e., the applicability of the proposed hybrid techniques in the design and synthesis of an asymmetric multilayer FSSs.

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Youth Education in Contest: A Study of The Encyclical *Divini Illius Magistri* (1929)

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Abstract

This article aims to understand the enunciative flows and frictions of the Catholic Church on youth education. It uses the qualitative approach and its research materials are some bibliographic and documentary references, with special emphasis on the encyclical Divini Illius Magistri, promulgated by Pius XI, on December 31, 1929. It uses the description and analysis of utterances as theoretical-methodological contributions. It considers that youth education has become the agenda of dispute between the Catholic Church, the family and civil society. According to Pius XI, there was a hierarchy between such institutions that could not be challenged. The father and mother, as Christian devotees, used to be considered the first educators and should be attentive to their functional roles at home. Without the execution of these prescriptions, youth education could be weakened or even succumbed in "modern times".

Keywords: Youth, Catholic Church, Family, Civil Society

1. Introduction

Currently, the conception of "modern times" still has a positive meaning, being characterized with assumptions about development, progress and civility. In some cases, the conception of "ancient times" has a pejorative meaning, characterized by assumptions about late, archaic and unfeasible.

In the context of history, it is possible to investigate the relationship between these two times with another perspective, because: what is considered modern can bring along the resumption of what is considered old, even when it results in novelties. What is considered ancient does not refer exclusively to what is overcome, because it moves the very reinvention of the visible and invisible things of the world (LE GOFF, 2003).

In the first half of the 20th century, the understanding of the process of secularization of the world became an emblem of "modern times" and referred to an intense process by which sectors of society and culture were removed from the domination of religious institutions. It was manifested with the withdrawal of the Catholic Church from areas that had previously been under its control or influence, as

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well as "the separation of the Church and the State, expropriation of the Church lands, or emancipation of the ecclesiastical power education, for example" (BERGER, 2003, p.119).

However, even with the process of secularization, the Catholic Church remained active, acting to expand, or at least maintain, its influence on (de)limiting modes of existence. One action did not exclude the other. What was once considered modern-secular did not entirely exclude what was considered ancient-religious. The Catholic Church remained and exhibited a vitality that was deemed extinct. There was an intense shock between innovations and the apparatus of tradition, the longing for progress and the return of the sacred, the public and private sphere, the generational customs and the unevenness of their remaining in the present (MATA, 2010). Among its main concerns was youth education.

In the scientific sphere, it is possible to say that there is no veiled and homogeneous agreement on youth, because it has complexities and its own configuration of expression: it depends on how, when and who makes its meanings. Therefore, it is feasible to know the writings concerning it, in the present as well as in the past. In view of these initial considerations, this article aims to understand the enunciative flows and frictions of the Catholic Church on youth education in the first half of the 20th century.

2. Materials and Methods

Over the 20th century, as well as currently, official documents of the Catholic Church were already written based on quotations and/or commentaries of the Sacred Scripture, apostolic tradition and magisterium. The Sacred Scripture was seen as a source of "irrefutable truth", where the New and Old Testament complemented each other and related to demonstrate the legitimacy of the salvation promise, that is, an eternal, postmortem life. The Apostolic Tradition organized and maintained the transmission of the "revealed truth" among ones and others". It would sediment institutional hierarchies and promote polarities between those who were able to drive and those who should let themselves be driven. The Church Magisterium served to authentically interpret the Sacred Scripture and promote new writings. Since the previous century, not only the writings of the Doctors of the Church, but also the papal documents were considered a fundamental part of the Magisterium.

Knowing this, we have chosen to use, as the main source of research, the encyclical *Divini Illius Magistri*, promulgated by Pius XI, on December 31, 1929. This internationally disseminated encyclical brings in itself flows and friction enunciatives on youth education.

It is possible to consider that the directive statements of the Catholic Church do not constitute an immutable unity, once they are in the transversality of phrases and propositions. The utterances do not get to an end in oral or written language. They are actions – of an individual/institution who speaks and/or writes – which brings within themselves things that are transmitted and preserved, which have a value, and of which they are appropriate, repeated, reproduced and transformed (FOUCAULT, 2012).

The utterances consolidate modes of existence. Therefore, it is feasible to take them by the surface contacts they keep with what surround them, in order to map the "regime of truth" that welcomes them and that, at the same time, support them, reinforce and justify their reiterations. The utterances overlap another/others or repel the divergent one/(s).

Instead of being a definitively spoken thing [...] the utterance, at the same time it arises in its materiality, it comes up with a status, enters networks, is placed in fields of use, offers the transfers and possible modifications while it integrates in operations and in strategies in which its identity remains or is erased. Thus, the utterance circulates, serves, dodges, allows or prevents a wish fulfilment, is docile or rebellious to interests, enters the order of disputes and struggles, becomes the subject of appropriation or rivalry (FOUCAULT, 2002, p. 121).

The analysis of a pontifical document should therefore, attempt to the flows and frictions of the very utterances. There is no intention of organizing the utterances into categories thought *a priori*. Neither to identify a supposed essence of them, but to find the "regimes of truth" by which they are triggered and deleted.

In this case, even silences are only silences, for which it is not important to seek fillers; they should be read by what they are and not as unspoken things that would hide a sense that did not come out of the speech. Methodologically, this is both easier and harder. Easier, because it does not involve a whole set of linguistic and analytical operations that other discourse analyses require. More difficult, because it is necessary to be attentive to what has been effectively said, only the inscription of what is said, without imagining what could be contained in the gaps and silences (VEIGA-NETO, 2007, p. 98).

With the qualitative approach, the cataloged information is thoroughly described and the analysis of the utterances tends to follow an inductive path (LÜDKE; ANDRÉ, 1986). With such approach, there is no intention of making judgments or allowing prejudices and beliefs to contaminate the results. Attention is given to the nuances attributed to youth education. Thus, before knowing the enunciative flows and frictions contained in that pontifical document referred to, it becomes valid to draw a brief profile of Pius XI, mentioning other documents written by him, as well as some information on the historical conjuncture in which he was inserted.

3. Results

At the beginning of the 20th century, the world was still subject to the capitalist supremacy of the nation states of Europe, such as England. However, a movement of supremacy to Germany and the United States, driven by its industries and armaments was perceived. Asia and Africa were disputed by the great imperialist powers that wanted to (re)colonize them. New nation states emerged and defended the premise of self-government, without external interference. The world seemed like an "immense powder keg" and for the pastors of the Catholic Church that was a consequence of the very actions of human beings that dismantled God's designs (KÜNG, 2002).

During the beginning of World War I (1914-1918), the dispute over consumer markets resulted in rivalries between imperialist states and the division into two antagonistic poles: the Triple Alliance (Germany, Austria and Italy) and the Triple Entente (England, France and Russia). In addition to thousands of deaths, the War had as consequences new state divisions, Europe's economic decline, the rise of the

United States, the deployment of Socialism in Russia and the emergence of authoritarian regimes in Italy (Fascism) and Germany (Nazism) (HARARI, 2018).

In the midst of the global catastrophe, attempts at dialogue for peace by Benedict XV were disastrous. The Vatican did not participate in the final decisions for the suspension of the war. The Catholic Church was no longer seen as a power to directly interfere with state decisions, especially rich states and those ones in continuous socioeconomic development, from Europe and North America (FISCHER-WOLLPERT, 1999; KÜNG, 2002).

Seeking to legitimize the Catholic Church's performance in the post-war world, Benedict XV's successor, Pius XI refuted the idea that faith was a private issue, aiming to strengthen it, in the midst of an increasingly rational world. In his encyclical *Ubi Arcano Dei Consilio*, promulgated on December 23, 1922, he stressed the importance of Christians building a society entirely based on the teachings of Jesus Christ, in which the "Good Shepherd" would act on all aspects of life, where the Catholic Church would remain active. From two other encyclicals, *Quas Primas* and *Miserentissimus Redemptor* proposed worship of Christ the King and the Sacred Heart of Jesus. Concerning the Catholic Church, he promulgated the encyclical *Mortalium animos* on January 6, 1928, in which he reiterated her unity under the guidance of the Roman Pontiff.

During his pontificate in 1929, the Italian State regulated the territorial demarcations of a city where the "celebrated pastor" had absolute autonomy and political leadership: the Vatican state city. With his signature in the Treaty of Latrão, rather than a broad state, as the previous Pontiffs intended, then the Catholic Church was responsible for the administration of minimal territory, although it still had a relative impact on the decisions of other State-nations and legitimacy before them, especially in Latin America (KÜNG, 2002).

In honor of 40 years of Leo XIII's encyclical *Rerum Novarum* on the condition of workers in "modern times", Pius XI promulgated the encyclical *Quadragesimo anno* and the encyclical *Divinis Redemptoris*, through which he proposed the restoration and improvement of the social order under the Evangelical Law.

It was about the importance of rejecting the "internationalism" of money and economic nationalism, stressed in uncontrolled and unrestricted profit, but also the claims of atheist Communism. Among the reasons for his reaction were the loss of territories for the newly formed Italian state, the fear that nation states were an obstacle to the Church's action towards the faithful and the concern that "modern inventions" would deviate from the Salvation.

By promulgating the encyclical *Divini Illius Magistri* in 1929, Pius XI was immersed in this hectic juncture and intended to direct healthy words about the various problems of youth education. According to him, in different locations, nation states sought the democratization of teaching, emphasizing the implementation of the universal, free and mandatory public primary school, , in addition to investing – with divergences – in secondary education, contributing for secular teaching and learning in civil society. At the same time, the family was in process of reconfiguration and no longer paying attention to their educational function. In view of this, the Catholic Church saw herself in the mission of presenting opinions on youth education, outlining hierarchies and functions for everyone.

According to the Pontiff, education – in its broad sense – should be seen as a social and not individual project. Recognizing the insufficiency of earthly goods for individual and collective happiness, God's creatures sought material progress today and aimed to achieve higher perfection through education. However, instead of asking God for grace, they were concentrated and immobilized in themselves by being stuck to earthly as well as temporal things.

According to Pius XI, the Catholic Church, family and civil society (in the process of secularization) had strong participation in youth education, with diverse and corresponding proportions. According to him, the family was instituted by God for Christian education at home. The family had the priority of rights in civil society.

However, it did not have all the means for its own improvement. The civil society had the means for such improvement, that is, "the common temporal good", and the ability to contribute to the good of the family or its total damage. The Catholic Church, as a "society of supernatural and universal order", was a perfect society because it gathered in itself all means for its end", that is, the salvation of souls. That is why it was positioned above family and civil society.

The Catholic Church had two supernatural titles, conferred exclusively upon it and superior to others, that is, those only landly. The first of them was given by Jesus Christ, namely the "supreme mission of magisterium", where the Catholic Church was able to teach all peoples obedience to God's designs. Jesus Christ had conferred on this Magisterium the infallibility, along with the precept of teaching doctrine. The Catholic Church was the guide to truth, dedicating itself to preserving the divine, integra and inviolable faith, in the individual and collective actions of Christians.

The second title was "supernatural motherhood". Being the "Wife of Jesus Christ", the Catholic Church generated, nourished and educated the faithful in the divine life of grace. Acted, regardless of any governmental action, for its educational mission. He had the right to use the heritage produced in the old and new teaching knowledge, as well as the possibility of judging them favorable or contrary to education.

The Catholic Church had the full right to promote letters, arts and sciences, when necessary or useful to youth Christian education and the work of salvation. It could found and maintain suitable schools and institutions for the laity, help in the development of culture and different kinds of knowledge. Such actions did not prioritize divergent provisions to civil society or its annihilation. The Catholic Church was willing to help by agreeing on any disagreements, provided that her decisions were not destabilized. This relationship was not an "undue interference", but a "maternal measure" to protect the faithful against "the serious dangers of all doctrinal and moral venom", because:

[...] it is the Church's inalienable right, and at the same time its indispensable duty to monitor all the education of her children, the faithful, in any institution, both public or private, not only concerning what is being taught there, but in any other discipline or disposition, while related to religion and morality (Pius XI, 1929).

According to Pius XI, the Catholic Church realized the importance of not making mistakes in the conduct of future generations, nor in the direction towards its last end. The excellence of Christian education was in the possibility of ensuring "the Highest Good, God, to the souls of the students, and the maximum happiness possible in this world to human society". The vigilance of the Church did not fail to produce incitement to the order and well-being of the family and of all civil society, "by distancing away

from youth that moral poison that at this age, inexperienced and fickle, usually has easier acceptance and faster extension in practice."

Without the habit of respecting God, young women and young men were disorganized, disobedient and induced to disturb various places, such as home, the city and even all civil society. Based on millennial precepts, the youth Christian education would print the first, most powerful and lasting direction in life. Moreover, they were instigated not to move away from the path of salvation.

Pius XI pointed out that the Catholic Church knew how to respond to God's mission to educate human generations in Christian life. The Church acted in the world, creating and promoting, all over the centuries, several schools and educational institutions, in different branches of knowledge. Also made monasteries, convents, colleges, cathedral and non-cathedral officers, where faith was present enabling the spread of faith and citizenship. The Catholic Church also helped build universities in various parts of the world, always on initiative and under the custody of the Holy See. With the missionaries, the Catholic Church sought to educate "for Christian life and for civilization." She has radiated new possibilities of learning in the field of letters, philosophy, art and architecture. Many of these fields emerged driven by faith

For him, the rights of the family and civil society in youth education were not, in a certain way, in opposition to the "supereminence of the Church", but in a possible harmony.

[...] the supernatural order, to which the rights of the Church belong, not only destroys or diminishes the natural order, to which the other mentioned rights belong, but on the contrary, it increases and perfects it, and both orders provide mutual assistance and as a complement to proportional respectively to each one's nature and dignity. Precisely, because both proceed from God. And God cannot be contradicted (PiUS XI, 1929).

Created by God, the family had the educational mission in agreement with the Church: an inalienable right, for its obligation in the world was inseparably articulated; a right prior to any civil society; an inviolable right on the part of any and all earthly power. Care for the children should, therefore, be performed until they were willing to take care of themselves. The early separation between each other was harmful to the family order.

At home, the Christian education of youth was not limited to pass on beliefs through words, but also through everyday practice. As educators, the father and mother were responsible for avoiding their children's curiosity and inclination to the sins of the flesh, guiding them not to corrupt God's designs. Bearing witness of faith, they taught, with their own example, a very large family model, once the amount of children represented God's blessings to the couple. Despite the differences, the children should prioritize friendly bonds with each other, valuing the bonds of brotherhood just like Jesus Christ did with his apostles and faithful.

Father and mother had a duty to meet their children's basic needs (food, protection, etc.), but they should also monitor the risks arising from their rebellious acts. Being responsible in everyday life, father and mother could be attentive to daily correction. In certain cases, the correction could have more

incisive contours, as it aimed to prevent the accomplishment of moral deviations. However, it should be performed with caution, since exasperation could spring in the children.

According to Pius XI, in their youth, the children were weakened by their affective and sexual changes, so the correction did not intend to exterminate the deepest desires, but to delay their realization. The correction aimed to maintain chastity before marriage took effect. With the inculcation of decency, father and mother taught not to show more than was allowed, refuted the gestures that aroused undecorous desires, in addition to the ways of dressing, looking at themselves and others.

At home, the children of a couple, from an early age, should learn the creed, the importance of the sacraments and one of the most reliable commandments of the Law of God, that is, to honor the father and mother, thanking the bond that united them. The children were responsible for materially helping the father and mother, in cases of illness, old age or even loneliness. They were forbidden to abandon them in the last years of their lives, giving them what they had received. They should keep the honor to their father and mother, gladly accepting the admonitions, whether emancipated or outside the house of their parents. Willingly accepting the admonitions, even when emancipated or outside the home of their parents.

According to the Pontiff, some rulers argued that the human being was born a citizen and therefore belonged primarily to the state. However, they did not realize that before someone became a citizen, he was already a son. Therefore, the decision on the education of children initially belonged to the father and, in addition, the mother. The right of the father and mother to educate was not absolute or despotic, for it was "inseparably subordinate to the last end and natural and divine law", besides being directly subordinated and linked to the decisions of the Catholic Church.

Whereupon, the mission of educating belonged "first and foremost, first of all to the Church and the family", belonging to them by "natural and divine right, and therefore in an irrevocable, unassailable and irreplaceable way". However, civil society also had duties in the face of youth education, besides promoting peace and security for citizens, material well-being and free access to faith.

Directly impacting the demands of civil society, nation states did not replace the family's functions, but could supply her shortcomings and provide appropriate means for a straight education of their developing citizens, staying in harmony with the natural rights of younger generations and supernatural rights of the church,

They had a duty to protect the previous right of the father and mother in the education of their children and respect the supernatural right of the Church before this type of education. It was up to the nation states to protect the right of new generations, in cases of physical or moral faults, from the action of the parents, by default, disability or indignities of those.

In addition to helping the Church and the family in education, nation states were able to create their own public and/or private schools and institutions, contributing to citizens having the necessary knowledge of their civic and national duties, a certain degree of intellectual, moral and physical culture, provided that they were focused on the common good. However, it was unfair and unlawful to try to monopolize youth education or force citizens to attend, exclusively their training centers, which was not in accordance with religious precepts.

According to the Roman Pontiff, schools managed by different nation states needed to harmonize with the family and the Catholic Church, aiming at a moral unity between them, to the point of constituting – together with them – a consolidated reference of education, "under penalty of failing in its scope, and otherwise becoming a work of destruction." Parents were responsible for choosing the schools their children would attend. Teachers were forbidden to disturb the youth's faith, promoting interest for absolute, illusory and false freedom. Neither teachers, nor parents, had the right to blemish the prescriptions raised, or manage them according to their unique intentions, because the education of this exquisite audience had to "correct disorderly inclinations, excite and order the good ones".

The Catholic Church challenged the "modern systems of various names", which called for a desired autonomy and unlimited freedom of young people, and which diminished or even suppressed the action of the educator. Such "modern systems", self-styled with seculars, excluded or despised religious precepts and attributed young women and young men "an exclusive primacy of initiative and an independent activity of all natural and divine higher law, in the work of their education" .

In favor of freedom in schools, these "modern systems" made young women and young men "slaves to their blind pride and disorderly passions." They sought to submit to questions "the supernatural facts concerning education", such as the priestly or religious vocation".

[...] Nowadays, it is indeed, quite strange, the case of educators and philosophers who are fatigued in search of a moral and universal code of education, as if there were neither the Decalogue, nor the evangelical law, nor the natural law, carved by God in the heart of man, promulgated by the straight reason, coded with positive revelation by the same God in the Decalogue. And, likewise, such innovators, as contempt, call Christian education 'heteronoma', 'passive', 'late', , because it is founded on divine authority and its holy law (Pius XI, 1929).

In the first half of the 20th century, while some Catholic schools directed their pedagogical practices to a specific sex, being known as educational spaces appropriate for the integral formation of childhood and, male or female youth, the number of lay schools, which valued co-education, that is, the combination of the sexes in the same educational space, with similar subjects, increased.

The state-nations historically linked to Protestantism, like the United States, Sweden and Finland, pioneered the implementation of co-education. However, in the state-nations historically linked to Catholicism, such as Italy, Portugal and Spain, as well as those located in Latin America, co-education has aroused opposition until the last decades of the 20th century. For the high echelon of the Catholic Church, this approach could weaken the virility of young men and, considered fragile and delicate, to brutalize the young women, causing them to lose their docility. In addition, young women and boys would be subject to affective and sexual temptations caused by the coexistence of differences.

According to Pius XI, co-education aroused "a deplorable confusion of ideas that confused legitimate human coexistence with promiscuity and leveling equality." Between man and woman:

[...] there is no argument in nature itself, which makes them diverse in the body, inclinations and skills, no argument from which it is deduced that there may or should be promiscuity, let alone equality in the formation of the two sexes. These,

according to the Creator's admirable designs, are intended to complement each other in the family and society, precisely for their diversity, which, therefore, must be maintained and favoured in educational formation, with the necessary distinction and corresponding separation, proportionate to the various ages and circumstances.

These principles apply in timely time and place, according to the standards of Christian prudence, in all schools, particularly in the most delicate and decisive period of training, which is adolescence; and in the gymnastic and sporting exercises, with particular preference to Christian modesty in female youth, to which all exhibition and publicity (Pius XI, 1929) is very badly all about display and publicity (PIUS XI, 1929).

According to him, "the guilt against good customs was an effect, not so much of intellectual ignorance, as well as and especially of the weakness of will, exposed to occasions and not sustained by the means of Grace". It was urgent to monitor the complex teaching and learning process in schools, for the good of children and the whole family. Children and, especially young people, with Christian parents, were forbidden to attend secular schools, where rationality overlapped faith. The coexistence in these schools became viable only in certain temporal and territorial circumstances, since judged by a representative of the Church (PIUS XI, 1929).

Contrary to the idea of gender equality in secular schools, Pius XI stressed that, even with the frequency in such institutions, young women and young men lacked examples at home. From an early age, the boy should be led to identify with his father and girl with his mother. The socialization of the boy would highlight the future profession and authority he would later acquire. The socialization of the girl would emphasize the domestic chores and submission to the daily wills of the father. Preparing her for continuous submission in the future family, with her husband.

Pius XI reiterated that religion was the true foundation of education given in Catholic schools, organized by religious orders and congregations, or even bishops. In them there was assiduous surveillance of teachers, programs, books, contents, etc. Even with the weather stemming from the high costs, it remained a viable option for the father and mother who had already begun the Christian education of their children.

[...] nowadays it is necessary to monitor all the more extensive and careful, the more have increased the occasions of moral and religious sinking for inexperienced youth, especially in the wicked and licentious books, many of which have increased devilishly scattered, at ridiculous and despicable price, in the shows of the cinematographer, and now also in the radio auditions, which multiply and facilitate all sorts of readings, such as the cinematographer all sorts of shows (PIO XI, 1929).

According to the Pontiff, anchored in solid religious precepts, Catholic schools contributed to the extent of human, individual and social, spiritual and intellectual, sensitive and moral life, not to diminish it, but to perfect it according to the examples and Christian doctrine. For its implementation, the Catholic Church

lacked the support of civil society, through actions of partnership with the nation states, and the active participation of the father and mother.

4. Final considerations

Pius XI's directive statements, contained in the encyclical *Divini Illius Magistri*, point out how youth education became the target of recommendations in the mid-20th century. In such statements, youth is presented as a phase of doubts and uncertainties. Besides being a phase of constant rebellion, where it was possible to destabilize ancient modes of existence.

According to Pius XI, for the success of youth education, hierarchies between the Catholic Church, family and civil society were viable. The first had authority over the others. The second one should be protected by the third, but should accept the opinions of the first. The third could help the second, as long as it did not refute the premises of the first. Despite the disputes, the partnerships between them were seen as advisable for the good of youth.

Also, according to the Roman Pontiff, in means of divergences of interests between the Catholic Church, the family and civil society, the father and mother – considered the first educators – were responsible for choosing the schools that their children would attend, watching them closely so that they would not insert content that could cause affective and sexual deviations.

Catholic schools were preferred in relation to secular schools, because in them Christian teachings were protagonists in teaching and learning. The father and mother, as good devotees of the Church, should be paid attention to the dangerous coexistences between young women and boys in the same school, because co-education could trigger sleeping desires or anticipate them. Living with differences was not advisable. Without the execution of these prescriptions, youth education could be weakened or even succumbed in "modern times".

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