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Prevention of falls in elderly users of a Family Health Strategy in the city of Ananindeua-Pará

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**Keywords— Elderly, Falls, Prevention,
Primary Care.**

Abstract— *Objective: understand the measures to prevent the risk of falling in elderly users of a family health strategy in the city of Ananindeua, state of Pará, Brazil. Methodology: Approximately 15 of the 316 elderly enrolled were selected: male and female, which sign the Free Informed Consent Form and were at the ESF on the day of the research. Were excluded from these research people aged 59 years or less, who not enrolled in the ESF, do not have mental conditions to carry out the research, and those who do not agree to sign the IC. Results: The results of the study showed that the predominant age range was between sixty-four (64) and eighty (80) years old, and 80% of the elderly population is female. Four categories emerged from this study for analysis covering the common context polydrug use in this age group, the multimorbidities, the history of falls, and the physical environment of residence of the elderly. Conclusion: Several factors were identified associated with the risk of falling among the elderly include the were visual deficits, advanced age, nervous system disease, excessive medications, slippery floors, among other situations that make the elderly suffer some risk of falling and have consequences relevant to their lives, it was also verified that the degree of autonomy of the elderly is quite*

comprehensive where they manage to do simple daily activities without making much effort.

I. INTRODUCTION

The human aging process is characterized by its complexity, as several physiological and systemic changes arise in the body, including the reduction of muscle tone, flexibility, and nerve endings, a process that generates limitations and vulnerabilities that generally interfere with the functions of the balance of the elderly, increasing the risk of falling [1]. According to the World Health Organization (WHO), a fall is an involuntary action that brings the body to the ground or another surface, it is estimated that one-third of elderly people over 65 years have an episode of fall per year. This is the second leading cause of death from unintentional injuries worldwide [2].

The Unified Health System (SUS) offers to the entire population, full, universal, and free access to health services, with emphasis on Primary Health Care (PHC) who has emerged as a priority level to assist and monitor the health status of the elderly population, also acting in the prevention of diseases and health promotion in this population. Thus, the importance of evaluating health care services for the elderly has increased, especially in primary care, to achieve active and healthy aging [3].

In this context, falls in the elderly are a geriatric syndrome that has great social importance in the context of public health, as it is one of the main causes of injuries, traumas, hospitalizations, and death in this age group. In addition, such events are associated with the functional decline that reduces autonomy, directly reflecting on the quality of life of the elderly, and such factors also bring an association between falling and frailty, another geriatric syndrome [4].

In a study on the association between the risk of falling and the frailty syndrome in elderly people living at home, the prevalence of the risk of falling was 51.7%, and in all scales used there was an association between frailty and risk of falls, the elderly considered frail had 6.05 times more chances of falling than those who were not frail, also emphasizing that the scales are accessible instruments for health professionals and can identify and prevent the risk of falls in the elderly, improving the quality of life in aging [5].

Not all seniors have access to sufficient information on the health of the elderly, and primary care is a single health system organization, where it will help the human needs of communities, to find out how families live from a core practice in family health an integral action to the needs of

individuals and co-responsibility for the health of the population in its territory [6].

Based on the above, this study aimed to understand the measures to prevent the risk of falling in elderly users of a family health strategy in the city of Ananindeua, state of Pará, Brazil.

II. METHODOLOGY

This is descriptive research, with a qualitative exploratory approach. Qualitative research must have a statistical sample that consists of a set of individuals taken from a population, so that its study can provide important information about that population being studied, in this case, the elderly, to have more reliability [7].

The study was carried out in a Family Health Strategy (ESF) located in the Municipality of Ananindeua, State of Pará from August to October 2018. The ESF can be considered the government's main efforts to improve primary health care in Brazil. The ESF offers a wide range of primary health care services provided by a team consisting of one doctor, one nurse, one nursing assistant, and four or more community health workers. Approximately 15 of the 316 elderly enrolled were selected: male and female, which sign the Free Informed Consent Form and were at the ESF on the day of the research. Were excluded from these research people aged 59 years or less, who not enrolled in the ESF, do not have mental conditions to carry out the research, and those who do not agree to sign the IC.

The data collection procedure consisted of a semi-structured script with open and closed questions, with an accessible and simple language, all the information collected individually was transcribed in full by the authors of the work, where the participant's identity was preserved by the letter I, which means Elderly and alphanumeric encoding (I1, I2, I3,...). The semi-structured script for collected data is in an appendix to the article.

Data analysis was performed using the Bardin technique, which is a method used for organizing communication/information, which aims to obtain a description of the content of the indicator messages and knowledge regarding the conditions of variables inferred in the message which themes/topics and concepts/knowledge emerge [8].

To meet the requirements of all Ethics Committees and comply with Resolution No. 466, of 12 December 2012,

the research project was submitted to Plataforma Brasil, an institution by the federal government, which research projects from all over the country involving people are found.

This project was approved by the Research Ethics Committee (CEP) of Universidade Paulista under CAAE: 00212718.1.0000.5512 in which all ethical and legal aspects about research involving human beings were respected.

III. RESULTS AND DISCUSSION

The results of the study showed that the predominant age range was between sixty-four (64) and eighty (80) years old, and 80% of the elderly population is female. Of these 9 consider themselves brown, 4 white, and 2 black regarding ethnicity. In terms of education, 1 is illiterate, 5 have completed elementary school, 7 have high school and 2 have higher education. The weight of respondents between 125,663 lb to 178,574 lb the height of the elderly is between 58,26772 into 66,14173 in, compatible with, and characteristics of the age.

Table 1. Clinical profile of the elderly interviewed in the family health strategy on the city of Ananindeua – Pará.

Features	Results
Gender	3 male and 12 female
Age range	64 – 80 years old
Breed	4 whites 9 browns 2 blacks
Schooling	1 illiterate 5 fundamental level 7 medium level 2 upper level
Weight	125,663 lb to 178,574 lb
Height	1.48cm – 1.68cm

*Moisture content on oven dry weight basis

3.1 - Category Analysis

Category 1: “Do you use any type of medicine? Which?”, we highlighted the statements of the interviewees:

"Yes, I always take medication when I feel something and when I feel pain, my children tell me not to take medication without needing it, but I'm afraid of getting sick and I end up taking it." (I.1)

"Yes, I started taking medicine for high blood pressure every day, the press 25 mg, sometimes I forget to take it and I've gone four days without taking the medicine." (I.2)

"I do, I use medication for high blood pressure, I developed about 2 years ago with the loss of my husband, I was stricken with suspicion of hypertension, I was referred

to the cardiologist and prescribed the medication “Brassart 160 mg/5mg 1x a day-night” (I.3)

"Yes, I use losartan and atenolol blood pressure medicine and I take one tablet each and I usually take them together at night, that's when I don't forget to take it." (I.4).

"Yes, I take 50 mg of losartan one in the morning and the other in the afternoon hydrochlorothiazide in the morning and the acetylsalicylic acid in the evening once, sometimes I change it and take it wrong, but I try not to forget to take it every day." (I.5).

"Yes, I use medicine for the bones, because I have an osteoporosis problem and I take alendronate for the treatment and when I feel any kind of pain I self-medicate, I take any medicine to reduce the pain” (I.6)

"Yes, I use medicine for diabetes, hypertension, bones, headaches, and body, I have all kinds of medicine." (I.7)

"Yes, I take medicine for blood pressure and cholesterol and back pain, I have back problems and sometimes I can't even walk straight, and I take the muscle medicine on my own, I haven't gone to the doctor to see this yet." (I.8)

"Yes, I use medication for diabetes, blood pressure and cholesterol and I also use eye drops for cataracts, but sometimes I forget to take it, my wife gets upset and I also take it at different times sometimes, because it's so much medicine that I get confused" (I. 9)

"Yes, the medications I take are insulin, lithiasis, omeprazole and I also take it when I feel pain." (I.10)

"Yes, I only take medication for cholesterol, because I feel dizzy sometimes and for pressure, and I also do treatment for leprosy" (I.11)

"Yes, I use the drugs metformin 850 mg, 1 human insulin, and new rapid insulin, foraseq 400 mg, amlodipine, losartan 50 mg. I use these medications because I am diabetic and hypertensive and asthmatic, I also had a stroke and was in the hospital for three days." (I.12)

"Yes, because of a fall in my work area, I slipped on the wet floor and fell hitting my head which caused a 25% hearing loss in my hearing and triggered glaucoma. The medicines I use are logan and Combigan. (I.13)

"Yes, antidepressant sertraline as a result of the loss of all the siblings in a family of 09 children and there were only 3 children left with him, and this fact shook my emotions a lot." (I.14)

"Yes, I take celebrates 500 as a result of joint pain." (I.15)

It is noted that, according to the interviewees' statements, everyone takes medication, and this ends up triggering some physiological changes in the body, such as disorders in the immune, nervous, metabolic, cardiac, gastrointestinal systems, such changes are intensified with the aging process. In Brazil and the world, public policies focused on humanization are also being applied to the health of the elderly, providing guidelines for care and prevention, with polypharmacy being one of the recurrent themes in emphasis for the WHO and in primary care since older people possess a greater risk of vulnerability [9].

The largest groups of medications used by these elderly people reflect the high prevalence of non-communicable chronic diseases such as systemic arterial hypertension and diabetes myelitis, mental illnesses such

as depression in the elderly population. It is important to discuss the consequences of polypharmacy for the elderly, as it is often associated with negative clinical issues that compromise the quality of life and safety of the elderly, being necessary to readjust the prescriptions always aiming to reduce the number of medications [10].

Category 2: "He does have non-communicable and communicable diseases"?

"No, but I feel pain in the body, and I went to the doctor and said I have rheumatism and I also have arthrosis and pain in the spine and lumbar region, I feel pain all over the body" (I.1)

"Yes, I have high blood pressure and I can't tell you if I have another disease, as all I take care of is high blood pressure." (I.2)

"Yes, only arterial hypertension that I knew, I don't know if I have another disease, my blood pressure is very high sometimes because I feel a lot of headaches and sometimes, I even feel dizzy." (I.3)

"Yes, I have diabetes and take medication only for that, I have about five years to discover." (I.4)

"Yes, I've been diabetic for a long time and I try to keep it under control for me, it's very difficult because I eat everything and I don't diet, only when I'm high." (I.5)

"No, but I had a suspicion of diabetes because I was overweight and I felt very thirsty and the doctor gave me a very strict diet and said it had gone down, but it's been a while, I don't know how it is today." (I.6)

"Yes, I'm diabetic and hypertensive is what I know, I don't know if I have another disease." (I.7)

"As a child, I had measles and chickenpox which I remember having and I have hypertension and high cholesterol as I told you." (I.8)

"I've had many diseases as a child such as mumps, measles, chickenpox and I have diabetes and high blood pressure." (I.9)

"The only disease I've had is diabetes, I've never had another disease," (I.10)

"The only diseases I remember having been chickenpox and measles and I don't have diabetes." (I.11)

"The only diseases I have is diabetes, hypertension, and asthma, I get that after I had her first child." (I.12)

"Yes, for hypertension only, caused by emotional stress (annoyance) due to a speech at work. (I.13)

"I don't have chronic non-communicable diseases" (I.14)

"No, I only have bone problems, only." (I.15)

It was observed that due to the living conditions of the elderly interviewed, they are simple people and chronic non-communicable diseases were triggered by an unruly life of work, stress, and care for their children, that is, there was no attention to health, and also, they are people who were smokers, drinkers, and self-medicated. According to the IBGE, three out of four elderly people have chronic diseases and most of them are incurable, and most of them are non-transmissible, such as diabetes mellitus and systemic arterial hypertension. Other diseases include heart attack, stroke, pulmonary emphysema, chronic bronchitis, Alzheimer's disease, and other dementias [11].

In the study on the relationship between population aging and chronic non-communicable diseases, the participation of family members and health professionals stands out as an important factor to prevent the emergence of diseases in old age that can predispose to the risk of falling, being the guidance and monitoring the diet of the elderly essential components that directly influence the quality of aging of people [11].

Category 3: "You have fallen once, in which place and how many times. if it has fallen, was there any consequence that committed health?"

"Yes, already, on the street for a year or so, only once I fell and I didn't have any problems or consequences" (I.1)

"Yes, I have fallen several times at home, I even lost count, but the serious thing was that I tripped and there was a fracture in my left leg, and I was unable for 3 months to walk straight and do my personal needs, I couldn't even walk and sleep well" (I.2)

"It falls, only 4x, since I was 60 years old, I've counted, only the 4, and the oldest ones I'll explain to you when it happened and how it happened. The first fall was on the street near my residence, I was on my way to the fair when I bumped into a rock that was on the way and I got distracted, not watching the fall, I lost my balance with a stumbling block. The second one was at home, I usually relax in the room in the hammock, I went to put it on the guard and I got distracted by looking at the TV and it didn't fit and when I lay down it fell, I fell on my back, there was no fracture, my daughter took me to the hospital emergency room, the doctor only confirmed after an X-ray exam that there was no fracture, only muscle pain. The third fall I set up the hammock to relax, as I had arrived from the street and wanted to lie down for a while, so I went to set up the hammock and I got distracted by thinking I was armed, which gave rise to the fall. There

was no fracture, I just hit the back, again I went to the emergency room and the doctor told me it was just muscle pain." (I.3)

"I've already fallen on the street several times, I got dizzy and when I got off the bus, at home doing activities in the house, kitchen, and bathroom, at work too, I had the consequence that I put my leg in a cast, my elbow swelled and I fell in a sitting position and I feel pain in my legs. legs and even today it hurts" (I.4)

"Yes, twice, once at home I got dizzy and hit my head, the other time I was careless and fell and hit my head again and went to the emergency room and I had no serious consequences, just a swelling" (I.5)

"Yes, many times, and all of them were in my house, in the bedroom, in the living room, in the kitchen, in the bathroom and the backyard and all of them had scratches on my arms and legs and pain in my muscles because I usually beat my arms and legs." (I.6)

"Yes, I fell in the bathroom and hit my head, in the living room I slipped and in the bedroom, I tripped over something that was on the floor and ended up falling and hit my arm." (I.7)

"Yes, more than three and all went home and the most serious was when I climbed onto the bed and lost my balance and fell over my arm, my shoulder tendon was injured and I had surgery and I still don't have the strength on the left arm, I can't carry anything heavy" (I.8)

"I have fallen on the street several times, I trip over sidewalks sometimes, as I can't see right due to a cataract surgery I had, my vision has been impaired, the night is worse, I sometimes fall at home, and I always get some bruises." (I.9)

"Several times and all were on the street, and it was about 05 times, and I had no serious consequences, only muscle pain." (I.10)

"I've fallen a couple of times on the street, one was on a bicycle and another tripped and my leg and knee were inflamed, and I wasn't unable to do so, just having difficulty walking for a few days." (I.11)

"I've already fallen at home twice, I slipped, because my tile is very smooth, it was wet and I only felt pain in the leg I hit." (I.12)

"Yes, at my workplace 01 times and home 01, as a result of an emotion falling down the stairs, there was a 15-day absence from the workplace and at home, I stayed away for 07 days and underwent physical therapy." (I.13)

"Yes, 01x on the street, I felt it was after using a drug and I felt sleepy" (I.14)

"Yes, 10 times and all on the street and I was away from my work, and I was away for 06 months for treatment. The falls were caused by the unevenness of the sidewalks and because I'm vain and I wear shoes with small heels." (I.15)

The subject of falls for people with advanced age is a relevant topic and accidents are common at this stage of life, which can happen in a family environment or not, there are light or serious consequences that may have intrinsic and extrinsic factors. So the need for senescence for health treatment is very common due to the frailty of their ages, mainly in the family health strategy, which is a public service aimed at communities in general, and as a rule, there is a significant population of elderly [12].

The aging of the oldest old needs help and understanding of the younger population, as aging is an irreversible process that cannot be seen as negatively as most people do, and old age is a stage that should be seen with a glance more careful and wiser, as this phase is conducive to having more pathologies and care should be more elaborate [13].

All older people have already had some kind of fall and the most common places are their homes, streets, and buses, due to various factors such as the use of medication, dark place, inadequate vision, difficulty in balance, reduced muscle strength in the upper limbs and inferiors, among others. The fall in the elderly is a concern for public health in Brazil, as it can cause major injuries such as trauma, and even death. And this can be due to several factors such as drug interactions, intrinsic and extrinsic factors, side effects, and adverse reactions that can make the elderly suffer some consequences [14].

The home environment is one of the most common places for the occurrence of episodes of falls, where it should be a safe place ends up becoming dangerous and can cause problems with mobility and, consequently, tissue damage, injuries, hospitalization, fear, and loss of autonomy. The environmental risk factors most present in homes where there are accidents are slippery floors, inadequate shoes, poor lighting, and objects in high places [15].

Category 4: "The physical space where you reside has a fall risk protection structure (bathroom, bedroom, living room, etc...). comment."

"My house is very simple and has a wooden handrail on the stairs, but it is very firm." (I.1)

"The land of my house is low, so my house is low and the only thing it has is the non-slip floor in the bathroom." (I.2)

"Yes, it is undergoing a reform for adaptation and putting a non-slip masonry handrail on the stairs, rubber for the floor, non-slip floors. In my house there is only one ladder." (I.3)

"My house is a little narrow and does not have stairs and there is a part of the room that has non-slip tiles" (I.4)

"In my house, there is no type of protection, but I always try to leave it clean and nothing wet on the floor." (I.5)

"In my house, there is only non-slip flooring in the bathroom, the rest of the house is normal flooring." (I.6)

"At home it's simple, we don't have non-slip flooring or stair protection, but I always try to keep it clean and free from dirt and I don't have much furniture in my house or carpet." (I.7)

"In my house, there is no structure for the risk of falls, only there are no rugs in the living room and I took vases inside the house and in my house, it has a second floor but I don't go upstairs and on this stairs, there is no handrail." (I.8)

"My house is very simple, it has non-slip tile in the bathroom, that's all." (I.9)

"In my house, there is a non-slip tile in the bathroom, the only thing and I try not to put a rug near the doors so I don't fall." (I.10)

"In my house, the floor is common, it has no non-slip floor and there is nothing against preventing the risk of falls." (I.11)

"My house is very simple, it has a room with a living room and bathroom and on top, there is a large bedroom, but there is no protection against falls, the stairs on one side have no protection and my tile is smooth in all compartments and has a knocker on the bathroom door." (I.12)

"There are few compartments in my house to prevent falls, only in the bathroom that has a non-slip floor. (I.13)

"No, my house is made of masonry and the tile is smooth and has no stairs, but my wife always leaves the house clean. (I.14)

"In my house, the only thing it has is the proper non-slip floor in the bathroom." (I.15)

The protection in the life of the elderly is something very important, especially in the places where they live, but not everyone has the financial means to change their residence, but there are simple precautions that can be taken. The elderly person's booklet has important guidelines to avoid falls, such as not using a carpet, stairs and hallways must have handrails on both sides, using

closed shoes with rubber soles, placing non-slip mats in the bathroom, avoiding walking in areas with damp floors, among others [16].

Most elderly people, after a fall episode, develop fear and low confidence, which becomes a disabling factor and reduces the mobility and functionality of this elderly person, thus affecting their quality of life and causing functional damage over time, it is important to emphasize too the omission of their falls, whether out of fear, shame or getting.

too angry, it is always important for the health professional to emphasize and ask about the subject during the consultation with the elderly [18].

IV. CONCLUSION

Primary health care is important, as it performs prevention, promotion, diagnosis, and initial treatments to the population's health, especially in public policies aimed at the health of the elderly, which requires greater attention.

In the research, the factors associated with the risk of falling among the elderly in the FHS were visual deficits, advanced age, nervous system disease, multimorbidity and polydrugs, slippery floors, among other situations that make the elderly suffer some risk of falling and have consequences relevant to their lives, it was also verified that the degree of autonomy of the elderly is quite comprehensive where they manage to do simple daily activities without making much effort.

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An Analysis and Comparative Study of Replacement of Shear Wall with Intermediate Beams

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Keywords— Shear walls, Storey drift, Base shear, Shear force, Bending Moment, Node displacement.

Abstract— Shear wall systems are one of the most commonly used lateral load resisting systems in high-rise buildings. Shear wall has very high in-plane stiffness and strength, which could be used to simultaneously resist large horizontal loads, and supports vertical or gravity loads. In multi-storey buildings to resist lateral forces incorporation of shear walls has become inevitable. It is very necessary to determine the effective, efficient, and ideal location of the shear wall. This paper's study of G+5 storey building in zone-III is presented with some preliminary investigation which is analyzed by changing various position of shear wall and replacement of shear with an intermediate beam. In this paper determine the node displacement, maximum shear force, maximum moment storey drift and base shear with the help of STAAD-pro software. The building is modelled with floor area of (28m*18m) with 7 bays along 28m span each 4m and 6 bays along the 18m span each 3m and each storey height is 3m. The analysis is carried out using STAAD-pro software. A comparative study has been done placing of shear wall at different position of building and shear walls replace with the intermediate beams in the building.

I. INTRODUCTION

Shear walls are vertical elements of the structure i.e. the horizontal force resisting system [2]. Shear walls are a type of structural system that provides lateral resistance to the building. Shear walls are designed to resist in-plane lateral forces, typically wind and seismic loads. Reinforced shear wall has high in plane stiffness. Positioning of shear wall has influence on the overall behavior of the building [1]. In many jurisdictions the international building code and international residential code govern the design of shear walls. A shear wall resists loads parallel to the plane of the wall. Shear walls are typically light framed or braced wooden walls with shear panels, reinforced concrete walls, reinforced masonry walls, or steel plates. Shear walls generally start at foundation level and are continuous throughout the building height. In absence of shear wall axial load and bending moments are maximum on column [6]. The constructing of shear wall in building

damages due to effect of lateral forces due to earthquake and high wind can be minimize [8]. The thickness of the reinforced concrete wall can be as low as 150mm or as high as 400mm in high rise buildings. Shear walls are usually provided along both length and width of buildings. All of the load combinations in the STAAD Pro software. Load like dead load, live load, earthquake load and other load. The load combination is 1.5 (dead load + earthquake load) is to be more critical. [11].

In residential building construction, shear walls are straight external walls that typically from a box which provides all of the lateral support for the building. When shear walls are designed and constructed properly and they will have the strength and stiffness to resists the horizontal forces [9]. In building construction, a rigid vertical diaphragm capable to transferring lateral forces from exterior walls, floors, and roofs to the ground foundation in a direction parallel to their planes. Examples are the

reinforced concrete wall or vertical truss. Lateral forces caused by wind, earthquake, and uneven settlement loads, in addition to the weight of structure and occupants create powerful twisting (torsion) forces. A structure with shear wall offer significant reduction in lateral sway [10]. A study has been carried out to determine the strength of Reinforced shear wall of a multi-storey building by changing shear wall location and replace the shear wall by an intermediate beam. Parameters like maximum shear, maximum moment, node displacement, maximum reaction and storey drift are observed and compared. The different types of models are as follows (Table 2).

1. Type 1 Building without a shear wall.
2. Type 2 Building with shear walls at sides.
3. Type 3 Replacement of shear walls at sides by the intermediate beam.
4. Type 4 Building with shear walls at corners.
5. Type 5 Replacement of shear walls at corner by the intermediate beam.
6. Type 6 Building with shear walls at the center.
7. Type 7 Replacement of shear walls at center by the intermediate beam.

II. OBJECTIVE

1. To analyze and compare the buildings with shear walls and replacement of shear walls by intermediate beams and without shear walls with the help of STAAD pro software.
2. To calculate maximum node displacement and storey drift values in x-direction and z-direction and compare all types of buildings.
3. To calculate maximum bending moment in columns in y-direction and z-direction in different directions in all types of buildings.
4. To calculate the maximum shear force in columns in y-direction and z-direction in a different direction in all types of buildings.
5. To calculate maximum bending moment in beams of all types of buildings.
6. To calculate the maximum shear force in beams of all types of buildings.
7. To calculate base shear in x-direction and z-direction in all types of buildings.

III. METHODOLOGY

There are many ways to test the performance of various arrangements described above. The STAAD.PRO software

simulate various loading conditions and show results about how the structure will perform in actual scenarios. The software offers various types of analysis techniques such as p-delta analysis, static analysis, geometric non-linear analysis, buckling analysis, dynamic analysis, Time-history analysis etc. In our paper study of multistoried frame under seismic loads have been investigated for various locations of shear walls & replacement of various location of shear wall by intermediate beams. An analysis of multistoried frame of G+5 stories has been carried out. The building were assumed to be located in seismic zone III. The shear walls were provided at different locations of building and replacement of shear walls at different locations by an intermediate beams. The analysis of the building has been carried out by static method approach using STAAD Pro V8i SELECT series 4.

A G+5 multistory frame with three different locations of shear walls situated in seismic zone III have been taken for the purpose of the study. The size of building in plan is 28m x18m. Height of each storey= 3m, Size of column= 300mm x 300mm, Size of beam= 230mm x 230mm, Shear wall thickness= 200mm, Slab thickness= 150mm, Concrete mix used= M30, Grade of steel= Fe415. Dead loads and Live loads have taken as per IS 875 (Part 1) 1987 and IS 875 (Part 2) (1987), respectively Seismic load calculation has been done based on the IS 1893 (part 1) 2002. The loads combinations considered in the analysis are 1.5(DL+LL), 1.5(DL+EQ), 1.2(DL+LL+EQ) and 0.9DL+1.5EQ. Table (1) shows various features which are given as input to the software to simulate the loading conditions. After successfully performing the analysis the results are compared Results and Discussion section.

IV. RESULTS & DISCUSSION

In this paper, an attempt has been made to test & find the best location to provide shear wall in multi-storey buildings. In total, 7 different configurations were made and results were analyzed. When considering maximum shear force and maximum bending moment Type 4 configured showed least values of maximum shear force and bending moment in beams and columns.

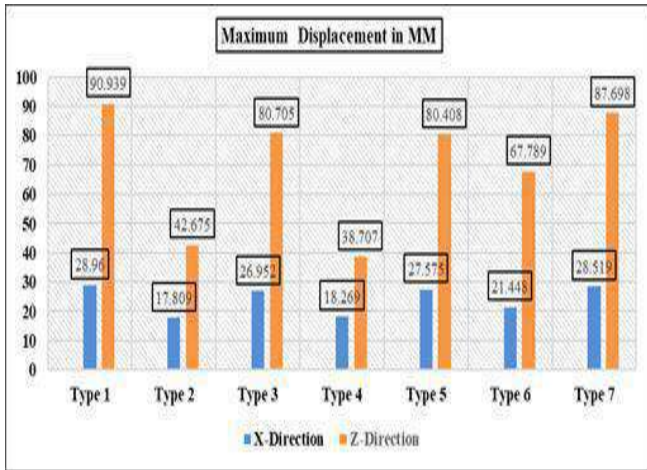


Fig. 1:- Maximum displacement in X-direction and Z-direction

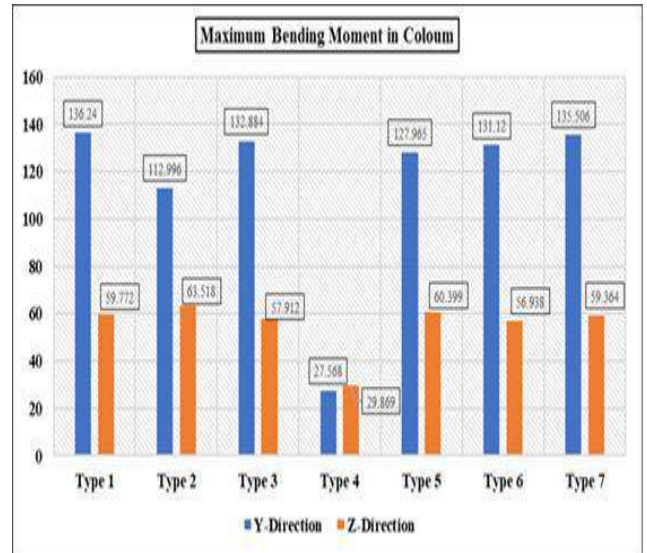


Fig. 4:- Maximum bending moment in column in Y-direction and Z-direction

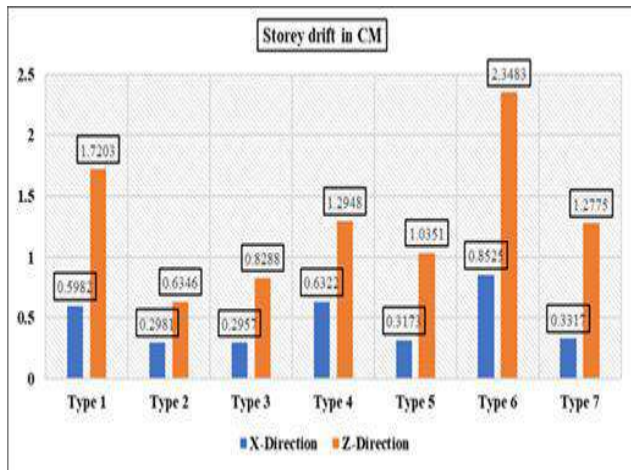


Fig. 2:- Maximum storey drift in X-direction and Z-direction

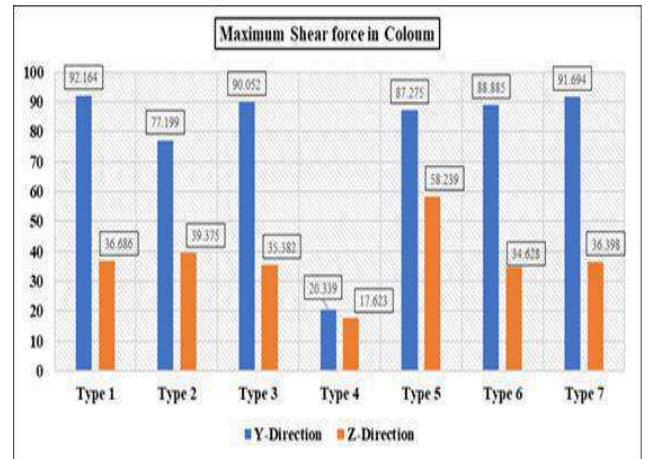


Fig. 5:- Maximum shear force in column in Y-direction and Z-direction

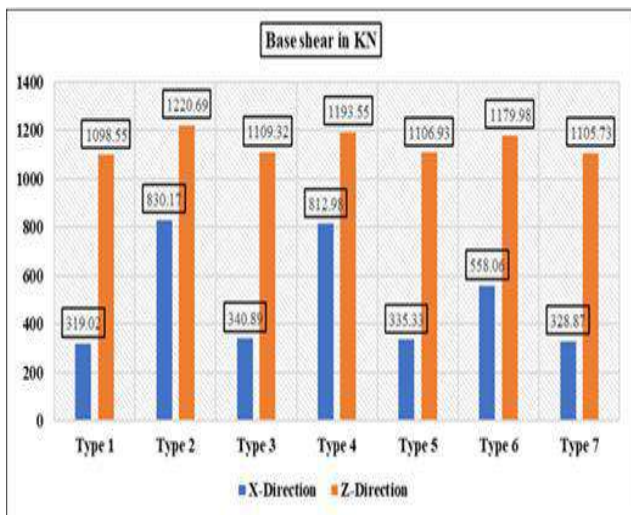


Fig. 3:- Maximum base shear in X-direction and Z-direction

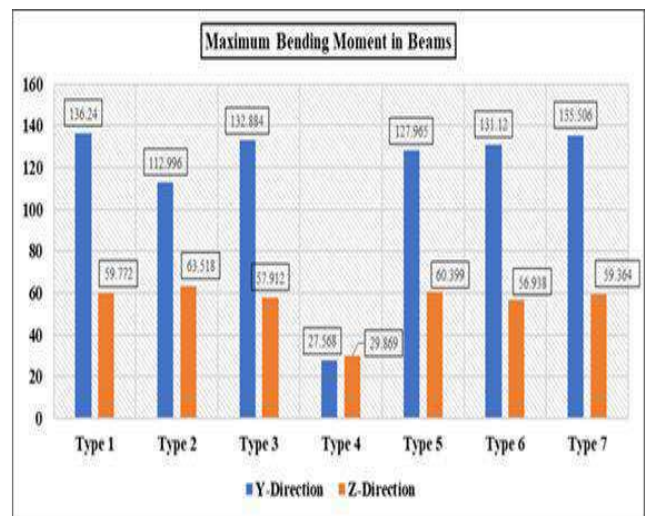


Fig. 6:- Maximum Bending Moment in Beams

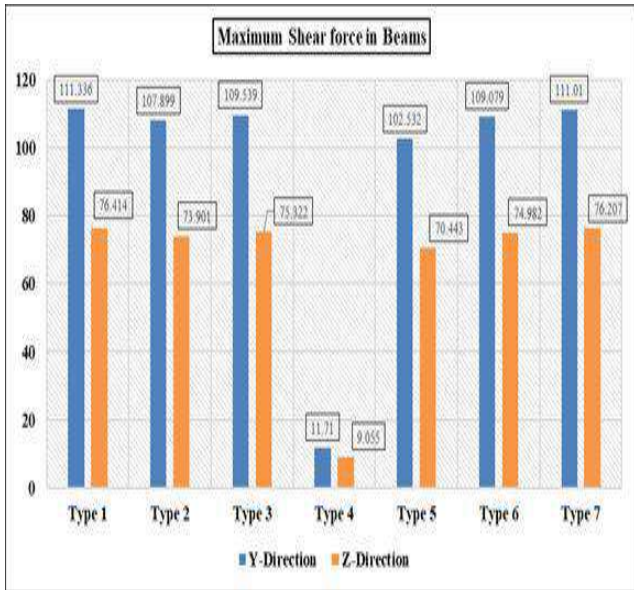


Fig.7:- Maximum shear force in beams

Table 1: - Structural Properties of RC Buildings

Properties	Details
Type of building	Residential
Stories	G+5
Storey height	3m
Beam dimension	0.23m x0.23m

Column dimension	0.3mx0.3m
Shear wall thickness	200mm
Depth of slab	150mm
Grade of concrete	M30
Grade of steel	Fe415
Support condition	Fixed
Earthquake Zone	III
Live load	3 KN/m ²
Floor finish	1 KN/m ²
Calculation of dead load- Self weight of slab	0.15x25= 3.75KN/m ²
Zone factor	0.16
Response reduction factor	5.0
Importance factor	1.0
Soil type	medium soil
Rock and soil site factor	2
Damping ratio	5%
Period in Z-direction	0.50 sec

Table 2: Different Types of Models made.

Type of Model	Types - 1	Types - 2	Types - 3	Types - 4
Description	Building without shear wall	Building with shear wall with sides.	Replacement of Shear walls at sides with Intermediate beam	Building with shear walls at corner
Illustration				
Type of Model	Types - 5	Types - 6	Types - 7	
Description	Replacement of Shear walls at corner by Intermediate beams	Building with shear walls at centre	Replacement of Shear walls at centre by Intermediate beams	

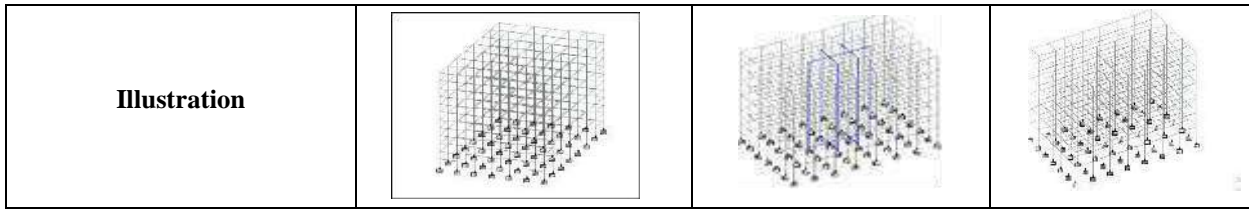


Table 3:- Value of base shear for all types of structure in X-direction and Z-direction

Type	Base shear in X-direction	% increase↑ and decrease↓
Type 1	319.02	-
Type 2	830.17	160.23 % ↑
Type 3	340.89	6.86 % ↑
Type 4	812.98	154.84 % ↑
Type 5	335.33	5.11 % ↑
Type 6	558.06	74.93 % ↑
Type 7	328.87	3.09 % ↑

Type	Base shear in Z-direction	% Increase↑ and decrease↓
Type 1	1098.55	-
Type 2	1220.69	11.12 % ↑
Type 3	1109.32	0.98 % ↑
Type 4	1193.55	8.65 % ↑
Type 5	1106.93	0.76 % ↑
Type 6	1179.98	7.41 % ↑
Type 7	1105.73	0.65 % ↑

Table 4:- Value of Bending moment in column in Y-direction and Z-direction in KN-m

Type	Bending moment in column in Y-direction	% Increase↑ and decrease↓
Type 1	136.240	-
Type 2	112.996	17.06 % ↓
Type 3	132.884	2.46 % ↓
Type 4	27.568	79.76 % ↓
Type 5	127.965	6.07 % ↓
Type 6	131.120	3.76 % ↓
Type 7	135.506	0.54 % ↓

Type	Bending moment in column in Z-direction	% increase and decrease↓
Type 1	59.772	-
Type 2	63.518	6.27 % ↑
Type 3	57.912	3.11 % ↓
Type 4	29.869	50.03 % ↓
Type 5	60.399	1.05 % ↑
Type 6	56.938	4.74 % ↓
Type 7	59.364	0.68 % ↓

Table 5:- Value of Shear force in column in Y-direction and Z-direction

Type	Shear force in column in Y-direction	% Increase↑ and decrease↓
Type 1	92.164	-
Type 2	77.199	16.24 % ↓
Type 3	90.052	2.29 % ↓
Type 4	20.339	77.93 % ↓
Type 5	87.275	5.30 % ↓
Type 6	88.885	3.56 % ↓
Type 7	91.694	0.51 % ↓

Type	Shear force in column in Z-direction	%Increase ↑and decrease↓
Type 1	36.686	-
Type 2	39.375	7.33 % ↑
Type 3	35.382	3.55 % ↓
Type 4	17.623	51.96 % ↓
Type 5	58.239	58.75 % ↑
Type 6	34.628	5.61 % ↓
Type 7	36.398	0.78 % ↓

Table 6:- Value of Bending moment in beam in KN-m

Type	Bending moment in beam	%Increase↑ and decrease↓
Type 1	111.336	-
Type 2	107.899	3.09 % ↓
Type 3	109.539	1.61 % ↓
Type 4	11.710	89.48 % ↓
Type 5	102.532	7.91 % ↓
Type 6	109.079	2.03 % ↓
Type 7	111.010	0.30 % ↓

Table 7:- Value of Shear force in beam in KN

Type	Shear force in beam	% Increase↑ and decrease↓
Type 1	76.414	-
Type 2	73.901	3.29 % ↓
Type 3	75.322	1.43 % ↓
Type 4	9.055	88.15 % ↓
Type 5	70.443	7.81 % ↓
Type 6	74.982	1.87 % ↓
Type 7	76.207	0.27 % ↓

IV. CONCLUSION

In this paper main aim was to compare and analyzed effect of shear walls at different Location of multistory. Building and replacement of shear wall by intermediate beams. The parameter of comparison like Maximum Node displacement, Base shear, Storey drift, maximum Bending moment and maximum shear force at different directions.

On analysis based on designed structure with various positional configuration of shear walls and of shear wall by intermediate beam with respect to seismic load acting as calculated from STAAD Pro software shows that at sides position of shear wall and replacement of shear wall by intermediate beam structure with respect to node displacement is best suited.

Base shear is an estimate of the maximum expected lateral force that will occur due to seismic ground motion at the base of structure. Value of base shear is observed minimum for the case in which no shear walls are provided in the structure. The value of base shear increases with the provision of shear wall and replacement of shear wall by intermediate beams. In this paper the maximum base shear is observed in the type 2, it means that it provides maximum safety against the earthquake load.

The proportionate material requirement for the applied load, in the construction of building is type 4 structure will be more economical than other type structure.

Provision of shear wall results in reduction of average displacements it means if shear wall is provided in

structure the displacement should be minimum and replacement of shear wall by intermediate beams will also displacement should be minimum with respect to without shear wall structure. In this paper type 2 structure is shows that the minimum nodal displacement.

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Scalar Dark Matter Formation in Electron - Axion Like Collider

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Keywords— Axion – Axion like, Dark
Matter, Standard Model, New Physics

Abstract— The aim paper is devoted to study the interaction of axion like (ALPs) with fermions when expanding the standard model. The process of collider between axion-electron, which produce scalar dark matter and release electron has been studied. The scattering amplitude and cross section of this collision in the center of mass system (CMS) have been calculated by using Mandelstam variables and then plotted its dependence on scattering angle and energy.

I. INTRODUCTION

In recent years, the search for particles outside the standard model with small mass and weak interaction with the standard model has attracted a lot of attention from the scientific community, especially those who interested in interactions of high-energy elementary particles. The motive of this interest is to answer the question of whether there is new physics; Are the new particles energetic or light? Theoretical studies also want to show that the light particles that interact weakly with the particles in the standard model are spontaneously generated by the extension of the standard model, as well as the dark matter (DM) formation process.

Axion like particles (ALPs) are the scalar (or pseudo – scalar) particles that appear in many different physical models, they can act as a Goldstone Boson of the U(1)PQ group (Peccei Quinn) [1,2] and can also appears as a component of the Chiral super-field in the super-symmetry theory (SUSY) [2].

ALPs with mass around MeV are associated with a wide range of phenomena for cosmology and astrophysics [3], such as affecting the Bigbang Nucleosynthesis (BBN), CMB, and stellar evolution. ALPs are also involved in the formation of cold dark matter and can be used to account for a large number of astronomical singularities such as the extreme cold efficiency of a class of stars, the transparency to the strangeness of the universe with its super-high-energy gamma ray [4] or the hiding of monochromatic X-ray around the energy of 3.5KeV [5]. ALPs also play a key role in breaking electroweak symmetry and in solving hierarchy problems through relaxation mechanisms. ALPs also give us the exciting ability to connect the standard model to potential dark matter particles [6]

The aim of this paper is to consider the interaction of scalar particles as ALPs with fermions when expanding the standard model, it occurs in most of the strong CP problems, in the model with break super-symmetry. The ALPs are pseudo-Goldstone bosons, they are light and very weakly bound together. The process of axion-electron interaction through positron exchange will study. It

produces scalar dark matter and release electrons. We will calculate the scattering amplitude and scattering cross section of the collision in the center of mass system (CMS) with Mandelstam variables and investigate the graphing number.

The paper is constructed as follow: In Sec.2, we find an expression of the scattering amplitude based on the Feynman diagram at the s - channel and the t - channel with Mandelstam variables used. In Sec. 3, the scattering cross section is deduced and numerically calculated, and then plotted its dependence on scattering angle and energy. In Section 4, we give some discussion and conclusion about the obtained results.

II. ALPS – ELECTRON SCATTERING AMPLITUDE

In this section, we will derive an expression for the scattering amplitude of the process $a(k_1)e^-(p_1) \rightarrow \phi(k_2)e^-(p_2)$, which ALPS collider with electron to create $e\phi$ through positron exchange.

The propagator of a electron has the form

$$D(q) = \frac{1}{q^2 - m_e^2 + i\epsilon} \quad (1)$$

q^2 is the square of momentum transfer.

The Lagrangian of axion – electron interaction is [7,8]

$$L_{ae^+} = -g_e \bar{e} i \gamma_5 e a. \quad (2)$$

where $g_e \approx \frac{m_a m_e}{m_\pi f_\pi} = 4,07 \cdot 10^{-11} m_a$ is the axion – electron coupling [7,9]

From (1) and (2), we use Feynman diagram law to compute the scattering amplitude for above process. In this process, ALPs – electron interaction is carried out simultaneously in both channels, s- channel and t – channel. So the total scattering matrix is

$$M = M_s + M_t \quad (3)$$

Where M_s and M_t are the scattering matrices of s - channel and t – channel respectively

2.1. s- Channel scattering amplitude

In this channel (Fig.1), an electron with momentum p_1 absorbs an axion with momentum k_1 to produce a positron, which then radiates out scalar dark matter with momentum k_2 and produces an electron with momentum p_2 .

Based on the rule of calculating amplitude according to Feynman diagram, we have

$$iM_s = \bar{u}(p_2) \left(-\frac{im_e g_e}{m_a} \gamma_5 \right) u(p_1) \left(\frac{1}{q_s^2 - m_e^2} \right) = -\frac{im_e g_e}{m_a} \cdot \frac{1}{q_s^2 - m_e^2} \bar{u}(p_2) \gamma_5 u(p_1) \quad (4)$$

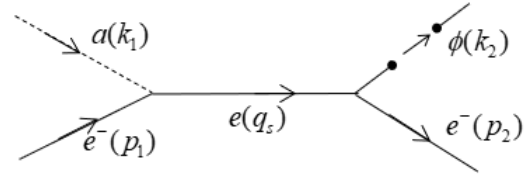


Fig. 1: s – Channel

Note that the sum is taken according to the spin states of the particle

$$u(p)\bar{u}(p) = (p_\mu \gamma^\mu \pm m)_{mm} = (\hat{p} \pm m)_{mm}$$

Here (+) for particles and (-) for anti-particles. Thus,

$$|M_s|^2 = \frac{m_e^2 g_e^2}{m_a^2 (q_s^2 - m_e^2)^2} Tr [(\hat{p}_2 + m_e) \gamma_5^2 (\hat{p}_1 - m_e)] \quad (5)$$

We already know the properties of gamma matrices

$$\begin{aligned} \bar{\gamma}_5 &= -\gamma_5, \\ (\gamma_0)^+ &= \gamma_0, (\gamma_k)^+ = -\gamma_k \quad (k=1,2,3), \\ \bar{\gamma}_\mu &= \gamma_0 \gamma_\mu \gamma_0 = \gamma_\mu, \overline{\gamma_\mu \gamma_\nu} = \gamma_\nu \gamma_\mu, \\ \gamma_5^2 &= 1 \end{aligned} \quad (6)$$

and γ_5 is anti-commutative with the other gamma matrices, then

$$(\hat{p}_1 + m_e) \bar{\gamma}_5 = \gamma_5 (\hat{p}_1 - m_e) \quad (7)$$

Putting eqs. (6), (7) into eq.(5) we get

$$|M_s|^2 = \frac{m_e^2 g_e^2}{m_a^2 (q_s^2 - m_e^2)^2} Tr [\hat{p}_2 \hat{p}_1 - \hat{p}_2 m_e + m_e \hat{p}_1 - m_e^2] \quad (8)$$

Since the product of an odd number of Dirac matrices equals zero, and

$$\begin{aligned} Tr [\hat{p}_1 m_e] &= Tr [\hat{p}_2 m_e] = 0; \\ Tr [\hat{p}_2 \hat{p}_1 - m_e^2] &= Tr [p_2^\mu p_1^\nu \gamma_\mu \gamma_\nu - m_e^2] = p_2^\mu p_1^\nu Tr [\gamma_\mu \gamma_\nu - m_e^2] \\ &= p_2^\mu p_1^\nu (4g_{\mu\nu} - 4m_e^2) = 4(p_2 p_1 - m_e^2) \end{aligned} \quad (9)$$

Substitute (9) into (8), we obtain:

$$|M_s|^2 = \frac{m_e^2 g_e^2}{m_a^2 (4E_1 E_2)^2} 4(p_2 p_1 - m_e^2) \quad (10)$$

Considering the center of mass reference system, using the law of conservation of momentum:

$$\begin{aligned} \vec{p}_1 + \vec{k}_1 = 0 &\Rightarrow \vec{p}_1 = -\vec{k}_1 \equiv \vec{p}; \\ \vec{p}_2 + \vec{k}_2 = 0 &\Rightarrow \vec{p}_2 = -\vec{k}_2 \equiv \vec{k} \end{aligned} \quad (11)$$

Here Mandelstam variables are used

$$\begin{aligned} p_1 &= (E_1, \vec{p}); k_1 = (E_2, -\vec{p}); \\ p_2 &= (E_3, \vec{k}); k_2 = (E_4, -\vec{k}); \end{aligned} \quad (12)$$

p_1, p_2, k_1, k_2 are the 4 – component vectors; \vec{p}, \vec{k} are the 3 – component momentums of incident and scattered particles.

We have $\vec{p}^2 = E^2 - m^2$ then

$$\vec{p}^2 = E_1^2 - m_e^2 = E_2^2 - m_a^2; \quad \vec{k}^2 = E_3^2 - m_e^2 = E_4^2 - m_\phi^2 \quad (13)$$

$$\begin{aligned} s &= q^2 = (p_1 + k_1)^2 \\ &= m_e^2 + m_a^2 + 2(E_1 E_2 + \sqrt{E_1^2 - m_e^2} \sqrt{E_2^2 - m_a^2}) \end{aligned} \quad (14)$$

$$s = m_e^2 + m_\phi^2 + 2(E_3 E_4 + \sqrt{E_3^2 - m_e^2} \sqrt{E_4^2 - m_\phi^2}) \quad (15)$$

Since the law of conservation of energy:

$$E_1 + E_2 = E_3 + E_4 \quad (16)$$

Ignore the mass of the particles besides the energy terms

$$|\vec{p}| = E_1 = E_2 = E; \quad |\vec{k}| = E_3 = E_4 = E \quad (17)$$

$$q_s^2 - m_e^2 \approx 4E_1 E_2 \quad (18)$$

So we have

$$\begin{aligned} p_2 p_1 &= E_1 E_3 - \vec{p} \cdot \vec{k} = E_1 E_3 - |\vec{p}| \cdot |\vec{k}| \cdot \cos \theta \\ &= E_1 E_3 - \sqrt{E_1^2 - m_e^2} \cdot \sqrt{E_3^2 - m_e^2} \cdot \cos \theta \\ &\approx E_1 E_3 - E_1 E_3 \cdot \cos \theta = E_1 E_3 (1 - \cos \theta) \end{aligned} \quad (19)$$

Then substitute (19) into (10), we derive

$$\begin{aligned} |M_s|^2 &= \frac{m_e^2 g_e^2}{m_a^2 (4E_1 E_2)^2} 4[E_1 E_3 (1 - \cos \theta) - m_e^2] \\ &\approx \frac{m_e^2 g_e^2}{4m_a^2 (E_1 E_2)^2} E_1 E_3 (1 - \cos \theta) \end{aligned} \quad (20)$$

From (13), (16), (17) and (18) while ignoring the electron mass m_e

$$\sqrt{E_4^2 - m_\phi^2} + E_4 = 2E \Rightarrow E_4 = E \left(1 + \frac{m_\phi^2}{4E^2} \right) = E \left(1 + \frac{m_\phi^2}{4s} \right) \quad (21)$$

$$E_3 = 2E - E_4 = E - \frac{m_\phi^2}{4E} = E \left(1 - \frac{m_\phi^2}{4s} \right) \quad (22)$$

$$s = q_s^2 - m_e^2 \approx q_s^2 = 4E_1 E_2 = 4E^2 \quad (23)$$

So the final expression for the s -channel scattering amplitude is

$$\begin{aligned} |M_s|^2 &= \frac{m_e^2 g_e^2}{4m_a^2 E^4} E^2 \left(1 - \frac{m_\phi^2}{s} \right) (1 - \cos \theta) \\ &= \frac{m_e^2 g_e^2}{4m_a^2 E^2} \left(1 - \frac{m_\phi^2}{4E^2} \right) (1 - \cos \theta) \end{aligned} \quad (24)$$

2.2. t- Channel scattering amplitude

In this channel, an electron radiates out scalar dark matter and produces positron, which immediately combines with axion to produce electron.

Doing the same as the s - channel transform, we have

$$\begin{aligned} |M_t|^2 &= \frac{m_e^2 g_e^2}{m_a^2 (q_t^2 - m_e^2)^2} 4E_1 E_3 (1 - \cos \theta) \\ &= \frac{m_e^2 g_e^2}{m_a^2 (q_t^2 - m_e^2)^2} 4E^2 \left(1 - \frac{m_\phi^2}{4E^2} \right) (1 - \cos \theta) \end{aligned} \quad (25)$$

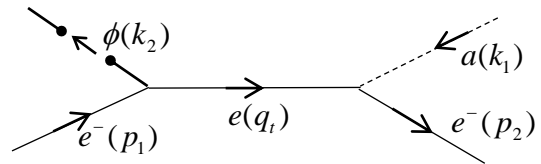


Fig. 2: t – Channel

Further more

$$\begin{aligned} q_t^2 &= (p_1 - k_2)^2 = p_1^2 + k_2^2 - 2p_1 k_2 \\ &= m_e^2 + m_\phi^2 - 2(E_1 E_4 + \sqrt{E_1^2 - m_e^2} \sqrt{E_4^2 - m_\phi^2} \cos \theta) \end{aligned} \quad (26)$$

Ignore the mass of the particles besides the energy term E_1, E_3 to derive

$$q_t^2 - m_e^2 = 2E^2 \left(\frac{m_\phi^2}{4E^2} - 1 \right) (1 + \cos \theta) \quad (27)$$

Thus, the expression of the t – channel scattering amplitude is

$$\begin{aligned} |M_t|^2 &= \frac{m_e^2 g_e^2 \left(1 - \frac{m_\phi^2}{4E^2} \right) (1 - \cos \theta)}{m_a^2 E^2 \left(\frac{m_\phi^2}{4E^2} - 1 \right)^2 (1 + \cos \theta)^2} \\ &= \frac{m_e^2 g_e^2 (1 - \cos \theta)}{m_a^2 E^2 \left(1 - \frac{m_\phi^2}{4E^2} \right) (1 + \cos \theta)^2} \end{aligned} \quad (28)$$

2.3. Total scattering amplitude

To continue calculating the total scattering amplitude according to (3), we have to calculate two more terms $M_s \cdot M_t^*, M_t \cdot M_s^*$.

Firstly,

$$M_s.M_t^* = \frac{m_e^2 g_e^2}{m_a^2 (q_s^2 - m_e^2)(q_t^2 - m_e^2)} Tr[(\hat{p}_2 + m_e)\gamma_5(\hat{p}_1 + m_e)\bar{\gamma}_5]$$

$$= -\frac{m_e^2 g_e^2 (1 - \cos \theta)}{8m_a^2.E^2 (1 + \cos \theta)} \tag{29}$$

and similarly $M_s^*.M_t = -\frac{m_e^2 g_e^2 (1 - \cos \theta)}{8m_a^2.E^2 (1 + \cos \theta)}$ (30)

Then, the expression of scattering amplitude is

$$|M|^2 = \frac{m_e^2 g_e^2}{4m_a^2 E^2} \left(1 - \frac{m_\phi^2}{4E^2}\right) (1 - \cos \theta)$$

$$+ \frac{m_e^2 g_e^2 (1 - \cos \theta)}{m_a^2 E^2 \left(1 - \frac{m_\phi^2}{4E^2}\right) (1 + \cos \theta)^2} - \frac{m_e^2 g_e^2 (1 - \cos \theta)}{2m_a^2.E^2 (1 + \cos \theta)}$$

$$= \frac{m_e^2 g_e^2}{m_a^2 s} (1 - \cos \theta) \times$$

$$\times \left[\left(1 - \frac{m_\phi^2}{s}\right) + \frac{4}{\left(1 - \frac{m_\phi^2}{s}\right) (1 + \cos \theta)^2} - \frac{2}{(1 + \cos \theta)} \right] \tag{31}$$

III. CROSS SECTION

In this section we will calculate the differential scattering cross section and the total scattering cross section of the above collision. These are important physical parameters that can be compared with experimental measurements

By definition, the differential cross-section is equal to

$$\frac{d\sigma}{d\Omega} = \frac{1}{64\pi^2 s} \frac{|\vec{k}|}{|\vec{p}|} |M|^2 \tag{32}$$

Substitute the expression of the total scattering amplitude in (31) into (32), we have

$$\frac{d\sigma}{d\Omega} = \frac{1}{64\pi^2 s} \frac{E_3}{E_1} \cdot \frac{m_e^2 g_e^2}{m_a^2 s} (1 - \cos \theta) \times$$

$$\times \left[\left(1 - \frac{m_\phi^2}{s}\right) + \frac{4}{\left(1 - \frac{m_\phi^2}{s}\right) (1 + \cos \theta)^2} - \frac{2}{(1 + \cos \theta)} \right] \tag{33}$$

$$= \frac{1}{64\pi^2 s^2} \cdot \frac{m_e^2 g_e^2}{m_a^2} (1 - \cos \theta) \left[\left(1 - \frac{m_\phi^2}{s}\right) - \frac{2}{(1 + \cos \theta)} \right]^2$$

Integrating this expression with attention $d\Omega = 2\pi d(\cos \theta)$, we get the total scattering cross section

$$\sigma = \frac{1}{32\pi s^2} \cdot \frac{m_e^2 g_e^2}{m_a^2} \int (1 - \cos \theta) \left[\left(1 - \frac{m_\phi^2}{s}\right) - \frac{2}{(1 + \cos \theta)} \right]^2 d(\cos \theta) \tag{34}$$

Set $A = 1 - \frac{m_\phi^2}{s}$; $x = 1 + \cos \theta$ then

$$\sigma = \frac{1}{32\pi s^2} \cdot \frac{m_e^2 g_e^2}{m_a^2} \left[-\frac{1}{2} A^2 x^2 + 2(A^2 + 2A)x - 4(2A - 1) \ln x - \frac{8}{x} \right] \tag{35}$$

We choose the input parameters as follows [8]:

$$m_e = 0,511 MeV = 5,11.10^{-4} GeV; g_e = 4,07.10^{-11} m_a \tag{36}$$

We then plot the dependence of the differential cross section in terms of $\cos \theta$ when choosing $s = 14$ TeV with different m_ϕ .

According to the Fig. 3, it is clear that the dark matter effect in this scattering process can only be clearly observed at small scattering angles ($\theta \approx 0$), while at large angles, the effect is negligible

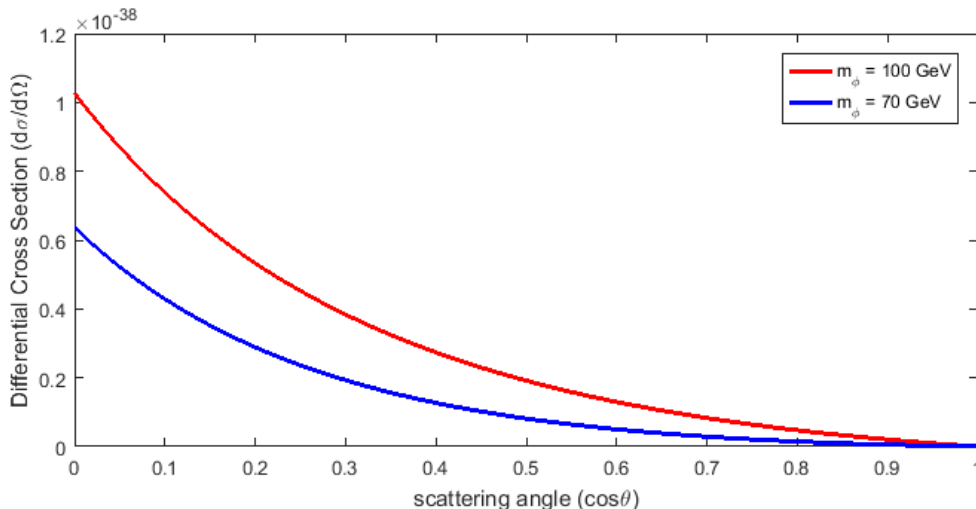


Fig. 3: Graph of the dependence of the differential cross section on the scattering angle

We plot the dependence of the total scattering cross section on the collision energy, with the scattering angle $\theta = 0$. We see, the total scattering cross section in this case is

inversely proportional to the collision energy, the larger energy collision, the smaller the total scattering cross-section.

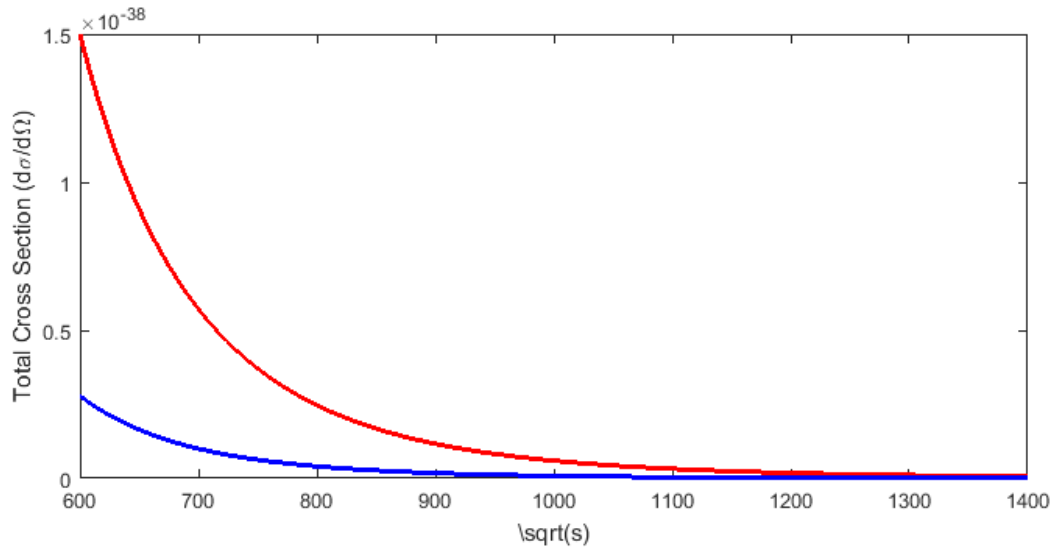


Fig. 4: Graph of the dependence of the total cross section on the collision energy

And finally we plot the dependence of the total scattering cross-section on the m_ϕ represented as follows

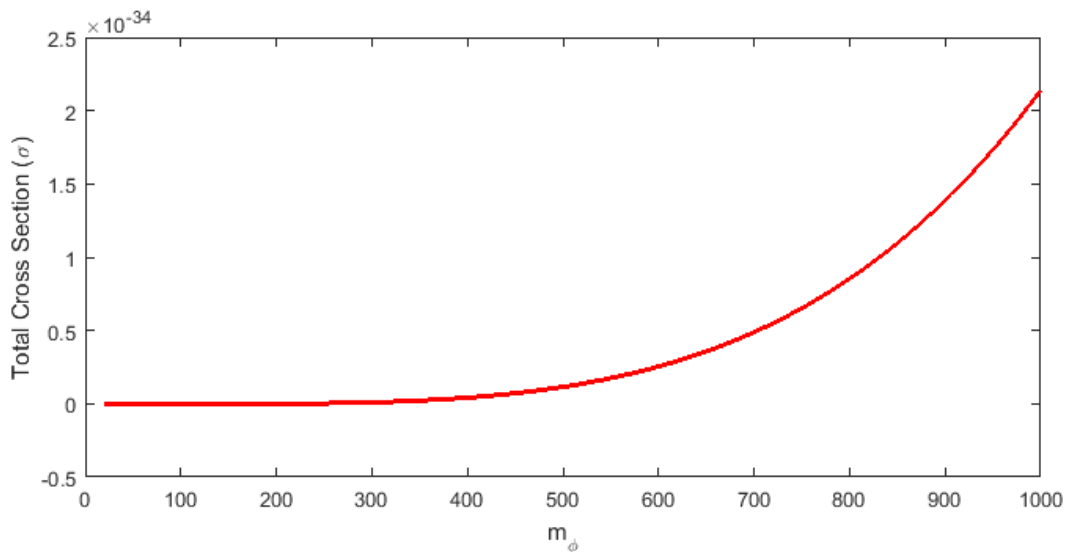


Fig. 5: Graph of the dependence of the total cross section on the mass of dark matter

The total scattering cross section in this process is directly proportional to the mass, as the mass increases; the total scattering cross section also increases. This is the same as in the case of $\gamma\gamma \rightarrow \gamma\gamma$ scattering [12,13] where radions are involved.

IV. CONCLUSION

In this work we have discussed theoretical situation concerning ALPs particles that interact with Standard Model particles via couplings to electron. It should be

emphasized that the effects of the radion have been found to be quite strong [11,12,13]. A scenario of particular interest is ALPs coupled electron to a light scalar DM particle. In this case, DM may pair – annihilate into photons DM can couple-annihilate into photons and therefore it is very difficult for us to observe DM-generating effects experimentally. Our results are attractive because of possible connection to radion and dark matter. We hope that future experiments will confirm the existence of radion. Works along these lines are in progress.

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Assessment of Energy Conservation Resource in Academic buildings seeking sustainable Energy planning

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Keywords— Energy Efficiency Energy Demand Side Management, Energy Management, Full Potentials Accounting and Valuation, Integrated Resource Planning.

Abstract— The objective of this work is to evaluate the application of the Full Potentials Accounting and Valuation (FPVA) method for ranking Energy Resources in a faculty of a large private Brazilian company. This work is justified by the importance and complexity in decision making for the implementation of energy efficiency projects in a consumer company. The method for developing this work is divided into three steps, first the inventory of Energy Resources is carried out, then Resources are analyzed within the sub-attributes of the four dimensions of Integrated Resource Planning (IRP) and based on the opinion of internal stakeholders of the company, the ranking of the Resources identified is obtained. The work demonstrates that it is possible to have synergy for the application of methods developed in academic studies in the corporate market, in addition to opening the possibility of carrying out the same study in other teaching units of the studied company or in companies from other economic sectors.

I. INTRODUCTION

Energy efficiency started to have a bigger prominence in the society from the decade of 1970, which was explained as a form to guarantee the security in the energy supplying, as a result of the worldwide crisis of the oil in 1973 [1]. The implementation of energy efficiency projects has also been stated to be considered a good opportunity to reduce costs for consumers who initially began to be guided through educational programs for efficient energy consumption [2]. In a second stage, energy efficiency projects began to be implemented through the modernization of equipment that consume little energy [3].

From the beginning of the 21st century, energy efficiency is considered a strategy to reduce costs of companies [4], besides also reducing negative impacts on the environment, thus becoming, critical subject in the

debates on sustainability [5]. The energy efficiency now incorporates all the previous concepts, being considered a set of actions that, when combined, can offer socio-environmental options, economic development, cost reduction for companies, and guarantee of energy supply to society [6].

This work recognizes energy efficiency projects as any type of Energy Resource that in one way or another makes the management of the energy bill more beneficial for the consumer company. Such an Energy Resource can have an impact on energy consumption in kilowatt-hours, as well as on reducing the value of the energy bill, without necessarily changing consumption in kilowatt-hours [7].

Considering that the decision-making for choice and implantation of an energy efficiency project can encompass many variables and become quite complex,

different studies are designed to rank the prioritization of the implantation of Energy Resources. Within this context, this article aims to rank Energy Resources that can be implemented by an energy-consuming company through the CVPC method. Differently from what is seen in other studies on the subject, rank ranking is based on the opinion of internal stakeholders of the company, as to the degree of importance that is given to each dimension of the IRP, since the simulations are made based on the percentage of importance attributed in the four dimensions by 8 employees of different departments and positions.

This direct participation of the decision-making and operational stakeholders of the company studied makes the results obtained more consistent with the strategic planning designed by the analyzed company. Thus, making them, more secure about decision-making.

In the work are simulated the implantation of 9 different types of Energy Resources described in TABLE 1 and is, 8 of them Demand Side Energy Resource (DSER) and 1 Supply Side Energy Resource (SSER) in a building of a large private company in the education sector, where a college works, in which they study approximately 4,500 students, it has 104 classrooms and a built area of approximately 31,000 square meters.

Table 1: Detailed description and summary description of the analyzed Energy Resources

Description	Explanation
DSER: environmental conditioning	It represents the replacement of 171 air conditioners, with the new ones having the inverter technology, 40% more efficient than the devices with conventional technology [8], and they are supplied by R410 gas to replace R22, the not degrading the ozone layer and not being flammable [9].
DSER: automation with presence sensor	It does not consider the replacement of light bulbs or air conditioners, it only considers the reduction in consumption resulting from the reduction in the operating period of the teaching unit, in accordance with the building's opening hours. According to information presented by the company studied, with the installation of this type of equipment the annual consumption in hours of use is reduced from 1,485 to 1,287 [10]. And it is precisely this reduction that impacts the valuation of the Resource in the

	dimensions analyzed.
DSER: migration to FECE	Migration of the consumer unit to the Free Energy Contracting Environment (FECE), which reduces the value of the energy bill without reducing consumption in kWh.
DSER: tax efficiency	Management of tax opportunities in the energy bill, based on tax regulations, which reduces the value of the energy bill without reducing consumption in kWh.
DSER: Demand Tuning	Request an adjustment of the demand contracted with the distributor, for more or less, in order to reduce the value of the energy bill, not impacting energy consumption in kWh.
DSER: Educative actions	Develop educational actions to raise awareness among students and employees, with the purpose, but without guarantee, of reducing energy consumption in kWh.
DSER: tariff framework	Adapt the consumer unit to the most beneficial tariff range, from a financial point of view, compared to the distributor, which reduces the value of the energy bill.
SSER: own energy generation	It is considered the generation of electric energy through solar energy in the morning and afternoon and the generation of electric energy with diesel generators during peak hours, from 5:30 pm to 8:30 pm, and use of energy from the grid during the remainder of the day [10].

Source: self-elaboration based on [10]

As a basis for analysis, consumption data for the year 2019 were used, given the irregularity of energy consumption in 2020, which was affected by the Coronavirus pandemic and which can be easily identified in Fig. 1.

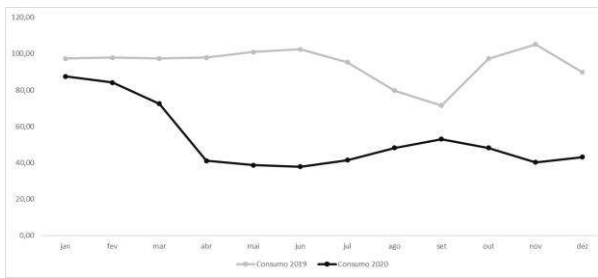


Fig. 1: Energy consumption between 2019 and 2020 in MWh

Source: self-elaboration based on [10].

Given that this study uses consumption information from 2019, and the financials analyses is made in the Brazilian currency (BRL) to show the same financials results in USD, is considered the exchange rate from December 31st of 2019, which was 1,00 BRL equivalent to 0,25 USD.

II. STATE OF THE ART

There are different methods of project evaluation, for example the Goal Question Metrics (GQM), whose approach begins with goals and strategies are drawn from them [11]. Furthermore, Life Cycle Assessment (LCA), which analyzes the environmental impacts associated with a particular product, process, or activity [12].

In addition to the evaluation methods mentioned above, as well as others that exist in there are those that are specific to evaluate energy efficiency projects. This work uses CVPC, which consists of the process of valuation of all Energy Resources in the four dimensions of the IRP and aims to value each Resource quantitatively and qualitatively [7 and 13].

In short, the CVPC is made by applying the Full Cost Assessment (FCA) methodology, inset with the Hierarchic Analysis of Processes (HAP) [10].

Within the scope of the IRP, the FCA attributes points and value the Energetic Resources inside the four dimensions [14 and 15]. The HAP, on the other hand, is a method that requires hierarchy or relationship structure in a given problem, to create comparison measures between the groups or objects analyzed [16].

The hierarchy and relationship between these evaluation methodologies are best explained in Fig. 2.

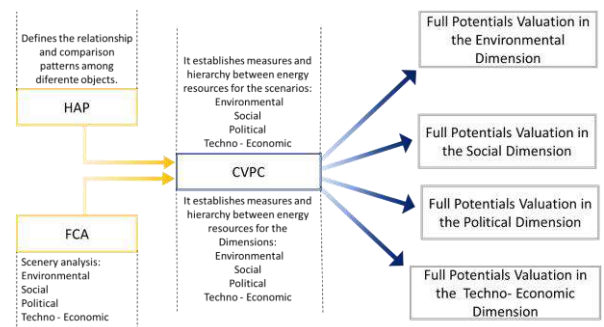


Fig. 2: Relation between HAP, FCA and CVPC

Source: Self elaboration.

III. METHODOLOGY

This work adapts the CVPC methodology of the PIR for the valuation of energy resources in the building where a teaching unit works, with the result obtained here it is possible to establish a practical and applicable method to other buildings with the same profile. Such method follows the steps of the Fig. 3:

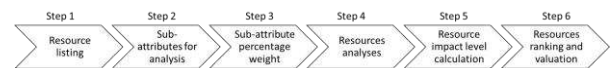


Fig. 3: Working method steps

Source: self-elaboration based on [10].

Step 1: Resource listing

It consists of making an on-site visit at the study site to raise all the Energy Resources, to select and list those that can be analyzed.

Step 2: Sub-attributes for analysis

Each type of company, as well as the place where the Resources are implanted have their specificities, therefore, must select and adjust the sub-attributes for analysis [10].

Step 3: Sub-attribute percentage weight

The company's internal stakeholders must establish the weight of importance for each dimension. In this work, the weights are established by 8 different employees of different functional levels and departments. Through the percentile weight in each dimension, it is possible to obtain the weight of each sub-attribute, according to i.e., (1) and i.e., (2).

$$\frac{\text{Dimension weight}}{\text{Attributes amount in the dimension}} = \quad (1)$$

= Each attribute's weight

$$\frac{\text{Each attribute's weight}}{\text{Subattributes amount in the attribute}} = \text{Each subattribute's weight} \quad (2)$$

The percentage weight of each dimension was obtained from the company's stakeholders through the application of a questionnaire, reaching the values in TABLES 2, 3, 4 and 5

Table 2: Assignment of weights by dimension by the Social and Environmental Responsibility department

Dimension	Management	Operating
Environmental	60%	50%
Social	20%	30%
Policy Statement	5%	5%
Technical-Economic	15%	15%

Source: self-elaboration based on [10]

Table 3: Assignment of weights by dimension by the Supply department

Dimension	Management	Operating
Environmental	20%	20%
Social	30%	10%
Policy Statement	30%	0%
Technical-Economic	20%	70%

Source: self-elaboration based on [10]

Table 4: Assignment of weights by dimension by the Teaching Unity studied

Dimension	Management	Operating
Environmental	25%	40%
Social	25%	30%
Policy Statement	10%	15%
Technical-Economic	40%	15%

Source: self-elaboration based on [10]

Table 5: Assignment of weights by dimension by the Engineering department

Dimension	Management	Operating
Environmental	23%	24%
Social	23%	17%
Policy Statement	31%	17%
Technical-Economic	23%	42%

Source: self-elaboration based on [10]

Step 4: Resources analyses

All the Resources of step 1 are analyzed in great detail all the sub-attributes of each dimension, and quantitative and qualitative analyses are made. In first the results, are obtained through mathematical analyses from numerical data informed by the company studied and through bibliographic research.

The resulting logic assigned to each Resource is presented in TABLE 6, where in the first column are the sub-attributes that are analyzed quantitatively, the second column presents the average obtained in the calculation performed with all Energy Resources, and the third column describes the interpretation that should be had in each sub-attribute, to then obtain the output of this step in the fourth column.

Table 6: Criteria for establishing the level of impact on sub-attributes with quantitative analysis

Sub-attribute	Average	Analysis	Output
Water demand, consumption and flow (m³)	19,848.38	Above average	A positive impact
		Below Average	Negative Impact
Greenhouse Gases (tonnes)	26.24	Above average	A positive impact
		Below Average	Negative Impact
Direct jobs	4	Above average	A positive impact
		Below Average	Negative Impact
Economic Activities / Infrastructure	\$ 77,919.00	Above average	A positive impact
		Below Average	Negative Impact
Development	\$ 23,996.30	Above	A positive

		average	impact
		Below Average	Negative Impact
		Above average	Negative Impact
Implementation cost	\$ 77,919.00	Below Average	A positive impact
IRR (Internal Rate of Return) 5 years	33%	Above average	A positive impact
		Below Average	Negative Impact
Inv./NPV (Net Present (Value) Index 5 years	1.24	Above average	Negative Impact
		Below Average	A positive impact
Payback (months)	12	Above average	Negative Impact
		Below Average	A positive impact
Useful life (years)	14.21	Above average	A positive impact
		Below Average	Negative Impact
Energy volume (MWh)	4,718.84	Above average	A positive impact
		Below Average	Negative Impact
Energy Integration (MWh)	4,718.84	Above average	A positive impact
		Below Average	Negative Impact

Source: self-elaboration based on [10]

For the above-mentioned sub-attributes, the calculations were made as shown in TABLE 7.

Table 7: Sub-attribute calculation method

Sub-attribute	Calculation method
Water demand, consumption and flow (m ³)	Relationship between energy consumption (kWh) and water demand, based on the Brazilian water matrix.
Greenhouse Gases (tons)	Relation between energy consumption (kWh) and CO2 emission, based on the 2019 National

	Energy Balance (BEN).
Direct jobs	Number of vacancies created is based on information obtained from the company studied
Economic Activities / Infrastructure	The investment value for each Energy Resource through the purchase and installation of equipment. In the case of the Tax Efficiency Appeal, the payment of court costs is considered.
Development	It is the income generated to employees directly involved during the project period. In this case, the account is made by combining the number of vacancies generated, the employee's functional levels, the number of minimum wages that each functional level receives and the minimum wage in 2019, \$ 261.25.
Implementation cost	It is the investment value for each Energy Resource.
IRR 5 years	Internal rate of return of the Energy Resource
Inv./NPV Index 5 years	The investment value for each Energy Resource divided by the Net Present Value calculated on the resource.
payback (months)	Return on initial investment
Useful life (years)	Duration of the Resource as informed by the studied company.
Energy volume (MWh)	It is the amount of energy saved over the lifetime of the Resource.
Energy Integration (MWh)	It is the amount of energy saved over the lifetime of the Resource.

Source: self-elaboration based on [10].

Qualitative analyzes are done in three different ways. For the policy instruments sub-attribute, the logic in TABLE 8 is followed.

Table 8: Analysis logic of the political instruments sub-attribute

Condition	Analysis	Output
Regulation on the Resource is already approved and	positively consolidated	A positive impact

positively		
Regulation on the Appeal is under review in court, with a positive perspective	positively under review	Low positive impact
Regulation on the Resource is already approved and negative	negatively consolidated	negative impact
Regulation on the Appeal is under review in court, with a negative perspective	negatively under review	Low negative impact
There are no regulations on the Resource.	There is no political instrument	There is no impact

Source: self-elaboration based on [10]

As for the sub-attributes: waste; land occupation; water quality, consumption and flow; degrading gases from the ozone layer; social impact due to occupied space; visual pollution; noise pollution; olfactory pollution; thermal pollution, through the analysis, classifications are assigned to the Resources, thus generating the output of the analyzes as shown in TABLE 9, where N/A means Not Applied.

Table 9: Analysis logic of sub-attributes classified by the researcher

Classification given by the researcher	Output
N/A with high positive impact	A positive impact
N/A with low positive impact	Low positive impact
N/A with high negative impact	negative impact
N/A with low negative impact	Low negative impact
N/A no impact	There is no impact

Source: self-elaboration based on [10]

The last type of qualitative analysis is made through questionnaires answered by experts from the energy market to the energy market to evaluate the sub-attributes: technologies and equipment, design and logistics, organized societies, NGOs and associations; generators, producers, and distributors; governments; consumers; legal

aspects. To all, 152 different institutions had been contacted, of which 40 had answered, being 18 organized energy management consultancies, 4 organized companies, NGOs, or associations, 17 companies considered generators, traders, or distributors of energy, and 1 governmental institution [10]. For each one of these market sub-attributes, specialists should respond from 1 to 5, with the interpretation and respective output in TABLE 10.

Table 10: Logic of the analyzes carried out by specialists in the electric market

Reply	Interpretation	Output
1	extremely pessimistic	negative impact
2	Pessimistic	Low negative impact
3	No preference	There is no impact
4	Optimistic	Low positive impact
5	extremely optimistic	A positive impact

Source: self-elaboration based on [10]

Step 5: Resource impact level calculation

This step is summarized in equation 3.

$$\text{Step 4} \times \text{multiplication factor} \times \text{subattribute weight} = \text{resource ranking in the subattribute} \quad (3)$$

Where the sub-attribute weight is obtained through equations 1 and 2.

The relationship between the output from the previous step and the multiplication factor is better explained as shown in TABLE 11

Table 11: relationship between output from step 4 and multiplication factor

Output	Multiplication factor
A positive impact	+1
Low positive impact	+0.25
No impact	0
Low negative impact	-0.25
negative impact	-1

Source: self-elaboration based on [10]

Step 6: Resources ranking and valuation

This step consists of the sum result of formula 3, to consolidate the score separately in each dimension and consolidate form with all the dimensions.

Having this sum, the Resources are ranked, so that it is easy for decision-makers to choose the order of preference for implementing the Energy Resources studied.

Valuation of the Resources

All the Resources had been explained in TABLE 1 of the work, this topic is presented in step 4 of the work, as shown in figure 3, including output denominated in each Energy Resource and all the sub-attributes.

1. DSER Modernization of the lighting installation

Within the environmental dimension, in the water litigation sub-attribute a reduction of 7.838, 93 m³ is calculated and in the greenhouse effect gas sub-attribute, a reduction of 9,44 tons of CO₂ is not emitted in a period of one year. For the terrestrial attribute and sub-attribute water quality pollutant emission, it should be considered that when substituting the lamps, the waste of more than 12 a thousand fluorescent lamps is prevented and almost 46 grams of mercury in the environment throughout 16 years [10]. This result, when compared to other Resources, is highly advantageous, since mercury is an extremely pollutant chemical in the terrestrial and aquatic environment.

In the social dimension, this Resource creates 7 direct jobs and generates an income of \$ 1,349.79 for the project implantation period - 5 days [10], in addition, to injecting \$ 31,095.29 through the investment made for the installation of the lamps of the efficient lighting system [10]. Due to the technical characteristics and advantages of LED lamps, it is possible to say that this Resource is beneficial within the sub-attributes visual and thermal pollution [10].

In the sub-attribute cost of implementation of the technical-economic dimension, the investment of \$ 31,095.29, 8,52% IRR is considered for valuation, the index used in the calculation of NPV of 0,334, the useful life of 16,8 years, and potential reduction in energy consumption by 1,805.18 MWh [10]. In the other two sub-attributes evaluated, the Resource is positively evaluated by external stakeholders [10].

In the political dimension, in the energy integration sub-attribute, the value is 1.805,18 MWh. In the sub-attributes in which evaluations are carried out by external stakeholders, the Resource is evaluated optimistically in

two of them and indifferently in the other sub-attributes, technologies, and equipment, and design and logistics, the Resource is evaluated with high positive impact [10].

2. DSER Modernization of the conditioning system of the environment

Initiating the assessment for the environmental dimension, a reduction of 69,597.35 m³ in water consumption and 83.78 tons of CO₂ that are not emitted into the atmosphere over a year is calculated. In the other sub-attributes, the elimination of degrading gases from the ozone layer stands out, as R410 does not degrade the ozone layer, the Resource is evaluated as having a high positive impact on the sub-attribute in question.

Within the social dimension, this Resource creates 9 direct jobs and generates an income of \$ 3,396.25 for the period of implantation of the project 10 days [10]. Since the investment required to implement the Resource is \$ 255,649.50, this is considered as a necessary value for comparison in the sub-attribute economic activities and infrastructure [10]. As for the comfort perception attribute, more specifically in the noise pollution sub-attribute, it is emphasized that equipment with the technology to invest is quieter than conventional equipment.

In the Technical-Economic Dimension, starting with the implementation cost sub-attribute, there is the same \$ 255,649.50. In the other attribute sub-attributes, IRR of 9.22%, NPV analysis index of 0.303, payback in 11 months, the useful life of 10 years, and 9,520.10 MWh saved over its useful life [10]. As for the two sub-attributes evaluated by external stakeholders, the Resource is classified as indifferent [10].

In the political dimension, for the energy integration sub-attribute, the Resource is well evaluated, since it considers the value shown above in the energy consumption sub-attribute. For all sub-attributes in which evaluations are carried out by external stakeholders, the Resource is evaluated indifferently, that is, there is no impact on valuation [10]. In the sub-attributes technologies and equipment and design and logistics, the Resource is positively evaluated by external stakeholders [10].

3. DSER Automation with presence sensor

First, within the environmental dimension, the reduction of 11,006.71 m³ of water and 13.25 tons of CO₂ in one year is identified. In the ozone layer degrading gases sub-attributes, it is evaluated that the Resource does not cause any impact, whereas, for the other sub-attributes of the dimension, the evaluation is based on mathematical analysis [10]. Given that the Resource reduces the unit's

operation, it is understood that fluorescent lamps last longer, thus postponing the disposal of lamps and, consequently, the disposal of mercury in the environment [10].

In the social dimension, the Resource creates 9 jobs, generating total income during its implantation of \$ 5,094.38 [10]. As evaluated in the studied company, the investment for implementing the Resource is \$ 17,421.75, which is, therefore, the value for evaluating the Resource in the sub-attribute economic activities and infrastructure. For the other sub-attributes of the dimension, the Resource is considered to have no impact.

In the technical-economic dimension, for the sub-attribute implantation cost, considers the value of the cited investment the same above, in addition to 21.24% in the IRR, 0.113 in the NPV index, 5 months of payback, 5 years of useful life, and reduction 752.79 MWh in energy consumption over its lifetime. For the two sub-attributes technologies and equipment and design and logistics, the Resource was evaluated as indifferent [10].

In the political dimension, the Resource is optimistically evaluated by institutions considered to be organized societies, NGOs, and associations and indifferently by other external stakeholders [10]. In political instruments and tenure and/or ownership, the Resource is evaluated as positively consolidated and with a high positive impact, respectively [10]. Finally, in the energy integration sub-attribute, the volume 752.79 MWh is considered.

4. DSER Migration to the Free Energy Contracting Environment (FECE)

Knowing that the studied unit already is in the free market, to analyze this Resource inside of the ambient dimension, TABLE 12 is used to demonstrate water consumption according to the source of energy generation, also considering TABLE 13 with the proportional distribution of primary sources of the energy consumed by the unit and respective water consumption in each source.

Table 12: water consumption for power generation, by primary source

Source	m ³ / GJ
Biomass	72.00
Coal	0.20
Wind	0.00
Natural Gas	0.10

Hydroelectricity	22.00
SHP	22.00
Nuclear	0.10
Petroleum	1.10
Solar	0,30

Source: self-elaboration based on [17]

Table 13: Water consumption proportional to energy consumption in the studied teaching unit, where SHP means Small Hydroelectric Plant

Source	Energy matrix: Teaching Unit	kWh Consumption	m ³
Biomass	6.0%	67° 51 '	17.5
SHP	82.0%	928.91	73.6
Wind	12.0%	135.94	0.0
Total	100.0%	1,132.36	91.07

Source: self-elaboration based on [10]

With this Resource and for a period of one year, there is a reduction in the emission of CO₂, 6.45 tons. Within the sub-attribute that deals with the reduction the water consumption, the increase of the water consumption occurs, in 8.293, 34 resultant m³ of the high consumption of deriving energy of biomass plants, which is due to the high-water consumption for generation of energy for biomass plants [10].

In the social dimension the Resource, due to the investment required for implantation, inserts \$ 3,595.75 into the economy and creates 3 work units. Even though the number is low, within the social impact and human development sub-attribute, the Resource is what causes greatest impact.

It generates \$ 62,700.00 in total, during project execution, which takes place through an energy management consulting contract [10]. In the other sub-attributes of this dimension, no type of impact caused by the Resource is identified.

In the technical-economic dimension, the implementation cost sub-attribute is considered the same value as the investment, which is positive in this assessment as it requires low cash outflow by the company, in addition to 85.02% in the IRR, 0.023 in the NPV index and 2 months payback. Within the lifespan sub-attribute, it is evaluated as a low positive impact, as the Resource depends on energy purchase and sale contracts, and regulatory issues imposed by the government. In other words, within this scenario, even if

the company remains in the FECE, it will not know how long it can stay in this environment. In the volume of saved energy sub-attribute, by keeping the same level of energy consumption, changing only the primary source, the Resource is evaluated neutrally. The other two sub-attributes evaluated by external stakeholders, technologies and equipment and design and logistics, are optimistic about them.

In the political dimension, the Resource is optimistically evaluated in all sub-attributes of the acceptance, motivation, and stakeholder interest attribute. In political support, it is evaluated as positively consolidated, as there are already consolidated laws and optimistically by stakeholders, however, within the sub-attribute tenure and/or ownership, it is evaluated as a low negative impact because it is not a Resource that has full control of the consuming company, in a way, it is subject to other public and private institutions that influence the energy market [10].

5. DSER Tax efficiency

This Resource analyzes the possibility of exempting the consumer company from the payment of the Tax on Circulation of Goods and Services (ICMS) levied on the tariff for the use of the energy distribution system (TUSD). In the studied unit, the energy consumption costs related to TUSD are equivalent to 30% of the energy bill and the ICMS rate is 18% [10]. Assessing the possibility of ICMS exemption involves - in addition to the initial expense with legal fees- the payment to a hired law firm of 8% of the monthly amount saved on the energy bill [10].

In all attributes of the environmental dimension, as it is a Resource that has no impact on reducing energy consumption or replacing equipment, it is evaluated as neutral.

The same occurs in the sub-attributes of the perception of comfort in the social dimension attribute, as well as in the social impact due to occupied space sub-attribute. However, still in the social dimension, the Resource has an impact on direct jobs sub-attributes, 2 vacancies are generated, a lawyer and an administrative assistant for one year, a contractual term identified with the company studied [10]. This result impacts the human development sub-attribute, with a value of \$ 34,485.00 [10], above the average found. Finally, in the sub-attribute economic activities and infrastructure, there is a positive impact due to the investment of \$ 150.00 in the number of legal fees identified [10].

Within the technical-financial dimension, considering the initial investment, which is considered in the

implementation cost sub-attribute, there is an IRR of 69.99%, an NPV index of 0.011, and a payback of 2 months. In the other sub-attributes, the Resource is evaluated as indifferent by external stakeholders, with a low positive impact on the useful life sub-attribute and neutrally on the energy volume sub-attribute, as it does not reduce energy consumption at all.

The analysis of this Resource is very important in the political dimension, as it is directly influenced by regulations published by the federal government, as well as authorized, altered, or denied by the legal body of the national tax system [10]. Considering these variables, stakeholders say they are indifferent in the sub-attributes organized society, NGOs and association, generators, producers and distributors and government, which does not occur with the consumer sub-attribute, where they consider themselves pessimistic about the Resource, it is considered by the stakeholders in the sub-attribute tenure and/or ownership. In the political instruments sub-attribute, the Resource is evaluated as positively under analysis, since lawsuits are being processed in court and, for the time being, in a positive way to consumer companies [10]. And, finally, in the energy integration sub-attribute, the Resource is neutrally evaluated as it does not impact energy consumption at all.

6. DSER Demand Tuning

Contracted demand is a technical parameter used in contracting electricity and must be adjusted according to the power demand characteristics of the consumer unit.

The Resource has no impact on the environmental dimension, as its implementation does not change energy consumption and does not require replacement of equipment, that is, it is evaluated as neutral in all attributes.

The same occurs in the sub-attributes of the attribute perception of comfort in the social dimension, as well as in the social impact sub-attributes due to occupied space and economic activities and infrastructure, since, in the first, there is no space occupation by the Resource and in the second, for not requiring initial investment. However, also in the social dimension, the Resource has an impact on the direct jobs sub-attribute, 1 job opening is generated for an engineer, for one year, a contractual term identified with the studied company [10]. This result impacts the human development sub-attribute, with the value of \$ 28,215.00 in the same period [10].

Within the technical-economic dimension, as it does not require an initial investment, it is not possible to calculate the IRR, NPV index, and payback, however, it is

possible to simulate the financial gain that the unit has with the change in contracted demand. In the studied unit, the contracted demand is 200 kW, with the maximum demand registered from January 2019 to December of the same year of 487.4 kW and, in this same period, the average consumed demand was 370.2 kW [10]. Thus, two simulations were carried out with demand adjustment, the first considered a contracted demand of 370.2 kW and the second of 487.4 kW. The financial savings found were, respectively, \$ 82,288.83 and \$ 79,814.40 in one year. That is, even though it is not possible to calculate the IRR, NPV index, and payback, the Resource is evaluated in the sub-attributes referring to these indexes as a high positive impact. It is also positively evaluated in the useful life sub-attribute, as it is a Resource that has no degradation, however, it is linked to regulatory issues, that is, without full control by the consumer company. Also in this Dimension, the Resource is evaluated by external stakeholders optimistically in the technologies and equipment sub-attribute and indifferently in the design and logistics sub-attribute, in addition to being neutrally evaluated in the energy volume sub-attribute, as it does not change the consumption of unit power.

In the political dimension, stakeholders assess the Resource indifferently in terms of sub-attributes that generate, products and distributors, governments, consumers, and legal aspects, however, optimistically in organized society, NGOs, and associations. Also neutrally, the Resource is evaluated in the political instruments sub-attribute, since there is no political instrument that regulates it and in energy integration, as it does not change the unit's energy consumption in any way. However, it is assessed as having a low negative impact on the sub-attribute tenure and/or ownership, as it is not under the company's full control and can be changed as the regulatory body wishes.

7. DSER Educative actions

Within the environmental dimension, the Resource is evaluated neutrally, that is, without causing any impact on all sub-attributes.

Likewise, within the social dimension, there is also no impact on the perceived comfort attribute and the social impact sub-attributes due to occupied space and economic activities and infrastructure. In the direct employment and human development sub-attributes, the Resource has a positive impact. In the first, it is understood that 1 job is created for an engineer, for a year, which, consequently, generates an income of \$ 28,215.00 [10], which is the value attributed to the second sub-attribute cited.

In the technical-economic dimension, the Resource is also neutrally evaluated, without impacting all the sub-attributes of the generation cost and technological domain attributes. In the first, because there is no investment and no identifiable financial return, and in the second, through evaluations made by external stakeholders who were indifferent to the Resource. In the energy potential attribute, no impact is identified in the energy volume sub-attribute either, since, as explained, with the implementation of this Resource, it is not possible to identify changes in the energy consumption of the studied unit. However, the Resource is positively evaluated with low impact on the useful life sub-attribute, as it has no expiration date, however, it can be implemented when necessary and for as long as necessary.

In the last dimension of this Resource, within the attribute acceptance, motivation, and interest of Stakeholders, it is seen optimistically by organized societies, NGOs, and associations and indifferently by other stakeholders. It is also neutrally evaluated in the political support attribute, as there is no political instrument for or against the Resource, and as indifferent by stakeholders within the legal aspects sub-attribute. Finally, it is seen as a high positive impact on the sub-attribute tenure and/or ownership, in this case, it is understood that the consumer company has full control over the Resource and is neutrally evaluated in the energy integration sub-attribute, since, as explained above, it is not possible to identify whether its implementation in any way alters the energy consumption of the unit.

8. DSER Tariff framework

As there is no change in energy consumption, as well as equipment change, no environmental impact is perceived with this Resource, that is, in all sub-attributes of the Environmental dimension, the Resource is evaluated neutrally, with no impact on valuation.

In the social dimension, its implementation creates 1 job opening for an engineer and a year, considered in the evaluation of the direct jobs sub-attribute. That impacts the human development sub-attribute, with income generation in this period of \$ 28,215.00.

In the technical-economic dimension, specifically in the generation cost attribute, the Resource does not require an initial investment, but it is known that after implemented by company decision, it will generate a financial return, thus, the IRR, NPV index and payback with low positive impact sub-attributes are evaluated. The same logic is used in the energy potential attribute, the Resource does not change the energy consumption at all and, as it is not possible to calculate its useful life, it is

evaluated with a low positive impact. For the stakeholders, responsible for evaluating the technological domain attribute, the Resource is evaluated indifferently, that is, without any impact on the final valuation.

Finally, in the political dimension, the Resource is seen optimistically in the sub-attribute organized societies, NGOs, and associations, however, indifferently towards other stakeholders. In the political support attribute, the same assessment is made by stakeholders in the legal aspect sub-attribute, in addition to being neutrally assessed in the political instruments sub-attribute, since it does not involve any type of statutory and legal decision for implementation. Finally, within the attribute property of the resource, it is evaluated with a low negative impact on tenure and/or ownership, as it is under full control of the consuming company and neutrally in the energy integration sub-attribute, as it does not change energy consumption at all.

9. SSER Own energy generation

In the environmental dimension, within the terrestrial environment attribute, the Resource is evaluated as a low negative impact, both the photovoltaic equipment and the Diesel generator occupy the terrestrial space in some way, the latter also eliminates waste from the terrestrial environment through combustion for generation of electricity [10]. However, as it is not possible to calculate the impact, the Resource is evaluated as N/A with a low positive impact on the medium terrestrial attribute. In the aquatic environment, with the analyzes carried out, it is known that the Resource saves 19,092.27 m³ of water in a year after its implementation, whereas in the water quality and pollutant emissions sub-attribute the Resource is evaluated as N/A with low negative impact, given that the Resource emits pollutants from the aquatic environment, however, it is not possible to calculate this impact. Finally, in the air and in one year, the Resource reduces the emission of carbon dioxide by 18.29 tons per year and is evaluated as N/A with no impact on the ozone layer degrading gases sub-attribute, as it does not impact the ozone layer.

In the social dimension, the Resource generates a total of 7 job openings, 1 engineer, 5 electricians, and an administrative assistant, which, within three months, the Resource's implementation period, generate an income of \$ 24,296.25. In the social impact sub-attribute due to occupied space, it is evaluated as N/A with high negative impact, it is known that both the solar panels and the diesel generator occupy space, regardless of where they are installed in the building. In the sub-attribute of this dimension, economic activities, and infrastructure, the

Resource is evaluated at \$ 159,601.67, which is the amount necessary for investment [10]. Finally, in all sub-attributes of the comfort perception attribute as N/A with high negative impact, given that none of these 4 sub-attributes can be analyzed mathematically, however, it is known that it generates visual pollution, noise pollution, olfactory pollution, and thermal pollution, especially the diesel generator [18].

In the technical-economic dimension, as already shown in the initial investment value, \$ 159,601.67 is considered in the evaluation of the implementation cost sub-attribute, in the other sub-attributes evaluated through mathematical analysis, 1.36% is obtained in the IRR, 6,634 in the NPV index, 36 months of payback, 25 years of useful life and 6,797.30 MWh in a volume of energy saved [10]. In the sub-attributes that are evaluated by external stakeholders, the Resource was evaluated as optimistic and indifferent in terms of technology and equipment and design and logistics, respectively.

In the political dimension, the last analyzed, the Resource is evaluated as optimistic in the organized societies, NGOs, and associations sub-attribute and indifferent in the generators, producers and distributors, governments, consumers, and legal aspects sub-attributes. Within the political instruments sub-attribute, the Resource is evaluated as positively consolidated, since there are already laws that safely positively regulate the Resource. In the tenure and/or ownership sub-attribute, the Resource is evaluated as N/A with high impact, since the goods, photovoltaic panels, and diesel generator, belong to the consuming company and, finally, within the energy integration sub-attribute, once it is dealt with self-production of energy, it should be considered that 6,797.30 MWh are saved, which, in turn, would be a demand on the electricity grid itself.

IV. OBTAINED RESULTS

After all the analyzes performed, the result is obtained according to the weight assigned to each dimension of the IRP, presented in TABLES 2, 3, 4, and 5, and according to the combination that is made between them, so that, with different interpretations and opinions be able to make the best decision as to which Energy Resource should be prioritized.

The following combinations are made to present the results:

Fig. 4: Equal division between the 4 dimensions: the Resource ranking is done with an equal weight of 25% for each dimension

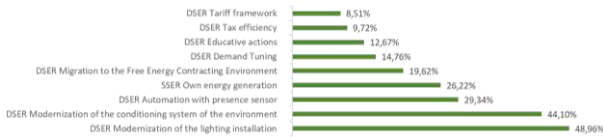


Fig. 4: Equal division between the 4 Dimensions

Source: self-elaboration

Fig. 5: division according to managers: ranking is done according to the average of the weights assigned by area managers, that is, decision makers

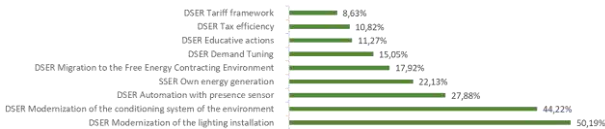


Fig. 5: Ranking according to managers

Source: self-elaboration

Fig. 6: Division according to operational employees: the ranking is based on the average of the weights assigned by the operational employees in each area.

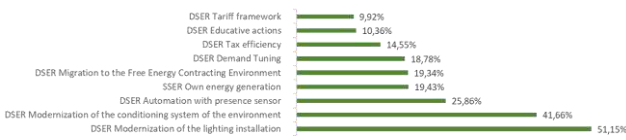


Fig.6: Ranking according to operational employees

Source: self-elaboration

Fig. 7: Division according to the vision of the sustainability department: in the ranking the averages of the weights assigned by the manager and operational employee of the area are considered.

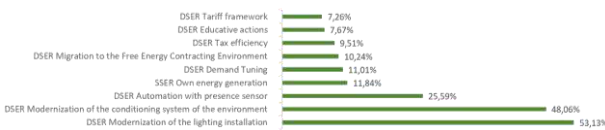


Fig. 7: Ranking according to the sustainability area

Source: self-elaboration

Fig. 8: Division according to the view of the supply department: in the ranking the averages of the weights assigned by the manager and operational collaborator of the supply department are considered

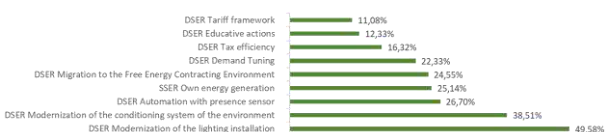


Fig. 8: Ranking according to the supply department

Source: self-elaboration

Fig. 9: Division according to the vision of the engineering department: the ranking is done considering the averages of the weights assigned by the manager and by the operational areas.

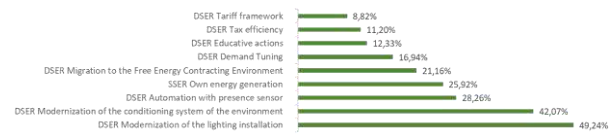


Fig. 9: Ranking according to the engineering department

Source: self-elaboration

Fig. 10: division according to the view of the teaching unit studied: ranking is based on the averages between the weights assigned by the manager and by the operating unit of the unit where the study is carried out

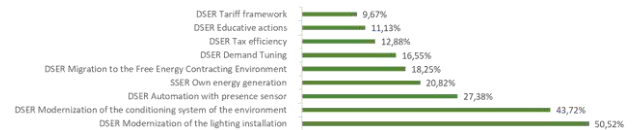


Fig. 10: Ranking according to the unit in which the study was carried out

Source: self-elaboration

Fig. 11: Division according to all stakeholders involved: the ranking considers all the weights assigned by all employees together, that is, the overall average for each dimension.

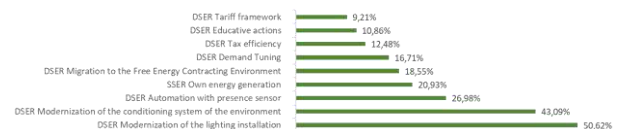


Fig. 11: Ranking according to all employees

Source: self-elaboration

V. CONCLUSIONS AND DISCUSSIONS

The work develops and validates the application of the CVPC method for valuation and ranking of Energy Resources in energy-consuming companies so that it can fill in the academic literature the gap that exists between studies on the valuation and ranking of Energy Resources applied to consumer companies. The fact that the method applied in this work uses the opinion of different internal company stakeholders as to the degree of importance in each Dimension, makes it unprecedented in the literature.

The work leaves as a legacy the proof to academics and professionals in the area that the application of the CVPC method, as described here, allows for obtaining the ranking

of Energy Resources in an energy-consuming company. The possibility of associating analysis methods developed in academia with their application in the corporate market is proven, thus enabling joint work between the corporate market and academic studies.

For future work, it is suggested that the same method is applied in the same teaching unit studied after having implemented one of the Energy Resources valued here, it is understood that the application of the best ranked Resource, in this case, DSER lighting, will change the profile of energy consumption in the unit and, therefore, it will modify variables used for valuing the other Resources. In addition to allowing the application in other teaching units of the same company as a possibility, given that the size, location, opening hours, etc., impact the energy consumption profile and, therefore, also impact the ranking of Energy Resources. And, finally, to enable the application of the same method in other companies from different economic sectors.

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Experimentation of the Solar Dryer with Parabolic Trough : Drying of Okra

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Abstract— According to Arthur S. EDDINGTON (1921): "I can prove nothing to you whether you do not let me make any measurements. Measurement is for me the only way to find the laws of nature. I am not a metaphysician". In order to confirm the performances of the indirect solar dryer, with cylindrical-parabolic collector, the performances noted by the numerical results and validated by the value of the Square Root of the Mean Systematic Error, RMSE, equal to 4.5°C, between the numerical and experimental temperatures of the heat transfer fluid, at the entrance of the drying cage, experimental tests of the said dryer were carried out, via the drying of the variety, Clemson spineless, of okra. The diffusion coefficient of dried okra pieces gave satisfactory results, $(16.49-22.72) \times 10^{-10} \text{m}^2 \cdot \text{s}^{-1}$ for cylindrical samples and $(6.24-15.59) \times 10^{-10} \text{m}^2 \cdot \text{s}^{-1}$ for longitudinal slices. These findings are consistent with the literature.

I. INTRODUCTION

Solar drying is the most common method of preservation, especially in many African countries. Unfortunately, this open-air conservation technique produces dried products of mediocre quality. Thus, in-depth studies have made it possible to correct the weaknesses of this technique as well as those of solar equipment, known as indirect solar dryers, with a plan collector [1-3].

These improvements do not always achieve the desired temperature level and drying time [4].

Therefore, the indirect solar dryer, with a solar-thermal converter, cylindrical-parabolic as an air insulator, seems to be a viable technical-economic compromise, avoiding the cost of improving the thermal performance of a flat plate collector, an alternative to the low energy density of the incident solar radiation [5] and finally, a good response to the problem previously mentioned [4]. To confirm this conclusion, tests related to the drying of okra were conducted. The results are presented here and compared to the literature data.

II. MATERIALS AND OPERATING PROCEDURES

2.1. Materials



Fig.1: Images of this dryer in use

2.2. Operation of the new solar dryer

The present dryer consists of a parabolic through, the actual surface of which is covered by an aluminium foil, with an opening width, $a = 50$ cm, a length of 100 cm, a focal length, $f = 10$ cm and a depth, $h = 15.6$ cm. Indeed, an optimal dimension of an absorber produces a maximum of useful energy, obtained by the reduction of optical and thermal losses. But, for a large dimension of the said absorber, it results in important thermal losses [6], also obviously a high realization cost.

The receiver is made of a thin steel sheet, rolled up, with a diameter of 10 cm and a length of 140 cm approximately, placed at the focus of the concentrator. The receiver is made up of two coaxial cylindrical tubes, one of which, made of glass, ensures the greenhouse and the second, made of blackened steel, serves as an absorber of the reflected solar flux. Therefore, the radiative and convective losses are minimized. Also, the losses by convection are reduced by the presence of the vacuum in the annular space between the absorber and the glass.

The whole unit is inclined at 12° to the horizontal, to favour natural convection movements towards the outlet.

In figures 1, the different images of the experimental set-up, in use (a) and at the end of drying (b), are shown.

The choice of the tubular configuration of the receiver is linked to the fact that the tracking of the sun, in its daily apparent course by the present sensor, is not automatic, thus the solar beam making an angle with the axis of symmetry, does not focus any more correctly!

Built of local materials with sides and bottom insulated with thin polystyrene, the parallelepipedic drying chamber contains trays spaced from each other, arranged in a square face, made of wooden frame and metal grid, on which the products are spread. Access to the trays is possible through a door placed in the back side of the drying chamber.

2.3. Procedure

The okra variety used in our experiments was Clemson Spineless (figure 2). This is the variety that we found available at the place of purchase and its optimum production is in the off-season, when it is very successful because of the very high prices of okra at that time. It is an early variety and very productive (25 to 30 t/ha). It was bought very early in the morning (around 06h) in a field. After the purchase, when arriving at the site of the experiments, samples were sorted according to their length and diameter. To prepare them, the stems and the end of the cap had to be cut. We had then proceeded to different cuts,

including: the cylindrical cut (heights 1 cm, 1.5 cm and 2 cm) and the longitudinal cut in two sectors (lengths 1cm, 1.5cm and 2 cm). Finally, these samples were

weighed, arranged on racks and placed in the oven. All these steps are shown in figure 2.



Fig.2: Stages of drying

III. EXPLOITATION OF THE RESULTS

3.1. Dry mass and initial water content

To obtain the dry mass, m_s , of the various dried samples were placed in an oven, brand Memmert at 70°C for 24 hours [7]. After this stay in the oven, the dry mass of said sample is noted, m_s . Therefore, the initial water content in dry basis X_0 is determined according to the following equation (1):

$$X_0 = \frac{m_0 - m_s}{m_s} \tag{1}$$

3.2. Water content and absolute humidity of okra

The water content in dry basis $X(t)$ during drying at a time t is determined by the mathematical expressions (2) and (3):

$$X(t) = \frac{m(t) - m_s}{m_s} \tag{2}$$

Or again

$$X(t) = \frac{m(t)(X_0 + 1) - m_0}{m_0} \tag{3}$$

Where $m(t)$ is the mass of the okra at each time t of drying and m_s its dry or anhydrous mass

The wet basis or absolute moisture content of the product is X_h determined according to the expression of P. Monneveux (1991) [8]:

$$X_h = \frac{m(t) - m_s}{m_s} \times 100 \tag{4}$$

With m_0 , the initial mass (or fresh mass) of the okra.

The relations that allow us to go from one definition to the other are equations (5) and (6):

$$X = \frac{X_h}{1 - X_h} \tag{5}$$

and

$$X_h = \frac{X}{1+X} \tag{6}$$

3.3. Drying speed

It allows to evaluate the quantity of water lost in the different dried okra samples per unit of time. It is determined according to the following relationships (7), (8) and (9):

- At $t = t_0$ $V_0 = \frac{X_1 - X_0}{t_1 - t_0}$ (7)

- At $t = t_i$ ($i = 1, 2, \dots, n-1$)
 $V_i = \frac{X_{i+1} - X_{i-1}}{t_{i+1} - t_{i-1}}$ (8)

- At $t = t_n$
 $V_n = \frac{X_n - X_{n-1}}{t_n - t_{n-1}}$ (9)

3.4. Diffusion coefficient

The diffusion coefficient gives us an idea of the speed of movement of water and the amount of water passing through a given surface. It is obtained by applying the analytical solution of Fick's second law for biological products, depending on the cutting geometry of the product [9].

➤ Cylindrical cutout

$$\frac{\partial X}{\partial t} = \frac{1}{r} \left(\frac{\partial}{\partial r} \left(D r \frac{\partial X}{\partial r} \right) \right) \tag{10}$$

➤ Longitudinal cut

$$\frac{\partial X}{\partial t} = D \frac{\partial^2 X}{\partial x^2} \tag{11}$$

The analytical solution of these equations is given by equalities (12) and (13), taking into account the cutting shapes.

☞ Cylindrical cutout

$$MR = \frac{X_t - X_{eq}}{X_0 - X_{eq}} = \frac{4}{\beta^2} \exp\left(-\frac{\beta^2 D t}{r_c^2}\right) \tag{12}$$

☞ Longitudinal cut

$$MR = \frac{X_t - X_{eq}}{X_0 - X_{eq}} = \frac{8}{\pi^2} \exp\left(-\frac{\pi^2 D t}{4L^2}\right) \tag{13}$$

Where, MR is the water content rate, X_t , X_{eq} and X_0 (in g/g_{waterms}) are respectively the average, equilibrium and initial water content of the product; D (m².s⁻¹) is the diffusion coefficient; r_c (m) is the radius of the cylindrical cut; L(m) is the characteristic length of the longitudinal slice; and t(s) is the drying time.

IV. RESULTS AND DISCUSSION

4.1. Dry mass and initial moisture content of okra

We placed 107.52 g ± 0.01g of fresh okra (m_0) in the oven, set at 70°C for 24 hours. At the end of this stay, the dry mass of the said sample (m_s) was recorded and is worth: 12.82g ± 0.01g. Thus, the value of the initial water content is obtained, using equation (1). It is worth :

$$X_0 \approx 7.38 \text{ g}_{water} / \text{g}_{ms} \text{ or in wet basis,}$$

$$X'_0 \approx 88.07\% .$$

This value is consistent with the literature. Indeed, the range of initial moisture content of okra is 88-90% and the final moisture content is 5-10%, in wet basis [10].

4.2. Influence of cut shapes

Two different shapes of cut (round and longitudinal), of varying height and length (1cm and 2cm), were made. The initial mass of the product to be dried was 207.7g for each of the 4 cuts. The drying process started at 8:30 am and stopped at 5:30 pm on the first day, then continued the next day from 8:05 am to 5:05 pm, a period during which the solar radiation was good.

At the end of this experiment, the mass results of the samples are presented in Table 1.

Table 1: Balance sheet for the firstday of drying okra

Cutting shapes	Initial weights	Final weights	Discharged water mass
Long, 1cm	207.7g ± 0.1g	37,3g	170,4g
Length, 2cm	207.7g ± 0.1g	49,7g	158,0g
Round, 1cm	207.7g ± 0.1g	80,2g	127,5g
Round, 2cm	207.7g ± 0.1g	100,1g	107,6g

According to this data, the longitudinal cuts have evacuated more water than the cylindrical slices and therefore dry faster than the latter.

Also, the amount of water evacuated depends not only on the shape of the cut, but also and especially on the size (length and/or height) of each piece. This will be verified later (Table 3) with regard to the values of the diffusion coefficient of each of the said samples.

Table 2: Results of okra drying on second day

Cutting shapes	Initial weights	Final weights	Discharged water mass
Long, 1cm	36,3g	22.3g ± 0.1g	14,0g
Length, 2cm	48,2g	22.4g ± 0.1g	25,8g
Round, 1cm	78,8g	22,5g ± 0,1g	56,3g
Round, 2cm	98,1g	23.2g ± 0.1g	74,9g

Differences in final weight due to cut shape and size (length and/or height) were observed on dried samples. The reduction in moisture content of okra during the first day was higher than that found on the second day, based on the values shown in Table 2. A similar fact was found by Wankhade et al (2013) [11]. The amounts of water lost decreased much more on the second day than on the first day. An opposite finding to the first day is noticeable on the second day of drying, regarding the amount of water lost in the same samples. The slices that lost more water on the first day lost less this time. This is certainly due to physical deformations (shrinkage) of the structure of samples and to the level of the pores, blocked by soluble nutrients (salt and sugar). A fictitious "drying front" line was formed, moving from the hot air attack front to the product exit surface, beyond which the air will be unable to dry further [12].

4.3. Influence of the cutting shape on the drying speed

Figure 3 shows the influence of the cut shape on the drying speed. These are the longitudinal (1cm and 1.5cm) and cylindrical (1cm and 1.5cm) cuts. The drying speeds are monitored as a function of drying time.

We notice on these graphs (a and b) that the drying speed of the longitudinal cut is higher at the beginning of the drying than that of the cylindrical piece. After about 4 hours of drying, the situation is reversed until the end. This could be related to the exchange surface between the air and the product, which is larger for the longitudinal slice.

4.4. Influence of product location on drying speed

The location of a product to be dried in the drying chamber influences the drying process, in particular the drying speed, as can be seen in figure 4.

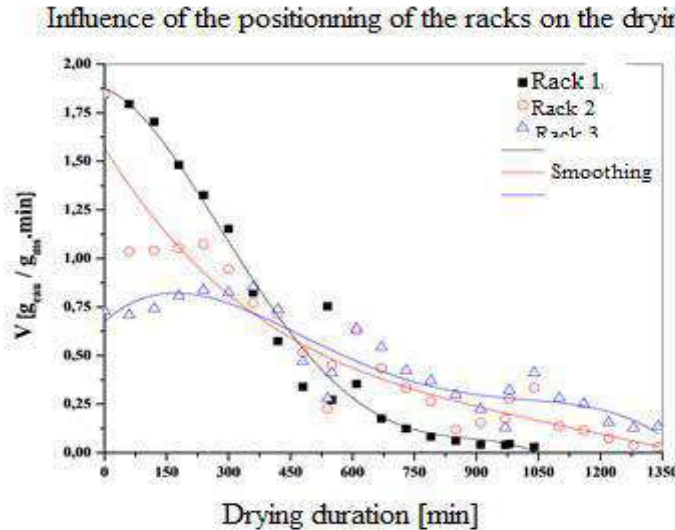


Fig.4: Influence of the positioning of the racks on the drying speed

The three curves obtained by smoothing all have two phases and two periods:

- ☞ During the first period, from 0 to 450 minutes of exposure, the loaded racks give a decreasing speed. Also, the speed of the sample on rack n°1 is higher than that of the next rack, which in turn is higher than the speed of the last rack.
- ☞ During the second period (more than 450 minutes), the drying speed of each of the racks

is reversed, due to the collapse of the samples, thus blocking the water migration phenomenon of the product.

4.5. Diffusion coefficient values

The experimental data allow us to determine the diffusion coefficient of two cuts of okra, longitudinal and cylindrical, recorded in table 3.

Table 3: Diffusion coefficient values, *D*, of okra slices

Cutouts	Dimensions (cm)	$D_{eff}(\times 10^{-10} m^2.s^{-1})$
Longitudinal	Long = 1	6.24
	Long = 2	15.59
Cylindrical	h = 1	22.72
	h = 1.5	20.48
	h = 2	16.49

The values of the diffusion coefficient obtained make it possible to appreciate the present drying technique. The higher the diffusion coefficient, the faster the transfers. In the present work, the diffusion coefficient of the cylindrical cutout shows this.

Diffusion was faster in the lower height samples than in the higher ones. This shows that the diffusion takes place in the direction of flow of the drying air.

In the longitudinal slice samples, the phenomenon is reversed. Indeed, the quantity of water contained in the longitudinal slice of 1cm is less important than that of 1,5cm length.

The diffusion is higher in the cylindrical cut than in the longitudinal cut. This may be related to the fact that following the longitudinal cut arrangement in the dryer, on the skin, constituting braking to heat transfer in these samples during drying [13].

Otherwise, the longitudinal samples have less water to evacuate than the cylindrical ones; this partly justifies the values of D (diffusion coefficient).

Compared to the literature, we have the data grouped in Table 4.

Table 4: Diffusion coefficient of okra in the present work and in the literature

Authors	$D_{\text{eff}} (\times 10^{-10} \text{m}^2 \cdot \text{s}^{-1})$	Cutouts	Dimensions
G. Ouedraogo	6.16	Longitudinal	
Présent work	16.49 – 22.72	cylindrical	R = 0.7cm
Dadali et al.	20.52 – 86.17		
I. Doymaz	4.27 – 13.0	Whole okra	

The differences could be justified either by the drying conditions; some of them are done with the help of microwave, or by the effect of temperature which influences the drying [13-14], or related to the thickness of the sample [15-17], to the varieties of okra, to the type of drying equipment used, globally to the operating conditions and other uncontrolled parameters.

V. CONCLUSION

A cylindro-parabolic, solar-thermal converter was manufactured and attached to a drying cage, thus forming an indirect solar dryer. In this article, we conducted an experimental campaign of the said dryer, via the drying of okra, of the Climson spineless variety. The diffusion coefficient values of the different dried okra samples indicate the performance of the present dryer. These coefficients take into account the shape and size of the dried okra slices.

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Quality Performance Index of the Hotel Sector in the Municipality of Guajará-Mirim, Rondônia: Use of the Varimax method as an analytic model

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Keywords— Index, Hotel sector, Varimax

Abstract— Objective: To build the quality performance index of the hotel sector in the city of Guajará-Mirim, on the border with Bolivia, based on the Varimax method. Method: The Varimax method was used as an analytical research model. The IDQSH questionnaire used is structured with 4 parameters and 15 variables. The questionnaire was applied after signing the Informed Consent Term - FICF. Data were collected from the guests of ten hotels that were randomly selected. The Sector Quality Performance Index - IDQSH was calculated following the Factor Analysis techniques. Result: the result found allows pointing out the classification among the hosting means. The hotels where the quality performance was considered “Good” are, in descending order of the IDQSH: A (0.542), F

method, Guajará-Mirim.

(0.529) and D (0.514). In the quality standard considered "Bad" are the hotels, also in descending order of the IDQSH: H (0.483), B (0.467), E (0.452), C (0.433), G (0.393) and J (0.369). Hotel I, with an index of 0.276, achieved the classification that indicates a "Terrible" quality performance. Final Considerations: The Quality Performance Index in Hotel Services (IDQSH) of the municipality of Guajará-Mirim obtained an index of 0.445, considered "Bad", according to the adopted classification.

I. INTRODUCTION

Tourism is one of the fastest growing tertiary sector activities in the world, according to data from the report prepared by the World Economic Forum. In Brazil, these estimates are no different. The development of tourist activity in Brazil, which is linked to the natural beauties and cultural diversities spread over its 8, 514, 876 km², leaves nothing to be desired for the great and important world destinations, such as the beaches in Central America, for example. The Brazilian Tourism Company - EMBRATUR has revealed that this activity contributes with more than 3% of national income from the export of goods and services, as well as being responsible for the creation of more than 7% of direct and indirect jobs in the Brazilian economy [1]. Given this, it is clear that the countless possibilities of tourist practices in Brazil, ranging from business tourism practiced in large cities, to ecotourism, a tourist modality popularized by Lascurain in "Ecotourism: the potential and the pitfalls, as the activity used observation and practices with nature [2]. This tourism modality committed to the environment tends to develop mainly in regions that have an ecological diversity that is still preserved, such as the States of the North region that integrate the immense Amazon forest in Brazilian lands. With this, the development of ecotourism in lands such as the state of Rondônia, more specifically the city of Guajará-Mirim, which has a rich natural, historical and cultural potential, and has an average flow of 360 visitors / tourists per day and , approximately 131,400 per year, which means more than triple the population of the municipality, must necessarily be based on a tourist infrastructure and quality services as an attraction factor. A service without quality and performance below expectations can mean the death of a business in tourism, as the authors warn Cobra [3]; Cobra [4] and Cobra [5].

Tourism is an important vector of endogenous development in Guajará-Mirim. According to Barreto [6], the distribution of tourist resources produces direct and indirect impacts on about 53 items of the economy of a location, as well as impacts on the dynamics of significant productive sectors in different places. Thus, in addition to presenting significant data in the economic field, tourism

influences important socio-cultural aspects of a location, as it constitutes a complex combination of interrelationships between service production, whose composition is integrated into a social practice with cultural base with historical heritage, a diverse environment, natural cartography, hospitality social relations, exchange of intercultural information. The sum of this sociocultural dynamic generates the phenomenon, filled with objectivity, consumed by millions of people, as a synthesis of the tourist product [7]; [8]. Therefore, the factors of tourist attractiveness in a given territory are constituted by natural or artificial (human) elements, which materialize as tourist destinations. Thus, Yázigü [9]; [10]; [11] clarifies that for a place to be considered touristic, it must have three basic characteristics: Have a relative tourist frequency; Provide support services and equipment as a tourist infrastructure (hotels, restaurants, tourism agency, among others) and have a tourist image projection for visitation.

However, it is necessary that local actors feel part of the structuring process of tourism in a given location, as, if this aspect is not met, the chances of success are drastically reduced. According to Melián-González; García-Falcón [12], competitiveness reveals that to increase this factor, tourist attractions, whether natural or artificial, and the action of local actors are necessary. For Loiola [13], the development of a location would result from the capacity of its actors to structure and mobilize, based on their potential and cultural matrix. In this sense, Cunha; Cunha [14] states that the integration of society, the environment and the economy of a locality would enable sociocultural diversities and productive differences, which would be used as potential for transformations and regional development. Thus, according to Nicolas [15], the tourist activity would have the capacity to create, transform and even value different spaces that might not have value in the context of the production logic. This context is reflected in the local reality of the state of Rondônia, which experiences the polarization of development in the Eastern Mesoregion of Rondoniense, leaving the Madeira-Mamoré Mesoregion, more specifically the city of Guajará-Mirim, the role of "faithful depository" of immense reserves, which

compromises its development in other areas of traditional economic activity [16]; [17].

Thus, Cavalcante [17] cites ecotourism as an alternative capable of boosting the local economy, since the city of Guajará-Mirim presents a combination of favorable elements, such as natural, historical, cultural and social factors, in addition to a strategic position in the region, in addition to the relationship with some South American countries. The development of ecotourism in the city of Guajará-Mirim is a vector of integrated and sustainable development in the region of Guajará-Mirim, in Rondônia, aiming at a healthy and balanced development process capable of boosting the local / regional economy, as well as capable of valuing local identity through respect for the environment, folklore manifestations and regional culture [16].

Knowing the IDQSH of the hotel sector in Guajará-Mirim/RO, allows the public power and the private sector, specifically the sectors directly linked to the hotel activity, a better understanding of the importance of quality as an essential factor of competitiveness in the tourist market, which, in the specific case of this study, it forms the foundation for a desirable process of local development. Therefore, this work aims to supply the scarcity of information about the subject in the referred region, which, in general, is known as one of the most important in the state of Rondônia in the tourism segment. In light of this scenario, the general objective of this study is to build the quality performance index of the hotel sector in the city of Guajará-Mirim, on the border with Bolivia, based on the theory of endogenous development, using the Varimax method as a model of analytical research.

II. METHOD

2.1 Type of Study

The research was structured based on aspects of interdisciplinary research given the complexity involved in the topic. This is a hypothetical-deductive study. For the study from a qualitative point of view, interviews were carried out with guests in the different types of accommodation surveyed, following a standard model of a pre-elaborated questionnaire.

2.2 Analytical Research Model

The VARIMAX method is a process where the reference axes of the factors are rotated around the source until some other position is reached. The objective is to redistribute the variance of the first factors to others and to achieve a simpler and more theoretically significant factorial [18], [19], [20], [21], [22], [23], [24] and [25]. The choice of

factors was carried out through the technique of latent root. So, the array of factorials loads, which measures the correlation between the common factors and observable variables, is determined by means of the correlation matrix, as Dillon and Goldstein [21].

In order to determine the Hotel Services Quality Performance Index - (IDQSH) the factorial score matrix estimated by the orthogonal-based factorial rotation process was used, as pointed out by Santana [23]. The factor score places each observation in the common factors gap. For each factor F_j , the i -th factor score extracted factorial score is defined by F_{ij} , expressed as follows [21]:

$$(2)$$

Then:

b_i = are the estimated regression coefficients for the n Common factorials scores;

x_{ij} = Are the n Observations of p Observable variables.

$$i = 1,2,\dots,N.$$

$$j = 1,2,\dots,p.$$

To reach the equation that is the perception index [21]; [22], show the sequence evolution of the formulas from the previous equation. It turns out that even if the variable F_{ij} is not observable it can be estimated through the factorial analysis techniques, using the matrix of observations of the vector x of observable variables. In factorial notation, equation 2 becomes:

$$(3)$$

In Equation 3, F is the matrix of the estimated regression from the n Factorials scores and it can be affected by both the magnitude and the measurement units of the variables x . To work around this kind of problem, replace the variable x by the standard variable w , given the ratio of the deviation around the average and the standard deviation of x , as follows:

$$\frac{x_i - \bar{x}}{S_x}$$

With these values, Equation 3 is modified making equation 4 possible, then:

$$(4)$$

Based on equation 4, the beta weights matrix (β) with q standardized regression coefficients, replaces b , given that the variables are standardized on both sides of the equation. Pre-multiplying both sides of equation 4 by the value w' , in which n Is the number of observations and W

is the transposed matrix of w' , it makes it possible to reach the following equation:

$$\frac{1}{n} w'_{(p,n)} F_{(n,q)} = \frac{1}{n} w'_{(p,n)} w_{(n,p)} \beta_{(p,q)} = R \tag{5}$$

The Matrix $w'w$, therefore is the matrix of intercorrelated variables or correlation matrix among the observations of the matrix x , designated by R. The Matrix It represents the correlation between the factorials scores and the factors themselves, denoted by Λ . With this, rewriting the equation 5, one must:

$$(6)$$

If the matrix R is non-singular, one can pre-multiply both sides of equation 6 by the inverse of R, obtaining:

$$(7)$$

Substituting the β vector into equation 4, we obtain the factorial score associated with each observation, as follows:

$$(8)$$

The main formula of the perception index is reached where the IP is defined as a linear combination of these factorials scores and the proportion of the variance explained by each factor in relation to the common variance. The mathematical expression is represented by the following formula:

$$(9)$$

Then:

$$i = 1, 2, \dots, n.$$

λ = is the variance explained by each factor;

$\sum \lambda$ = is the total sum of the variance explained by the set of common factors.

The factorial score was standardized (FP) to obtain positive values from the original scores and allow the hierarchies of the cities as the values of the performance index are located between zero and one. The formula that allows this tiering can be seen by the following equation:

$$FP_i = \left(\frac{F_i - F_{min}}{F_{max} - F_{min}} \right)$$

It can be seen that And are the maximum and minimum values observed for the factorial scores associated with the parameters observed. It is based on this understanding that it was possible to calculate the Hotel Services Quality Performance Index - (IDQSH) adopted in this study.

2.3 Scale Levels

The classification used by the research to express the results achieved by the IDQSH is described in table 1.

Table 1: Analysis scale adopted by the research.

IDQSH	Classification
> 0,900	great
0,701 - 0,900	very good
0,501 - 0,700	good
0,301 - 0,500	bad
0,000 - 0,300	terrible

Source: adapted from Hair et al[18].

2.4 Parameters and Variables

The IDQSH questionnaire used is structured with 4 parameters and 15 variables. Physical Structure, Service, Services and Daily Value are the Parameters. Accommodations of the lodging medium; Physical Space of Housing Units; Decoration of Housing Units; Comfort of Bed and Furniture; Ventilation and Absence of Noise from Housing Units; Garage location and layout; Ease of making reservations; Hospitality and care in attendance; Accuracy and Agility; Availability to Listen to the Guest; Ability to solve problems; Quality and Speed in Cleaning Services; Domain of other languages; Variety in the Menu of Meals and Benefits compatible with the Price charged, are the Variables.

2.5 Characterization of the research site

The city of Guajar-mirim, according to the Municipal Tourism Secretariat, had 23 lodging facilities, including 9 inns, 13 hotels and one Resort, to meet the accommodation needs of its visitors. The choice of the ten researched means of accommodation was made due to the scarcity of time and resources available to carry out the process. Thus, the choice of means of accommodation was made based on random criteria. Ten hotels were randomly selected, identified as follows: Hotel "A" Pakkas Palafitas; Hotel "B" Maylla Park hotel; Hotel "C" Jamaica Hotel; Hotel "D" Las Gardenias; Hotel "E" Lima Palace Hotel; Hotel "F" Fortaleza Palace Hotel; Hotel "G" Hotel Campos; Hotel "H" Guajar Pousada; Hotel "I" Hotel Gacha and Hotel "J" Hotel Mini Estrela.

2.6 Data Analysis

The statistical tool SPSS (Statistical Package for Social sciences) was used, which enabled the application of mathematical knowledge and allowed the construction of the IDQSH based on the results of the questionnaire.

2.7 Ethical Aspects

The questionnaire was applied after signing the Informed Consent Form – TCLE.

III. ANALYSIS AND DISCUSSION OF RESULTS

3.1 GUEST PROFILE CHARACTERIZATION

The research made it possible to trace the profile of guests in the means of accommodation in the city of Guajará-Mirim, a Brazilian city that borders Bolivia. The following variables were considered: Gender, Age, Education, Income level, Place of birth, Current residence, Frequency of visits to the city and Length of stay in the city.

Male guests prevail. In some hotels the prevalence of male guests reaches 90%. The hotels that predominate female guests can be explained by the location close to the municipal bus station and the ease of transport between the hotel and the crossing point for Bolivia. This fact can be explained by the location of the aforementioned hotel in relation to the municipal bus station and, also, the price charged by the establishment. Thus, it can be inferred that they are mostly street vendors coming, in general, from Porto Velho, through the formal bus line, which aims to shop in Bolivia, and then resell in the informal market in Porto Velho, capital. of the State of Rondônia.

In relation to age, which most lodging establishments presented, in general, an almost uniform distribution. However, when adopting the same analysis performed previously for responses with 50% or more, it was found that in 20% of the accommodations guests are in the range of up to 30 years (Hotel A and G), 30% in the range of 31 to 45 years (E, H and J) and another 20% in the age group from 46 to 60 years (D and I). There was no significant record for respondents over 60 years of age.

Regarding the level of education, it is observed in Graph 3 that in 40% of the means and accommodations, the guests interviewed declared having only elementary education level, in 41% of them reported having secondary education and only in 19% of these establishments the guests declared to be of superior level. Only hotel "A" 80% of guests have a university degree. Fifty percent or more of guests with elementary education were identified in accommodation facilities B, C, D, H, I and J. Hotels E, F and G had the highest percentages for secondary education.

As for the income level of the interviewees, it can be observed that 20% of the guests declared having an income of 1 to 3 minimum wages, 40% reported receiving 3 to 8 minimum wages and 30% declared receiving more than 8 minimum wages. The highest percentages with incomes from 1 to 3 salaries were in hotels H and J, while hotels A, D, G and J had the highest percentages of 3 to 8 minimum salaries and hotels B, C and F had more than 8 minimum wages.

The origin of the guests presented relatively uniform percentages in the North, South, Midwest and Northeast regions. Considering only the responses above 50% among the respondents of the surveyed means of accommodation, the hotels that presented the highest percentages with a native of Rondônia were B, D, G, H and I.

The results show that in 90% of the means of accommodation, respondents said they reside in Rondônia and only 10% declared that they currently reside in other states in other regions of Brazil. Only the Pakaas Novos hotel is the only one to attract a number of guests from other states more significantly, with 70% of guests from other regions of Brazil. This aspect is explained by the characteristics of the lodging facilities included in the Hotel Resort category, such as the pakaas hotel, where nature is the main product of attractiveness. When considering only responses above 50% among respondents, it was observed that the means of accommodation with the highest percentages residing in the State of Rondônia were, in descending order: B, C, I, D, F, G, H, J and E.

The results show that 80% of guests are visiting the city more than once. Guests visiting the city more than once constantly stay at hotels J, C, D, E, G, H, F and I.

Sixty percent of guests visit the city 1-2 times a year and 30% 3-5 times a year. Hotels D, E, F, C, H and J were the most that received guests 1 to 2 times a year

The length of stay of guests in the city helps to better understand the dynamics of the tourism sector in Guajará-Mirim. This information can be useful in the hotel planning process, as it indicates, together with feedback to hotels about the quality of their services in the city, and be translated as an indicator of attractiveness that can influence the decisions of guests. Eighty percent of guests stay in town for 2-3 days. The hotels that stayed the most between 2 and 3 days were hotels D, H, C, E, B, F, G and J.

3.2 FACTORS DETERMINING THE CHOICE OF ACCOMMODATION

3.2.1 Physical Appearance of Facilities

The physical appearance of the facilities are generally responsible for the first impressions that a guest may have about the establishment in which they will be staying, hence the importance of knowing how much it can influence the choice of a client/user. Fifty percent of surveyed guests say that the physical appearance of a hotel's facilities is not important when choosing. The hotels in which guests answered that their physical appearance was not very important in their choice were in descending order: I, G, J, A and E.

3.2.2 Hospitality

It is known that the act of “welcoming”, as an attitude of being hospitable, influences the choice of clients/users of the means of accommodation. Forty percent of the surveyed guests said that the hospitality of a hotel is relatively important when choosing and only 10% said it is important or very important when choosing the means of accommodation. This criterion was one of the most discredited by guests. It was verified that guests who registered responses in the “relatively important” (RI) category were in hotels A, B, F and G. Guests at hotels J and H stated that this criterion is “important” (I) and “very important” (MI), respectively.

3.2.3 Quality of hosting services

Ninety percent of guests are concerned about the quality of hotel services. Sixty percent answered that it is important (I) the services offered by the hotels. However, this service is not offered to guests. Most hotels have deficiencies in the services offered to guests.

3.2.4 Daily Value of Hosting

This parameter refers to the amount paid by guests for the daily rate, which also influences the choice of a means of accommodation. Based on Graph 13, it is possible to observe that 30% of the means of accommodation surveyed (A, D and H) based on the responding guests, declared that the daily rate is "important" and 20% of them (B and G) declared be this parameter “very important” (MI).

3.3 SUMMARY OF THE QUALITY PERFORMANCE INDEX OF THE HOTEL SECTOR

Based on the calculation of the IDQSH of the ten means of accommodation surveyed, it was found that in the general average, the result pointed to an index of 0.445. Given the scale adopted by the research, it can be noted, therefore, that, in general, the performance of the quality of hotel services in the city of Guajar -Mirim presented a level of quality considered Bad.

Hotel A had the best performance with an index of 0.542. Hotels F and D had rates of 0.529 and 0.514, respectively. Therefore, due to the scale adopted, these hotels are at a level of Good performance.

The vast majority of hotels have indexes between 0.301 to 0.500 considered as a Bad index. These indexes were found in hotels H, B, E, C, G and J. Hotel I was the one with the worst result, reaching an index of 0.276, considered a Terrible index by the adopted scale.

The result found allows us to point out the ranking among the searched means of hosting. For hotels where the quality performance was considered “Good”, they are, in

descending order of the IDQSH: A (0.542), F (0.529), and D (0.514). In the quality classification scale considered “Bad” are the hotels, in descending order of the IDQSH: H (0.483), B (0.467), E (0.452), C (0.433), G (0.393) and J (0.369). Hotel I, with an index of 0.276, reached the classification that indicated a “Terrible” quality performance.

Table 2: IDQSH of hotels in Guajar -Mirim.

Hotel	IDQSH	Classification
A	0,542	good
F	0,529	good
D	0,514	good
H	0,483	bad
B	0,467	bad
E	0,452	bad
C	0,433	bad
G	0,393	bad
J	0,369	bad
I	0,276	terrible
Average	0,446	bad

Source: Search result

Based on the result presented, it can be seen that the quality of services offered by hotels in Guajar -Mirim may be influencing the decision of tourists, which leads to underutilization of the city's hotel capacity. With this, it helps to explain why some tourists prefer to stay in the city of Guayar -Mirin in Bolivia and other tourists do not stay in hotels in Guajar -Mirim, returning immediately after their tours or business in the city.

3.4 SUMMARY OF GUESTS' OPINION ON THE POSSIBILITY OF THEIR RETURN AND LOCAL TOURISM

3.4.1 Guest Return to the Accommodation Means

Although the IDQSH has presented a result considered Bad for most hotels, the respondent guests affirmed, almost hegemonically, that they would return to stay in those means of accommodation. Despite the poor conditions of some hotels, this result would at first indicate a positive feedback. What may seem like satisfaction may also indicate the lack of alternative hotels with better quality in the city.

The hotels that respondents said they would stay again, even with their deficiencies, were hotels A, B, C, D, E, F and G (100%), and hotels H, I and J (90%). There is a prevalence regarding the return to the hosted hotel. This context seems to be paradoxical. Despite the poor

conditions, guests would return to stay at the same hotel.

3.4.2 Tourism as a development vector in the opinion of guests

Hotels A, B, C, D, F, G, H and J were unanimous in recognizing that tourism is a vector of development for the city of Guajar-Mirim. For hotels E and I, this rate was 90%.

Beni [26] raises the importance of service quality, comparing hotel enterprises with other industrial and commercial establishments as follows: While in the industry it is possible to plan the right amount of equipment, facilities and personnel for a certain type of production, the same does not occur with the hotel industry, which waits for the client to put its operational plan into action. The hotel product is static. The consumer must go to him. Industrial or commercial companies, on the other hand, make the product reach the customer. The costs of the hotel operating scheme are fixed. The hotel company, when compared to other types of companies, is less prone to automation, as personal treatment, human warmth, is an essential part of providing hotel services [26].

There are several internal and external factors that influence the process of purchasing a hotel good or service [27]; [28]; [29]; [30]; [31]. The basic factors that influence guests when choosing a hotel for business tourism, for example, are: location, comfort, apartment maintenance, daily rates, belonging to a business center service network, food and beverage services, fitness center facilities and loyalty programs [32]. In this sense, the housing units (UHs) smelling musty, the lack of courtesy and professionalism of the employees, the shower with low water pressure, a breakfast with little variety, an uncomfortable work area in the apartment, the delays Excessive check-outs and poor maintenance in the apartment are some of the factors that tend to go against the quality of hotel services. In general, the Accommodation Means are Housing Units - UHs that are actually the space, reachable from the main areas of common circulation of the establishment intended for use by the guest, for their well-being, hygiene and rest. And they are classified into: I – bedroom – HU consisting of, at least, a bedroom for the exclusive use of the guest, with an appropriate place to store clothes and personal effects. II - apartment - HU consists of the previous item, a bedroom plus private bathroom and: III - suite - HU consists of apartment II, plus living room.

Organizations permanently seek to "manage images" with some appeal for their audience to position themselves positively in the market [33]; [34]. With this, it is understood that the physical structure and the decorative

ambience of a hotel's accommodations are responsible for forming the first impressions and expectations, which pay attention to the cumulative satisfaction of the user's esteem and self-fulfillment needs. Scenarios or environments are influential elements in the public's perception of service encounters, as tangible attributes often pointed out by consumers as having the greatest influence on satisfaction and service quality [35].

About how people create and manage impressions in front of an audience, comparing them with the performance of service providers, it was noticed that they are always looking to create and even maintain good impressions with their target audience [36]. The layout of the facilities, furniture and other tangible elements are responsible for transmitting value-added messages to customers about the service they are purchasing, as it is through them that the customer can also assess the company's positioning, as well as the notion of value of the service offered [37]. According to the Forum of Hotel Operators of Brazil (FOHB), the costs of renovations in the means of accommodation vary according to the scope and state of refurbishment, and the ideal would be to allocate a fund around 5% to replace its assets. This concern with design, according to Schewe and Smith [38], would make it possible to establish a specific style of establishment in the market, in the sense of providing psychological satisfaction (status) in the enjoyment of its services by customers. However, physical appearance alone is not a single decision factor available to a guest. Thus, other factors may also be influencing this decision. Satisfaction, in this case, is a preponderant factor that goes beyond the physical aspect of the enterprise, as other elements are embedded in this vision. However, as satisfaction is practically inseparable from marketing, the concept presented is based on this perspective: The incessant search for ways to please consumers, offering products and services to win and keep them, and profiting from this activity, is what characterizes the market-oriented company that practices marketing concepts efficiently [39].

Quality is a term originating from the Latin *qualitate* which, according to Albrecht [40], is correlated with the way in which a good or a service experience satisfies a need, solves a problem or adds value to the customer. From the point of view of hotel products and services, quality makes it possible for the customer to meet their needs and, for the company that adopts TQM (total quality management), greater possibilities to stand out in the market, as the term quality: It is a real find for companies, in other words, it is the solution found so that a hotel or hotel chain can have a competitive advantage over competitors [41]; [42] and [43]. Total quality management

or “Total Quality Management” consists of a management strategy oriented towards quality in all organizational processes, using the PDCA cycle (Plan Do Check Act Correct) [44]. In this sense, quality gains the status of a very important competitive factor in the provision of tourist services, since in a market full of tourist service providers, a company needs to offer more and better services as customers can choose to obtain the same product tour from another supplier. To be successful, a tourism organization needs to understand the meaning of quality for the future customer, and strive to improve the quality of the service offered. Only then will customers keep returning again.

These and other literary definitions assigned to the term quality are summarized by Garvin [45] in five main approaches, supported by Paladini [46]. The user-based approach is the most comprehensive of all, as, when concerned with the consumer, it is understood that the company is automatically serving the others. In these terms, quality is a competitive weapon based on capturing the desires, needs and expectations of customers, which must be put into practice before the competition [41]; [42] and [43]. Quality can also be often related to the level of customer satisfaction as presented by Kotler [48] and Slack et. al. [49] in three possible situations: When customer expectations are greater than their perceptions: the quality is good; When the customer's expectations are equal to their perceptions: the quality is acceptable. Quality would lie in the identification of service encounters that constitute true decisive moments of interaction with the customer in order to always improve the services provided to customers / users, acting, for example, in the greater qualification of employees, in a process of improvement that continually surprises the clients [41]; [42]. Also according to the same author, hotel companies that only provide basic and essential attributes valued by customers would be doomed to exit the market, as, to establish a strategy with a competitive differential, they must offer their customers unexpected values, such as surprise attributes, for example, by providing a fruit basket or even a flower in the guest's apartment on the occasion of their arrival or special dates. Such surprising attributes, over time, cease to be unexpected and start to be expected by guests, recognized as part of the hotel's own products/services, hence the need to be always innovating to offer unexpected services [41]; [42]. Therefore, the quality of hotel services that deal directly and permanently with several tourists, requires from the employees a lot of initiative, creativity and receptiveness to the customer's wishes, as well as agility and promptness in the execution of services, with time being a variable that is highly charged by your visitors [41]; [42].

In this case, improved service and full customer satisfaction would depend on the establishment's daily occupancy flow related to its ability to recognize the guest's degree of accuracy, as well as its availability to prepare a sales plan that allows it to manage with effectiveness your service capacity. It also emphasizes the use of automated (computerized) systems. These systems, integrated internally, would enable planning and control of the hotel's activities, from the guest's check-in, the collection of extra services consumed by the customer and their check-out, thus streamlining the receptive services provided by the hotel establishment. Therefore, it is clear that the level of professional qualification and mastery of other languages are decisive factors for the tourist to choose to return, because, according to Castelli [41] and [42], in hotel services, the first contact is very important and definitive for the client to measure the quality of the services provided, even because one of the characteristics of the services is that there is, perhaps, no second chance for corrections. Thus, it is clear that mastering other languages constitutes an important differential [50]; [51]; [52].

When experiencing, even if eventually the hospitality of relatives, friends or even a hotel, one has the idea of how a good impression is born from a good reception. The art of hospitality is the first and main rule of hotel management and service providers concerned with delighting their customers. A unique feature in the provision of hotel services would be the promise of selling “pleasant moments”, something intangible, related to the perfect synchrony that must exist between the service and its physical structure. Hospitality would be a wide range of structures, services and attitudes that would be intrinsically related to the well-being of the guest, based on a welcoming environment, constituting an important input for the hotel sector and an often decisive attraction in the choices made by guests [41]; [42]. This aspect is confirmed by Mullins [53], when stating that good hospitality starts with the knowledge of what the guests like, from their arrival, accommodation, from the constant attention to their desires during their stay, to their departure. Relevant points in hotel administration can be to maintain the cleanliness of the establishment, as well as a good posture of front staff and others involved in the service; having the habit of welcoming guests, using welcoming expressions such as: a discreet smile and an appropriate greeting, knowing how to listen to them before anything else; call visiting guests as "Mr. or Madam", and in the case of regular guests, call by name, demonstrating recognition and personalized service; treat guests with a spirit of service, with kindness, enthusiasm, objectivity and promptness in providing service, and with the necessary

information; Recognize and even anticipate the needs, desires and expectations of customers, always ending the service with a "golden key" [41]; [42] and [43]. Therefore, the act of being hospitable when considered as the ability to provide personalized and disciplined service, capable of conveying seriousness and confidence to the customer, must be performed according to Dantas [54] by service providers who, in addition to knowing what they do, must enjoy dealing with people, being friendly and courteous in their activities, as well as knowing how to negotiate with others.

Unlike the sale of a product that has specifications predetermined by the manufacturer (in terms of size, weight, volume, use, etc.) that give consumers, through their handling, a clear idea of the benefit acquired, while the services, due to their intangibility and specific specifications, they can only, according to Crosby [55], be partially measured in subjective terms. This intangibility makes it impossible to adjust stocks and even the possibility of replacing a defective service. The importance of quality in process management is related to the fact that services are not protected by law against copying, which makes them, in turn, more competitive and dynamic than tangible goods. In this sense, the quantification of parameters that characterize and allow the judgment of the performance of a service is supported by ISO 9004-2 (Quality Management and Quality System Elements. Part 2: Service Guidelines), which alerts for importance of the service requirements being clearly defined, with the characteristics observed and evaluated by the customers. Thus, indicating the following essential characteristics: The waiting time for delivery or processing of the service; The ease and capacity of the personnel and material involved; Reliability, safety and hygiene; The competence, courtesy, comfort, aesthetics of the environment, among others [56].

The best way to measure the quality of performance of services provided by hotel organizations is through the perception of their guests/users, obtained through market research [57]. In this case, customer satisfaction can be objectively and subjectively measurable, and the objective models use indicators such as market share, number of complaints, annual revenue, among others, and the subjective ones are based, in turn, in the perception of customer satisfaction regarding their individual needs [58].

IV. FINAL CONSIDERATIONS

In the research, it was observed that the male population with a low level of education and age ranging from 20 to 45 years old prevails. It was found that guests who declared having an income of 1 to 3 minimum wages stay

in hotels with lower daily cost and that come from all regions of Brazil with a predominance of guests from the state of Rondônia itself.

It was also found that 80% of the guests of hotels J, C, D, E, G, H, F and I had already visited the city of Guajará-Mirim at least once, despite the deficiencies in infrastructure and services offered to tourists and / or visitors around the city. The guest's stay in the city varies between 2-3 days.

Regarding the 4 factors that would be influencing the choice of hotels, it was found that, significantly, in 50% of the means of accommodation (hotels I, G, J, A and E) the opinion of guests about physical appearance was considered as "little important" (PI). For the hospitality parameter, the result showed that in 40% of the establishments surveyed (hotels A, B, F and G) this parameter was considered as "relatively important" (RI) and for only 10% of this (H and J), hospitality when choosing a means of accommodation, it was considered "important" and "very important".

The Hotel Services Quality Performance Index (IDQSH) in the city of Guajará-Mirim obtained an index of 0.445, considered as "Bad", according to the adopted classification. This result allows us to accept the first research hypothesis where the quality of services would be interfering in the choice of guests, which helps to understand the low level of hotel occupancy in the city throughout the year. Regarding the parameter that analyzes the amount paid for the daily rate for hosting services, it was found that in 30% of the means of accommodation surveyed (hotels A, D and H), it was considered "important" (I) and 20% of the establishments (hotels B and G) "very important" (MI).

The Hotel Services Quality Performance Index (IDQSH) in the city of Guajará-Mirim obtained an index of 0.445, considered as "Bad", according to the adopted classification. This result allows us to accept the hypothesis that the quality of services would interfere with the choice of guests, which helps to understand the low level of hotel occupancy in the city throughout the year.

The result found allows us to point out the ranking among the searched means of hosting. Thus, for those hotels where the quality performance was considered as "Good", they are, in descending order of the IDQSH: A (0.542), F (0.529), and D (0.514). In the quality standard considered "Bad" are the hotels, also in descending order of the IDQSH: H(0.483), B (0.467), E (0.452), C (0.433), G (0.393) and J (0.369). Hotel I, with an index of 0.276, reached the classification that indicated a "Terrible" quality performance.

Therefore, this result validates the hypothesis that the

quality of services offered by the means of accommodation in Guajar-Mirim may be influencing the decision of tourists to no longer enjoy the city's hotel capacity. Despite this precarious situation, guests are attracted to the city because it is located on the border with Bolivia, where there is a shopping attraction in the city of Guayar-Mirim.

From the point of view of endogenous development, it is undeniable that there is recognition that tourism is the main development vector for the region. It was found that for accommodation facilities A, B, C, D, F, G, H and J, guests were unanimous in agreeing with this, and for accommodation facilities E and I, acceptance was 90%. Thus, the survey confirmed that the sector lacks quality, planning and management improvements. There is no way to think about endogenous development without mobilizing and strengthening the entire tourist trade, in the case of this study, the hotel sector. Cooperation between the parties is essential for everyone's survival. This is the closest way to success. Despite recognizing that there are serious deficiencies in the city's infrastructure, which hinders the region's good tourist performance, even so, there are other elements that equally deserve attention.

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Purchases of goods and services, personnel and debt payable

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**Keywords— Accounting Standardization
System; Control Suppliers Credit; Purchases
Record; Suppliers Audit**

Abstract— *With the implementation of the Accounting Standardization System in Portugal (SNC), the area of purchases and payables started to be approached according to a new aspect, with the audit procedures assuming a crucial importance.*

This work seeks to study this area as well as point out the main points of attention in auditing or tests to be carried out.

I. PURCHASES OF GOODS AND SERVICES, PERSONNEL AND DEBT PAYABLE (ACCOUNTING)

The main 1st degree accounts of the SNC that have to do with this audit area are as follows:

- 31 – purchases
- 62 - external supplies and services
- 63 – personnel expenses
- 22 – suppliers
- 23 – staff
- 25 – financing obtained
- 69 – financing expenses and losses

The scope of these accounts is as follows:

The purpose of account 31 – purchases is to record the cost of acquiring raw materials and provisionable goods for consumption or sale, regardless of whether the supplier's invoices have reached the company or not. According to NCRF18 - inventories "the costs of purchasing inventories include the purchase price, import duties and other taxes (other than those subsequently recoverable from tax entities by the entity) and costs of transport, handling and other

directly attributable costs acquisition of goods, materials and services. Commercial discounts, rebates and other similar items must be deducted in determining purchase costs"

With regard to expenses, it is necessary to comply with the provisions of the Conceptual Framework, in its paragraphs 76 and 77:

"76—The definition of expenses encompasses losses as well as those expenses that result in the course of the entity's current (or ordinary) activities. Expenses that result from the ordinary activities of the entity include, for example, the cost of sales, salaries and depreciation. They generally take the form of an outflow or depletion of assets such as cash and cash equivalents, inventories and property, plant and equipment.

77 — Losses represent other items that meet the definition of expenses and may or may not arise in the course of the entity's ordinary activities. Losses represent decreases in economic benefits and as such are in their nature no different from other expenses. Hence they are not seen as a separate element in this Conceptual Framework."

The Conceptual Structure also states that there must be a balance between expenses and income:

“92 — Expenses are recognized in the income statement when there has been a decrease in future economic benefits related to a decrease in an asset or an increase in a liability and that can be reliably measured. This means, in effect, that the recognition of expenses occurs simultaneously with the recognition of an increase in liabilities or a decrease in assets (for example, an increase in employee entitlements or a depreciation of equipment).

93 — Expenses are recognized in the income statement based on a direct association between the expenses incurred and the attainment of specific income. This process, commonly referred to as the matching of revenue expenses, involves the simultaneous or combined recognition of revenue and expenses that result directly and jointly from the same transactions or other events; for example, the various expense components constituting the cost of goods sold are recognized at the same time as the income derived from the sale of the goods.”

So,

Account 62 – External supplies and services is intended to record the acquisition of goods and services of immediate consumption related or not to the company's corporate purpose.

Account 63 - Personnel Expenses is intended to record the remuneration of the members of the management bodies and employees, as well as the respective charges

Account 69 – Financing gains and losses is intended to record interest paid, unfavorable exchange differences and other charges incurred with financing obtained, taking into account the provisions of the accrual accounting regime.

With regard to class 2 accounts, the provisions of the SNC framework notes must be taken into account. with third parties that do not fit in the previous accounts or in other specific classes. This class also includes deferrals (to allow recording of expenses and income in the periods to which they relate) and provisions"

Account 22 – suppliers registers movements with sellers of goods and services, with the exception of account 271 – Investment suppliers, which registers movements with sellers of goods and services towards the entity's investments. Account 228 — Advances to suppliers records deliveries made by the entity relating to deliveries (without a fixed price) to be made by third parties. This is an account of a monetary nature. Upon receipt of the invoice, these amounts will be transferred to the respective sub-accounts of account 22. If this is not the case, that is, with a previously fixed price, the advance must be registered in account 39 –

Advances on purchases. Also, upon receipt of the invoice, these amounts must also be transferred to account 22.

Account 23 – Personnel is intended to record debts payable (and eventually receivable) to members of corporate bodies and employees.

Account 25 – financing obtained registers debts payable resulting from financing obtained by the company, such as bank loans (including discounted bills), overdrafts, finance leases, factoring, debenture loans, supplies, etc. Depending on the term, the financing must be presented in current liabilities, those with a maturity of up to 1 year, in the remainder, they must be presented in non-current liabilities. Non-current liabilities must be measured at the balance sheet date at amortized cost as determined by NCRF27 “After initial recognition, an entity must measure, at each reporting date, all financial liabilities at amortized cost using the effective interest method, except as for financial liabilities classified as held for trading,

II. PURCHASES OF GOODS AND SERVICES, PERSONNEL AND DEBT PAYABLE (AUDIT)

As Costa and Alves (2001) refer, the audit objectives in this area include:

- Accounting procedures and internal control measures related to purchases of goods and services, personnel costs and debts payable are adequate and are, in fact, being applied;
- Purchases of goods and services and personnel expenses are related to the company's activity, relate to the period under analysis and are properly presented in the income statement;
- All significant liabilities existing or incurred at or up to the date to which the balance sheet refers are measured, recorded and classified in the balance at their appropriate values;
- All relevant information is properly disclosed in the annex.

The process relating to the economic-accounting cycle generally begins with a need to purchase. It is up to the body in charge of stock management to determine the opportunity or not to trigger a purchase, taking into account the observation of goods that are in warehouses or, through more complex mechanisms aimed at optimizing the system. It should be noted that the genesis of the need arises in the body responsible for production that detects the need to acquire certain goods. Currently, with the systems update, it is the stock management program itself that is predetermined to request the purchase of goods when they fall below a certain level

In the case of fixed assets, the process can be more complex, as it may be related to the implementation of new production lines, replacement of equipment or, eventually, an increase in production capacity.

Thus, when there is a need to trigger the purchase, the stock management body must send a request to the body responsible for purchasing, which should start the process of purchasing and selecting suppliers

Almeida (2017) states that a procurement process involves the following steps that, whenever practicable, must respect the segregation of functions, with the verification of the work of each worker or agency being responsible for another worker or agency:

1. Requisition of goods and/or services;
2. Purchase order issuance;
3. Receipt of goods;
4. Verification and confirmation of the supplier's invoice;
5. Accounting for the obligation;
6. payment of obligation
7. Payment accounting

Thus, the most relevant documents are purchase orders, which is a request to a supplier to provide certain goods or services under certain conditions, receipt notes, goods delivery documents, and invoices that are issued by Providers. The purchase order must be approved not only by the person in charge of the purchasing agency, but also by the financial officer, in order to include the future payment in the treasury budget.

The purchase order must mention the quantities and all specifications of the items to be purchased, unit price, discounts, delivery and payment terms

Costa (1998) recommends that the purchase order be issued in four copies, namely:

- Original intended for the supplier;
- Duplicated for accounting, in order to be later checked with the other documents originated by the purchase (invoice, delivery note, receipt note, etc.);
- Tripled for reception so that they know that the purchase has been launched;
- Quadrupled for the temporary file of the purchasing agency to be attached to the purchase order and which will be transferred to the defined file after the entry of the article

The next stage is the reception of the goods sent by the suppliers and must comprise two aspects: the quantitative and the qualitative. In terms of quantity, it is important to verify the count (weighing or measurement) of the goods. In qualitative terms, it is important to verify if the

specifications correspond to what was requested. A delivery note must be issued which must refer to the supplier's purchase order and delivery note numbers and itemize the items and quantities counted. This receipt form must be issued in quadruplicate: the original will be sent to accounting, the duplicate to the warehouse, the triplicate to the purchasing agency and one filed at reception.

This is followed by posting, which under normal conditions occurs when the vendor's invoice arrives at accounting. By that time, all the documents necessary for its proper verification should already be available (purchase order, delivery note, reception note and warehouse entry note). Checking the invoices includes confirming that the supplier is billing for what has been ordered (and received) and under the agreed conditions, and verifying that the invoice calculations are arithmetically correct. Therefore, the invoice must provide proof (evidence) that payment has been properly verified and authorized.

Finally, invoice maturities must be properly controlled by accounting. It is incumbent upon the treasury to make the payment, preferably by check or bank transfer, after authorization of the payment, keeping proof, such as a copy of the check or transfer order. Within the scope of function segregation, whoever authorizes payment should not interfere in the purchase process.

Almeida (2017) summarizes the most relevant aspects in the context of testing the internal control of the procurement process, namely:

- Documents are pre-numbered and properly filed;
- All internal operations are authorized by competent persons;
- There is a clear identification of the supplier, quantity, prices and terms in the purchase order;
- There is proof of comparison of receipt guides with purchase orders. In case of discrepancies, they were duly identified and investigated;
- There is a record of invoices proving their arithmetic accuracy and comparison with purchase orders and receipt guides;
- Adequate control of invoice maturities;
- Adequate accounting of payments;
- Conducting bank reconciliations.

Almeida (2017) states that as a starting point he should check whether the opening balance sheet is in accordance with the closing of the previous year. By extension, all outstanding debt balances on the balance sheet must be in accordance with the respective balance sheets.

As in the other items of the balance sheet, detailed tests and analytical procedures must be carried out

Within the tests of detail, one can mention the tests on the balances, which are tests aimed at verifying whether the final balances present material distortions or not, and the tests on the transactions, which are tests with the objective of verifying whether the transactions occurred throughout the year. were correctly accounted for.

In testing the balances, the main procedure is the confirmation of credit balances, which can be materialized through circularization (in the case of debts to current account suppliers, investment suppliers, financing creditors, etc.) or through obtaining certificates (in the case of debts to the Tax Administration and Social Security).

Thus, circularization is a specific type of inquiry from a third party. It consists of sending a letter in which each selected creditor is asked to confirm the balance. It is recommended that you be blind, that is, in the letter sent to suppliers you do not send the balance including its composition, as well as other information that the company has with the supplier. It is also recommended that the response be sent directly to the auditor in an RSF envelope (response without postage). The way to select can be different, but it is recommended to select the suppliers with whom the company normally works, those with the most significant balances and some suppliers with null balances.

With regard to the testing of transactions, the following can be mentioned: a) the vouching, which consists of the balance sheet of purchases and other acquisitions, reaching the supporting documents (purchase order, receipt guide and invoice) and b) the tracing that consists of in the reverse process, that is, from the supporting documents to reach the balance. A review of the documentation must also be carried out, such as, for example, verifying the arithmetic accuracy and agreement between the quantities and prices in the purchase order and those contained in the invoice, and the review of the cut of operations whose main objective is to verify that purchases carried out up to the closing date were accounted for in that period.

Regarding the analytical procedures, the following can be mentioned: a) procedures related to purchases and supplies and b) procedures related to balances – debts payable. In the procedures relating to purchases, it is important to identify relative and absolute variations, as well as analysis of the behavior of purchases in relation to other items in the income statement, such as gross margins, personnel expenses, supplies and external services, etc. With regard to the procedures relating to balances, it is also important to analyze the absolute and relative variations, as well as the reasonableness of the balances, namely, rotation of debts payable and average payment terms. Unusual behavior in the balances of debts payable may indicate situations of late payment to suppliers,

III. CONCLUSION

This area is an area likely to have a high inherent risk, as there is a significant number of transactions and allows for the emergence of distortions. The central issue is the emergence of undervalued liabilities, as there may be a temptation to present financial statements with a more favorable financial position.

Thus, we conclude that the audit procedures pointed out in this work must be considered in terms of the need for application, and must never be neglected.

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Factors related to the pandemic period and its possible influence on the exclusive breastfeeding phase in the cities of Belem and Ananindeua– PA/Brazil

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Keywords— Breastfeeding, Exclusive
breastfeeding, Child; Pandemic.

Abstract— The research aimed to understand the possible factors associated with the COVID-19 pandemic that may have impaired the period of exclusive breastfeeding. Cross-sectional and anonymous study with 62 mothers from the cities of Belem and Ananindeua – PA/Brazil, using an online form. As a result, predominantly: 1/3 had completed higher education, 25 and 49 years old, single, monthly income of 1 to 2 minimum wages, did not participate in government aid programs, cesarean delivery, prenatal care performed at SUS, were still breastfeeding, 45% had symptoms of anxiety, depression or compulsive disorder, 63% of children fell ill in the last 6 months. 24% of women felt insecurity or fear of breastfeeding because of media news. The presence of professional prenatal guidance on pregnancy and COVID-19 was absent in more than 1/3 of the women, 37% did not receive professional guidance on breastfeeding during prenatal care, and 81% did not receive guidance on breastfeeding with suspicion or diagnosis of COVID-19. Of the statements heard by a family member or close person, the most frequent was: "You cannot do prenatal care or go to the hospital so as not to get COVID-19". The number of times the child became ill in the last 6 months and hospitalization of the child were correlated with the period of breastfeeding with $p < 0.0001$ and $p = 0.0455$, respectively. This study brings a new perspective to the findings involving maternal and child nutrition and the COVID-19 pandemic, and it is essential that more comprehensive policies are reformulated, for the training of health professionals in the context of coping with COVID-19 and for managing news available in the media.

I. INTRODUCTION

The first reports of COVID-19 infection occurred in China, more specifically in Wuhan, at the end of 2019. The virus that causes pneumonia is SARS-CoV-2, being an agent of high transmission and lethality, capable of altering the routine and way of life around the world¹.

With the emergence of this hitherto little-known global emergency, concerns related to certain groups became increasingly emerging. In this sense, the group of pregnant and lactating women stands out, in view of the concern about the potential for lethality in them during pregnancy and the possible transmission of the infection to the fetus

and newborn². Few studies are described in the literature that can answer these questions, but, as far as is known, there is still no evidence of the existence of transmission of the SARS-CoV-2 virus through breastfeeding, at the time of delivery and not even in the intrauterine environment³.

In the context of breastfeeding (BF), this perspective culminates in the concern for a possible increase in early weaning, given that the World Health Organization - WHO⁴ dialogues with society about the importance of BF in the first hour of life, exclusive breastfeeding (AME) up to six months of age and complementary to introductory feeding up to two years of age. This relevance is due to the fact that breast milk can be considered the 'first vaccine' for children, protecting them from various problems during childhood and throughout life.

Furthermore, in the puerperium, BF is extremely important for the production of hormones that will help in various processes at this stage and also for the maintenance of the mother-infant binomial. In suspected or confirmed cases of COVID-19 in the mother, it is indicated that there is no direct contact between the mother and the child, in order to avoid contamination of the child through bodily fluids that have a potential risk of transmission. In negative cases, what remains is fear and maternal anguish, taking into account the seriousness of the period in which we live. In both situations, such processes can trigger negative consequences for the physiology of lactation, the health of mother and child, in addition to interfering with the mother-infant binomial⁵.

As a result, this study sought to understand the influence of the pandemic in the period of EBF, answering questions and providing information to lay people and health professionals about it.

II. METHODOLOGY

This quantitative, descriptive and cross-sectional study included mothers who breastfed during the COVID-19 pandemic, reached via the Google Form, with approval by the Research Ethics Committee under opinion No. 4,888,790. It was carried out in the cities of Belem and Ananindeua - PA, through a Google Form shared online, between the period of August 16, 2021 and October 22, 2021. Data collection began after project appraisal and authorization from Research Ethics Committee of the Institute of Health Sciences-UFPA and all precepts were followed. All women who did not fit the methodological profile mentioned above or who incompletely filled out the form were excluded from this study.

Data collect

Data were collected through a questionnaire filled out anonymously. After the authorization section, the participants filled in questions about their sociodemographic and economic data, with questions about their level of education, age, marital status, city and neighborhood of residence, family participation in monthly income, monthly family income value and participation in government programs.

Section three of the form consisted of clinical complications such as the occurrence or not of anxiety, depression, compulsive disorder or chemical dependency (illicit drugs, cigarettes, alcohol) during the breastfeeding period, infection or not by COVID-19, or period of infection, the month in which the participant contracted COVID-19, involvement or not of any disease in the postpartum period, if so, which disease and whether or not there was hospitalization, the number of times the child was hospitalized in the last 6 and whether or not there was hospital admission.

Section four consisted of questions about prenatal care and childbirth, such as type of delivery, network of prenatal care, whether or not there was guidance on COVID-19 and pregnancy, breastfeeding and breastfeeding and with suspicion or diagnosis of COVID -19 by a professional in prenatal care.

Section five of the questionnaire dealt with the breastfeeding period, with questions about the exclusive breastfeeding period, whether or not there was the presence of fear or anxiety about breastfeeding due to COVID-19 and the reason for the fear or anxiety.

The sixth section of the form referred to possible influences on the exclusive breastfeeding phase. They were asked whether or not they believed that the COVID-19 pandemic influenced the period in which they breastfed and, if so, how, if anyone in the family tried to advise them not to breastfeed due to COVID-19 and if they received any type of information about pregnancy or breastfeeding in the media during the COVID-19 pandemic, if you received any media information not recommending exclusive breastfeeding due to COVID-19, if there was insecurity or fear of breastfeeding as a result of news in the media about COVID-19; which means you received the most information encouraging breastfeeding during the COVID-19 pandemic, which means you received the least information encouraging exclusive breastfeeding during the COVID-19 pandemic, if there was a statement from a family member or person very close, not recommending breastfeeding and for them to comment in a few words, how was the experience of breastfeeding during the pandemic period.

Statistical analysis

Descriptive data were presented as standard deviation, mean and p-value. G tests were performed to verify the existence of a statistical association between the variables "Period of exclusive breastfeeding X Number of times the child became ill in the last 6 months", "Period of exclusive breastfeeding X Child hospitalization", "Period of exclusive breastfeeding X Maternal hospitalization after clinical complications", "COVID-19 infection in the mother X Number of times the child became ill in the last 6 months", "Type of delivery X Number of times the child became ill in the last 6 months", "School X Period of exclusive breastfeeding", "Age x Period of exclusive breastfeeding", "Monthly income X Period of exclusive breastfeeding" and "Problems during the breastfeeding period X Presence of influence of the COVID-19 pandemic in the breastfeeding period" using the BioEstat version 5.3 application and frequency distribution tables were used to determine the mean and standard deviation of the variables. Statistical significance was considered as $p < 0.05$.

III. RESULTS

Sociodemographic, economic, childbirth and breastfeeding data are shown in Table 1. Overall, 29% (n=18) of the participants had incomplete higher education, with 45% (n=28) between 18 and 24 years of age. age, 40% (n=25) declared themselves in a stable union and 53% (n=33) with a monthly income of 1 to 2 minimum wages, 81% (n=50) lived in the city of Belém/PA and the 19% (n=12) remaining in Ananindeua/PA, where 76% (n=47) reported not participating in any government program. Of the total number of volunteers, 62% (n=37) underwent cesarean delivery, 60% (n=37) obtained the Unified Health System (SUS) as a prenatal care network, 71% (n=44) of the mothers were still breastfeeding during the survey period, 55% (n=38) reported not having developed anxiety, depression or compulsive disorder, 69% (n=43) reported not having fear or anxiety about breastfeeding due to COVID-19 and 74% (n=46) reported that the COVID-19 pandemic did not influence the breastfeeding period.

Table 1 Survey of sociodemographic, economic, childbirth and breastfeeding data

(Tobecontinued)

Sociodemographic, economic, birth and breastfeeding data.	Sample of 62 participants (%)
Schooling	
Incomplete elementary school	1 (1%)
Complete primary education	1 (2%)
Incomplete high school	5 (8%)
Complete high school	15 (24%)
Incomplete higher education	18 (29%)
Complete higher education	6 (10%)
Postgraduate/Masters/Doctorate	16 (26%)
Age	
18 to 24 years old	28 (45%)
25 to 34 years old	25 (40%)
35 years old or more than	9 (15%)
Marital status	
Single	18 (29%)
Married	18 (29%)
Stable union	25 (40%)
Divorced	1 (2%)
City	
Belem	50 (81%)
Ananindeua	12 (19%)

Monthly income	
1 to 2 minimum wages	33 (53%)
3 to 5 minimum wages	20 (32%)
6 to 10 minimumwages	6 (10%)
More than 10 minimumwages	3 (5%)

Table 1 Survey of sociodemographic, economic, childbirth and breastfeeding data

(Conclusion)	
Sociodemographic, economic, birth and breastfeeding data.	Sample of 62 participants (%)
Participation in Government Programs	
Yes	15 (24%)
No	47 (76%)
Type of childbirth	
Normal	23 (38%)
Cesarean	37 (62%)
Prenatal health service	
Gratuity service (SUS)	37 (60%)
Private service	25 (40%)
Exclusive breastfeeding period	
Were still breastfeeding	44 (71%)
Less than 6 months	4 (6%)
More than 6 months	14 (23%)
Problems during the breastfeeding period	
Did not show any of the symptoms	38 (55%)
Anxiety	24 (35%)
Depression	5 (7%)
Compulsive disorder	2 (3%)
Fear or anxiety about breastfeeding due to COVID-19	
Yes	19 (31%)
No	43 (69%)
Presence of influence of the COVID-19 pandemic in the breastfeeding period	
Yes, there was influence	16 (26%)
No, there was no influence	46 (74%)

Data on clinical complications in the mother and child during the breastfeeding period are shown in Table 2. Among the interviewees, 53% (n=33) said they did not contract COVID-19 infection, 21% (n=13) of those who did. Reported having been infected during pregnancy. 89%

(n=55) had no clinical complications after delivery, among the 11% (n=7) who had complications; there was no need for hospitalization in 57% (n=4). In relation to the child, 53% (n=33) of the mothers informed that the child became ill once or twice in the last 6 months before filling out the

questionnaire, and among the total number of children who became ill during this period, 79% (n=31) did not require hospitalization.

Table 2 Characterization of clinical complications in the mother and child during the breastfeeding period

Clinical complications of mother and child during the breastfeeding period	Sample of 62 participants (%)
COVID-19 infection	
Yes	29 (47%)
No	33 (53%)
Period of infection by COVID-19	
Before pregnancy	9 (15%)
During the pregnancy	13 (21%)
Between delivery and up to 6 months later	7 (11%)
Didnotcontract	33 (53%)
Clinicalcomplicationsafterchildbirth	
Yes	7 (11%)
No	55 (89%)
Presence of hospitalization	
Yes	3 (43%)
No	4 (57%)
Number of times the child became ill in the last 6 months	
None	23 (37%)
One or two	33 (53%)
Three or more than	6 (10%)
Hospitalization	
Yes	8 (21%)
No	31 (79%)

In the figures below, data on the influence of the media, the health professional and the family on breastfeeding during the pandemic period are presented.

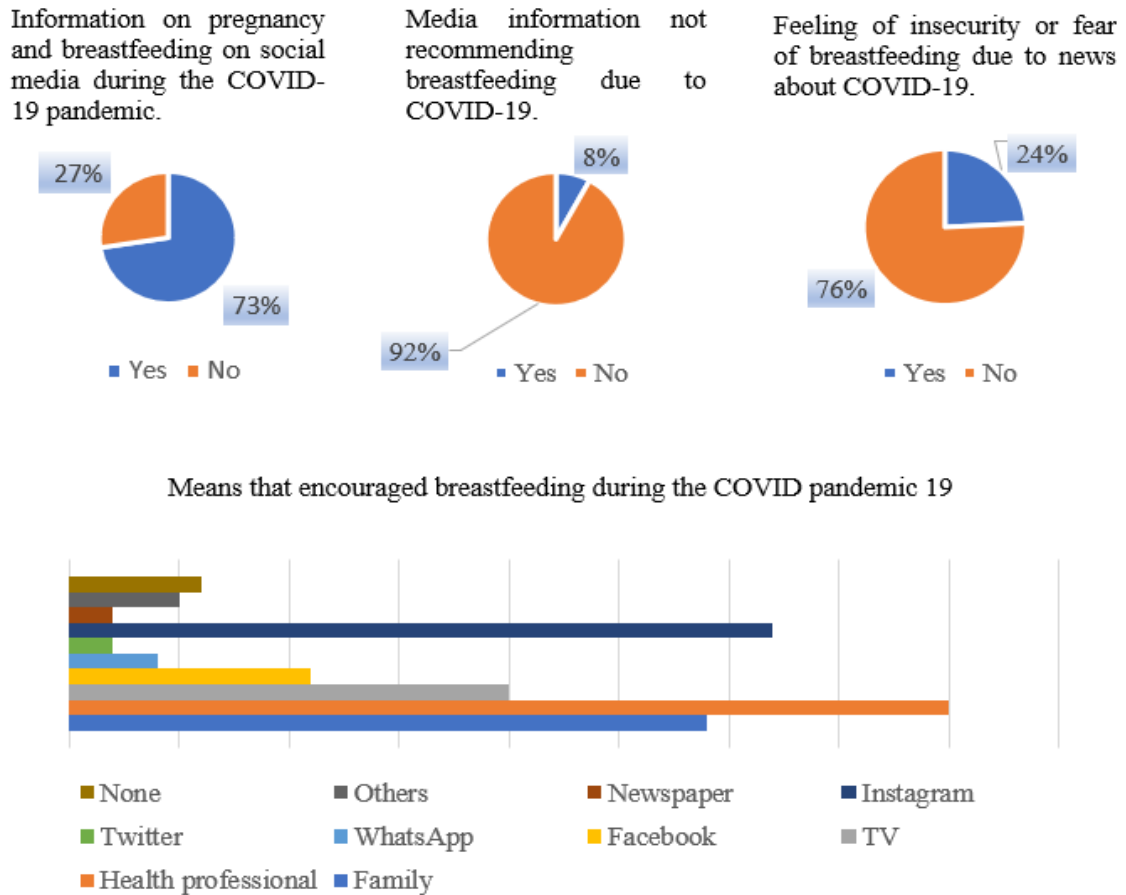


Fig.1 Media influence data

Source: prepared by the author of the work.

Among the total number of participants, 73% (n=45) claimed to have been exposed to some type of information about pregnancy or breastfeeding in the media during the COVID-19 pandemic, where only 8% (n=5) received guidance not to recommend breastfeeding in these media information. Regarding fear or insecurity in breastfeeding,

caused as a result of media news about COVID-19, 24% (n=15) of respondents said they had such feelings and the means where they most received information encouraging breastfeeding during the pandemic period were Professionals Health (n=40), Instagram (n=32) and Family (n=29).

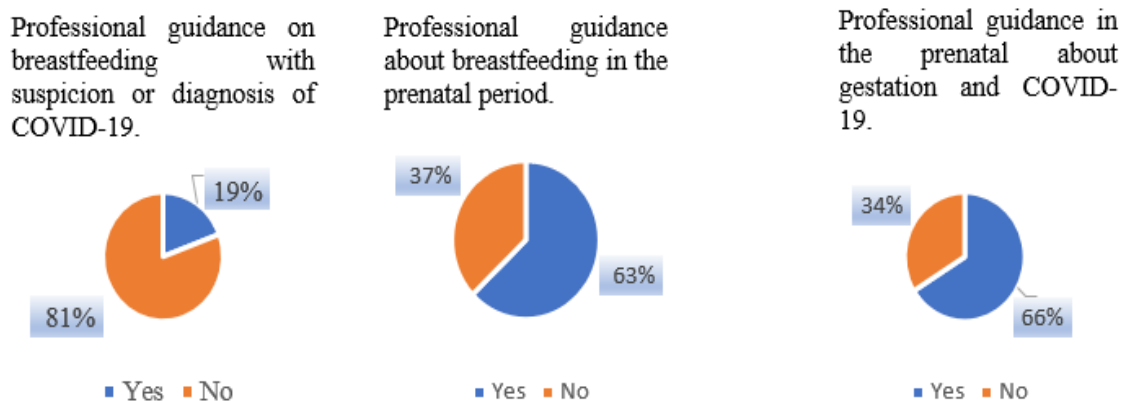


Fig.2: Data on the influence of the health professional

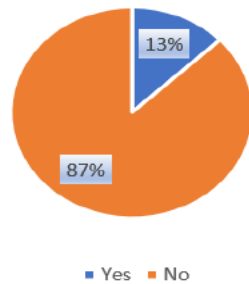
Source: prepared by the author of the work.

Among the participants, 81% (n=50) reported not having received professional guidance on breastfeeding with

suspicion or diagnosis of COVID-19, while out of the total, 63% (n=39) received general professional guidance

on breastfeeding in the prenatal period and 34 % (n=21) during prenatal care, about pregnancy and COVID-19. did not receive information from health professionals,

Family guidance not to breastfeed due to COVID-19.



Statements heard by family members or a close person.

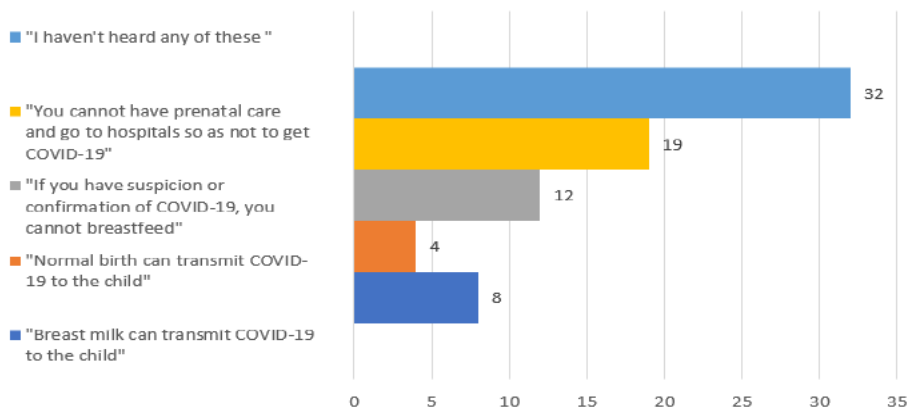


Fig.3 Family influence data

Source: prepared by the author of the work.

Among the 62 participants, 13% (n=8) received information from family members to avoid breastfeeding due to COVID-19 and from the allegations most heard by family members and/or close people on the subject, “You cannot do pre- birth or going to hospitals so as not to contract COVID-19” and “If you have suspicion or confirmation of COVID-19, you cannot breastfeed”.

Comparative analysis

Among the analyzed and correlated variables, only two correlations were statistically significant: "Breastfeeding period X Number of times the child became ill in the last 6 months" (Table 1) and "Breastfeeding period X Child hospitalization" (Table 2), with $p < 0.0001$ and $p = 0.0455$, respectively, while the other samples presented $p > 0.05$. This fact may have occurred as a result of the sample size (n=62) so that there was a significant correlation between the samples. The variables that did not reach statistical significance were: in table 3, the comparative analysis

between the period of exclusive breastfeeding and the occurrence of maternal hospitalization, which presented $p = 0.2789$; in table 4, the comparative analysis between COVID-19 infection in the mother and the number of times the child became ill in the last 6 months, with $p = 0.1950$; the statistical analysis performed in table 5, on the type of delivery and number of times the child became ill in the last 6 months ($p = 0.9859$); the comparative analysis between maternal education and the period of exclusive breastfeeding, in table 6 ($p = 0.9145$); in table 7, the comparative analysis between maternal age and the period of exclusive breastfeeding ($p = 0.5450$); then, in table 8, the comparative analysis between monthly income and the period of exclusive breastfeeding was $p = 0.1826$; and, finally, in table 9, the comparative analysis between problems during the breastfeeding period and the influence of the COVID-19 pandemic on the breastfeeding period ($p = 0.3164$).

Chart1 Comparative analysis between the period of exclusive breastfeeding and the number of times the child became ill in the last 6 months.

Exclusive breastfeeding period	Number of times the child became ill in the last 6 months		p value
	Average	Standard deviation	
I'm still breastfeeding	14,67	9,24	*p< 0.0001
Lessthan 6 months	1,22	2,31	
6 monthsor more than	4,67	3,79	

* p value. G Test

Chart 2 Comparative analysis between the period of exclusive breastfeeding and the occurrence of hospitalization of the child.

Exclusive breastfeeding period	Hospitalizationofthechild		p value
	Avarage	Standard deviation	
I'm still breastfeeding	14,67	9,29	*p=0.0455
Lessthan 6 months	1,33	1,53	
6 monthsor more than	4,67	3,79	

* p value. G Test

Chart 3 Comparative analysis between the period of exclusive breastfeeding and the occurrence of maternal hospitalization after clinical complications.

Exclusive breastfeeding period	Maternal hospitalization after clinical complications		pvalue
	Avarage	Standard deviation	
I'm still breastfeeding	14,67	16,26	*p=0.2789
Lessthan 6 months	1,33	1,53	
6 monthsor more than	4,67	5,03	

* p value. G Test

Chart 4 Comparative analysis between COVID-19 infection in the mother and the number of times the child became ill in the last 6 months.

COVID-19 infection in the mother	Number of times the child became ill in the last 6 months		p value
	Avarage	Standard deviation	
Yes	10,00	7,94	*p=0.1950
No	10,67	6,03	

* p value. G Test

Chart 5 Comparative analysis between the type of delivery and the number of times the child became ill in the last 6 months.

Typeofchildbirth	Number of times the child became ill in the last 6 months		pvalue
	Avarage	Standard deviation	
Cesarean	13,33	8,62	*p=0.9859
Normal	7,33	5,03	

* p value. G Test

Chart 6 Comparative analysis between maternal education and the period of exclusive breastfeeding.

Schooling	Exclusive breastfeedingperiod		p value
	Avarage	Standard deviation	
Incompleteelementaryschool	0,33	0,58	*p=0.9145
Complete primaryeducation	0,33	0,58	
Incomplete high school	2,00	2,65	
Complete high school	5,00	6,08	
Incompletehighereducation	6,33	6,11	
Complete high school	2,00	2,00	
Postgraduate/Masters/Doctorate	4,67	3,06	

*p value. G Test

Chart 7 Comparative analysis between maternal age and the period of exclusive breastfeeding.

Age	Exclusive breastperiod		p value
	Avarage	Standard deviation	
18 to 24 yearsold	9,67	10,97	*p=0.5450
25 to 34 yearsold	8,00	7,55	
35 years old or more than	2,67	2,08	

* p value. G Test

Chart 8 Comparative analysis between monthly income and the period of exclusive breastfeeding.

Monthly income	Exclusive breastfeedingperiod		p value
	Avarage	Standard deviation	
1 to 2 minimumwages	11,33	14,57	*p=0.1826
3 to 5 minimumwages	6,33	6,11	
6 to 10 minimumwages	2,00	1,00	
More than 10 minimumwages	1,00	0,00	

* p value. G Test

Chart 9 Comparative analysis between problems during the breastfeeding period and the influence of the COVID-19 pandemic on the breastfeeding period.

Problems during the breastfeeding period	Presence of influence of the COVID-19 pandemic in the breastfeeding period		p value
	Avarage	Standard deviation	
Anxiety	9,50	6,36	*p=0.3164
AnxietyandDepression	2,00	0,00	
Anxietyandcompulsivedisorder	0,50	0,71	
Anxiety, depression and compulsive disorder	0,50	0,71	
None of the above problems	18,50	14,85	

* p value. G Test

IV. DISCUSSION

The breastfeeding process involves several factors that can interact in ways that promote or harm the practice. Thus, low maternal education (Table 1) can lead to early weaning, these chances were 110% in cases where the mother had eight years of schooling or less. This fact can be associated with little possibility of contact with reliable information about the importance of exclusive breastfeeding and its benefits for both the mother and the baby, and the breastfeeding woman's exposure to common sense information that does not always have a scientific basis⁶. As shown in table 6, there was no statistically significant representation ($p=0.9145$) in the correlation between education and the period of exclusive breastfeeding. However, this factor may have been due to the relatively small sample size to demonstrate significance, making it necessary to expand the study so that more data can be collected and correlated.

Another variable that should be considered as a risk factor is maternal age (Table 1). Studies show that aesthetic factors and the feeling of insecurity and inability to breastfeed are among the main reasons that lead younger mothers to abandon exclusive breastfeeding, while older mothers tend to maintain this practice⁷. However, the literature is still divergent on the topic, considering that mothers of intermediate age may have more chances of interrupting the practice due to the return to work⁶. In table 7, on the comparative analysis between maternal age and breastfeeding period, there was also no statistical significance ($p=5450$) between the associated variables. However, the literature points to the need to carry out more studies on the topic, which is still quite divergent among researchers.

Regarding the marital status (Table 1) of the lactating women, the absence of a partner or lack of encouragement on the part of the partner can be a predictor of early weaning, considering that in the first months of the child's life, the mother will need a strong support network, necessary to provide support in this new family arrangement⁷. We note that the studies point to the negative aspects of the lack of support for the breast feeding mother, bringing a reflection on the need to implement actions to strengthen support for the mother-child binomial, aiming at improving the quality of life in the social sphere.

In the same study⁷, it could be observed that families with lower purchasing power (Table 1) may be less likely to abandon exclusive breastfeeding, because such family arrangements have less purchasing power to obtain possible breastmilk substitutes, while families of higher socioeconomic status may be exposed to a greater risk of

adhering to the practice of purchasing infant formula because they have more access to such means. Table 8 presents a non-significant statistical relationship ($p=0.1826$), which can be attributed to the sample size, which needs to be expanded to verify such relevance.

The mother's participation in government programs (Table 1) was suggested as a protective factor in the first year of life, as such benefits aim at transferring income to families in socioeconomic vulnerability, a factor that can provide better conditions for access to education and , consequently, information about the importance of exclusive breastfeeding for the first 6 months and complementary breastfeeding for up to two years of age⁸.

As for the variable type of delivery (Table 1), it is noted that cesarean section can directly interfere with breastfeeding, taking into account that this practice is a barrier from breastfeeding in the first hour, due to anesthesia and the surgical procedure itself, also interfering in the establishment of the mother-infant bond⁷. This factor can be considered harmful to the health of the mother and child, making it necessary to encourage maternal autonomy when deciding on the type of delivery.

Another factor that can be seen as protective of breastfeeding is prenatal care (Table 1), as it is during this period that health professionals provide information that is essential for the health of the mother and child, one of which is about breastfeeding. The study⁷ shows that the number of consultations carried out and humanized care provided by professionals can be directly associated with successful breastfeeding.

The breastfeeding period (Table 1) can impact not only the health of the mother and baby, but also the global economy. This practice leads to a reduction in morbidity and mortality in children from diarrhea and pneumonia, can reduce cases of childhood obesity and prevent the death of women from breast and ovarian cancer and type 2 diabetes, factors that could yield 1.1 billion dollars to the world economy annually⁹. In tables 1 and 2, it was noticed that there was statistical significance between the period of exclusive breastfeeding, the number of times the child became ill in the last 6 months and the presence of hospitalization of the child ($p<0.0001$ and $p=0.0455$, respectively). This relationship can be explained by the amount of nutrients and immunological agents that are made available to children through breast milk, protecting them against the main cause of neonatal death, which are infection. Because of this, actions to encourage breastfeeding are considered one of the most effective forms of protection and support, contributing to the reduction of infant mortality rates^{10,9}.

In a certain study⁸, a prevalence of 35.8% for depressive symptoms in the studied mothers was verified. This can be explained by the fact that the child's first year of life is marked as a period of many changes within the family arrangement, changes that can become an overload factor for the mother and trigger emotional and psychological problems. Children of mothers with such perspectives may also be exposed to a greater chance of developing the same problems. Such impasses can also be considered a barrier to the bond between mother and child. In table 1, it is identified that 45% of the interviewed mothers suffered from anxiety, depression or compulsive disorder during the breastfeeding period, however, only 26% reported feeling that the COVID-19 pandemic had some influence on this phase. It can be deduced that, although almost half of the interviewees present such symptoms, they do not relate such feelings as a consequence of the pandemic period. In Table 9, the analysis between problems during the breastfeeding period and the influence of the COVID-19 pandemic on the breastfeeding period was not statistically significant ($p=0.3164$).

In an observational study¹¹, it was identified that most participants who were infected with COVID-19 during pregnancy had mild infection. However, in a given cohort study¹², infected pregnant women were at high risk for pre-eclampsia, premature birth and cesarean section. In line with these studies, a literature review¹³ identified that such pregnant women do not present serious clinical manifestations and, as for the fetuses, there was identification of the possibility of fetal distress, respiratory difficulties and premature birth. Such data portray the need for further studies that will clarify these issues.

As shown in table 4, the comparative analysis between COVID-19 infection in the mother and the number of times the child became ill in the last 6 months, we can see that there was no statistical significance, with $p=0.1950$. These data corroborate research on most viral diseases, which reinforces the need for further studies to better understand the fact.

As for illness and maternal hospitalization (Table 2), a certain scope review¹⁴ found a higher risk of hospitalization in the ICU in postpartum women, with obesity and diabetes as a risk factor. It was also pointed out that infection with COVID-19 during pregnancy can result in exacerbation of the state during the puerperium, due to several hormonal changes common to the period of pregnancy and puerperium, in addition to an increased risk of thromboembolism among puerperal women who had the infection by COVID-19. In table 3, the comparative analysis between the period of exclusive breastfeeding and maternal hospitalization after clinical complications did

not find statistical relevance between the variables ($p=0.2789$).

A given cohort¹⁵ identified maternal age over 35 years, less than four prenatal consultations and cesarean delivery as a risk factor for the hospitalization of newborns. Maternal age may be related to changes that are characteristic of the physiological process of aging, leading to early delivery. Prenatal care can act to minimize such risks, it is during consultations that possible problems are identified and treated in the safest way possible for mother and child. However, in line with the analysis obtained in table 5 on the type of delivery and the number of times the child became ill in the last 6 months, a cohort study¹⁶ found that there was no correlation between the type of cesarean or vaginal delivery and respiratory infection and atopy until one year of life and overweight and obesity from 12 months of age. Thus, it is suggested that more detailed studies should be developed to clarify such variables.

Regarding the use of media by mothers (Figure 1), an integrative review¹⁷ corroborated the findings of this research, pointing to the frequent use of apps, internet, websites and e-mail. This factor was associated as a point of protection and maintenance of breastfeeding, as the content most consumed by such mothers referred to the search for information and resolution of maternal problems during EBF, allowing these participants to have access to information that they could not traditionally seek and enabling the support they need. However, this variable could also be related to the overload of information made available in such media.

Support networks (Figures 1 and 2) play a fundamental role in this life cycle. There was a four-fold increase in the chances of maintaining EBF when the mother had the encouragement of the family and health professionals. This factor can be associated with the importance of support at a time of weakness for the mother, where all efforts are focused on child and the guardians often feel overwhelmed with all the necessary demands at this stage. The period back to work is also a time of great need for help from the support network, it is at this time that many mothers interrupt exclusive breastfeeding for not being able to reconcile such demands^{18,19}. The studies reinforce the findings of this research, and it is worth warning of the need for an easily accessible information channel and safe content aimed at breastfeeding women, especially in emergency periods such as the current COVID-19 pandemic, where mothers do not have access to public services or secure information.

V. CONSIDERATION

Of the women surveyed, 1/3 had completed higher education, most were between 25 and 49 years old, single, with a monthly income of 1 to 2 minimum wages, did not participate in government aid programs, cesarean delivery, with prenatal care in the SUS, they were still breastfeeding and 45% had symptoms of anxiety, depression or compulsive disorder.

About 1/3 of the women reported fear or anxiety when breastfeeding due to COVID-19, although most deny the negative influence of the COVID-19 pandemic on breastfeeding.

A worrying percentage (47%) had COVID-19 infection, especially during pregnancy. Most did not report clinical complications after childbirth and of these, most did not require hospitalization. Most children fell ill in the last 6 months, requiring hospitalization in 21% of cases.

The women had contact with some type of media information about pregnancy or breastfeeding during the COVID-19 pandemic, with a worrying percentage (8%) of advertisements not recommending breastfeeding, awakening in 24% of the women the presence of a feeling of insecurity or fear of breastfeed for this news. The means where they received the most information encouraging breastfeeding during the pandemic were health professionals, Instagram and family members.

The presence of professional guidance in prenatal care about pregnancy and COVID-19 was absent in more than 1/3 of the women surveyed. Regarding the information provided by health professionals, it was noticed that the number (37%) of mothers who did not receive professional guidance on breastfeeding in the prenatal period is alarming, and the number of mothers who did not receive guidance on breastfeeding with suspicion or diagnosis of COVID-19.

Of the statements heard by a family member or close person, the most frequent were: "You cannot do prenatal care or go to the hospital to avoid contracting COVID-19", "If you have suspicion or confirmation of COVID-19, you cannot breastfeed" and " Breast milk can transmit COVID-19 to the child".

The number of times the child became ill in the last 6 months and hospitalization of the child were correlated with the period of breastfeeding with $p < 0.0001$ and $p = 0.0455$, respectively.

It is worth mentioning the insecurity and fragility perceived by women as a result of the lack of information made available through a reliable means, resulting in the public's misinformation, which must be considered a priority in the light of social problems. It is also inferred

that, although we have found in the media a possible factor to protect and promote the practice of breastfeeding, more effective monitoring policies must be implemented so that a certain portion of lactating women will not suffer from false information, and health professionals must act as a means of propagating scientifically proven information, through their proper qualification, especially with regard to the pandemic period and the indiscriminate dissemination of information, which can generate even more fear and insecurity for those who are already in a moment of fragility.

It is noteworthy that the method of reaching the participants and the methodology used must be taken into account. This study corroborates with studies already carried out in the field of maternal and child nutrition and with evidence about the new coronavirus, in addition to pointing to the emerging need for more studies on the topic addressed.

VI. FINANCIAL SUPPORT AND CONFLICT OF INTEREST

The research was funded with resources from researchers, with no conflict of interest by funding agents.

VII. AUTHORSHIP

All authors were essential in designing the study. BML proved to be indispensable in the formulation of research questions, in the conception and elaboration of the study, in carrying out the statistical analysis of the data, in the interpretation of findings and in the conception of the article's writing. BMSS was of paramount importance in formulating the research questions, in carrying out the study, as well as in disseminating and collecting the data obtained. IECF proved to be relevant in the process of formulating the research questions, in the study design and in the online dissemination of the research, through social networks. MKSM was instrumental in the entire initial process of the article, such as formulating the research questions and designing the study, as well as during its dissemination through the media. LMCS was of fundamental importance in the entire process of carrying out the study, from the formulation of initial questions to the correction of the writing of the article.

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Unmanned aircraft for monitoring elephant grass genotypes in energy biomass production

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Keywords — *Elephant grass, bioenergy, UAV, Vegetation index, remote sensing.*

Abstract— *Elephant grass is a promising plant for economic and sustainable energy production. However, adapted cultivars and efficient strategies for selecting genotypes aimed at energy biomass production is essential. Remote sensing techniques provide spatiotemporal information from plants in an agile, non-destructive and non-invasive way. The present study aimed to use remote sensors onboard an unmanned aerial vehicle (UAV) to monitor elephant grass genotypes and assist in plant phenotyping for energy biomass production. The experimental plots were imaged in the visible and near infrared bands. Imaging was carried out in 66 experimental plots in the José Henrique Bruschi Experimental Field (CEJHB), located in Coronel Pacheco, MG, Brazil. The experiment was arranged in a randomized block design with three replications, and 22 elephant grass genotypes were evaluated. The aggregated index $iMAP_{NDRE}$ was strongly correlated with the dry matter production observed in the field, therefore a method with potential application for estimating the biomass of elephant grass genotypes. Thus, sensors aboard UAV platforms can assist breeders to select the best elephant grass genotypes for energy production.*

I. INTRODUCTION

The demand for sustainable and renewable energy sources that can be alternatives to fossil fuels has been growing in recent years [1]. The production of energy from plant biomass is one of the economically viable alternatives. In this case, elephant grass (*Pennisetum purpureum* Schum.) has very promising potential for energy production when compared to other energy biomass sources such as sugarcane and eucalyptus.

Some of the advantages of using elephant grass as bioenergy source are the great productive potential, rapid growth and short production cycle. However, there are challenges to be overcome such as the lack specific cultivars for energy production and efficient strategies for selection of genotypes for quality of biomass in energy use. The development of automated phenotyping tools,

aiming to specific needs, can optimize the resources used in the selection and development of cultivars.

Automated data collection techniques and remote monitoring already contribute to boost agriculture and the rational use of natural resources [2, 3, 4]. The concept of smart farms has already been started, and devices such as Unmanned Aerial Vehicles (UAVs) have been helping farmers in activities including cargo transportation (fertilizers or pesticides), and monitoring of livestock and crops.

UAVs are platforms that embed sensors that provide a close panoramic view of the fields and are effective in generating data to extract knowledge or more accurate information about cropped areas to assist farmers in planning and decision-making [5].

Sensors that collect data in the visible range (RGB sensors) are the most common, but, they are cost-effective, as, in addition to the various spectral indices that can be generated, they have other applications such as a digital terrain model (MDT), 3D model, image orthomosaic, volume estimation and contour lines. On the other hand, sensors that capture data in the near infrared (700 to 1,100 nm) and thermal (5,000 to 12,000) ranges are very useful, for example, to identify vegetation stresses or plant that are more vigorous and excel in production and productivity.

The need for non-destructive, inexpensive, and large-scale experimentation makes remote sensing and data processing technologies fundamental to improving the performance and efficiency of plant phenotyping [6, 7]. Thus, remote sensing phenotyping methods have the advantage of gathering information from plants in a non-destructive and non-invasive way, both in space and time.

Recent technological advances have contributed to precision and high-throughput surveys to the benefit of large-scale field phenotyping [5]. From the foregoing, therefore, this study aimed to use remote sensors onboard an unmanned aerial vehicle (UAV) to monitor elephant grass genotypes and assist in plant phenotyping for energy biomass production.

II. MATERIAL AND METHODS

Study area characterization

The study was conducted at the José Henrique Bruschi Experimental Field (CEJHB) of Embrapa Dairy Cattle (Figure 1), in Coronel Pacheco (MG), Brazil.

Based on the Köppen-Geiger climate classification, the study area is located in a transition zone of Aw climate (tropical climate with dry winter season) and Cwa (temperate humid climate with dry winter and hot summer). However, there is a predominance of Cwa in the region of the municipality where the meteorological station of the National Institute of Meteorology (INMET) is located. According to the INMET climatological normals from 1981 to 2010, the annual average air temperature is 21.4°C and the average annual rainfall

volume is 1620.6 mm. July (12.6 mm) and January (355.1 mm) have the lowest and highest rainfall, respectively.

In the municipality of Coronel Pacheco-MG, 10% of the area has flat relief, 10% mountainous relief and 80% wavy relief. The maximum and minimum altitudes are 1,070 m and 409 m, respectively. The municipal seat has an altitude of 484 m. The altitude of the area of the experiment is between 414 and 418 m (Figure 1) and a clayey-textured dystrophic yellow latosol predominates.

Installing the experiment and sample data collection

The experiment was arranged in a randomized block design with three replications, 22 elephant grass genotypes, 66 experimental plots standardized with three 4-m rows and plots spaced 1.2 m apart, net plot established at 3.6 m² (3 x 1.2 m) to minimize the plot border effect (Figure 1). The total area of the experiment is 0.6 hectares. The growth period and plant height varied according to cutting, with approximately 20 cm of residue.

Biomass (Dry Matter Yield – DMY) samples were collected in the experimental plots to estimate the productivity of each elephant grass genotype. Standardized cuttings were carried out in the net plots, at 20 cm height above ground level. Each sample was identified, ground and weighed individually to estimate the total fresh weight of the sample (FWS). Dry matter was estimated using a random sub-sample of fresh matter, which was labeled and weighed (fresh sub-sample weight – FSSW). The sub-samples were dried in an oven at 55°C for a minimum period of 72 hours, until all the moisture was removed. Then, the subsamples were weighed to obtain the dry matter weight (DMW). Afterwards, the percentage of dry matter was calculated for each sub-sample (%DM):

$$\%DM = DMW * 100 / FSSW$$

Next, the productivity per hectare was estimated:

$$DM \text{ (kg/ha)} = FWS * \%DM * 10,000 / \text{Net plot}$$

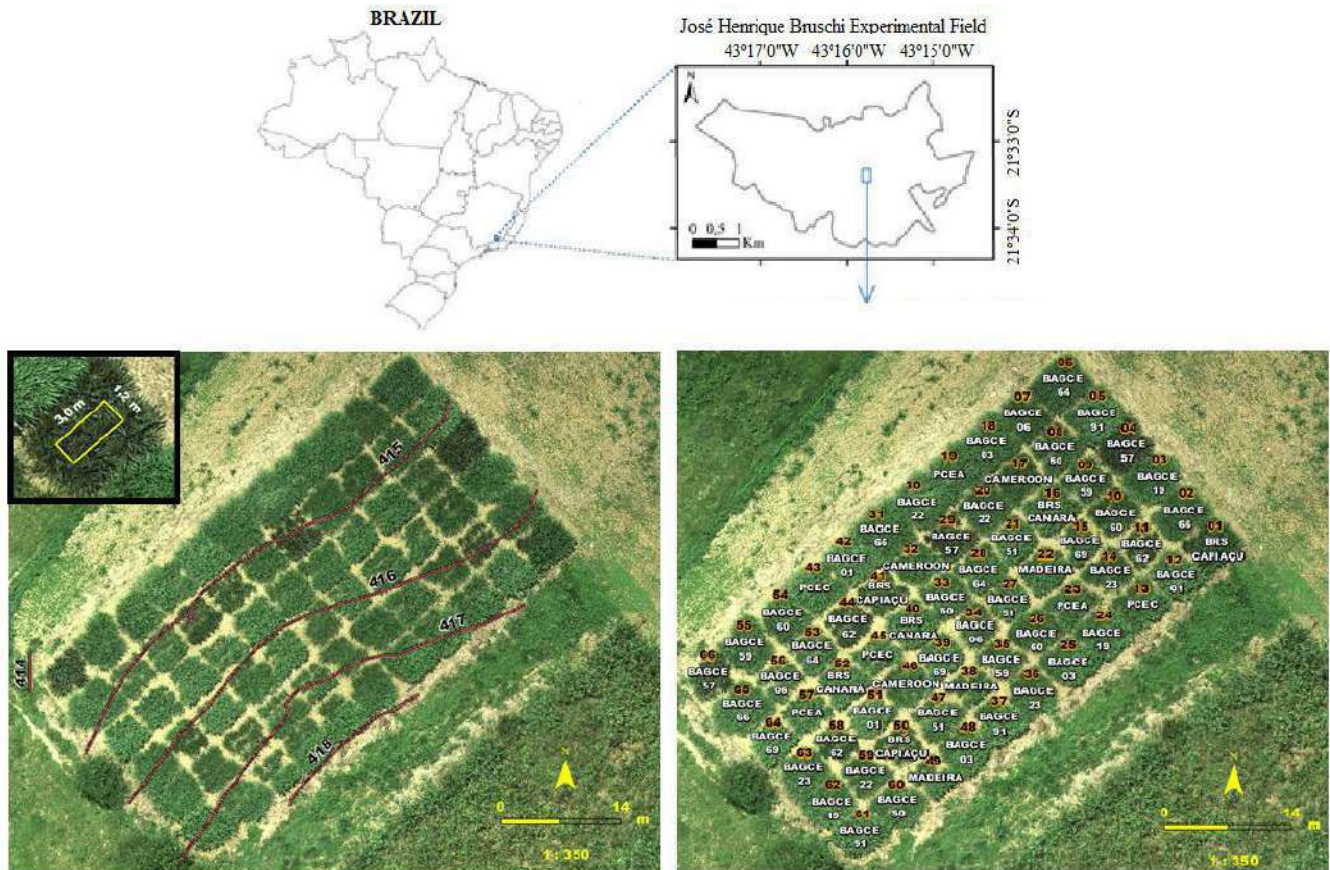


Fig. 1: Location of the José Henrique Bruschi experimental field - Coronel Pacheco, Minas Gerais, Brazil. Contour curves and identification of the sixty-six elephant grass plots and net plot for the genotype evaluations.

Aerial surveys and vegetation indices

The aerial surveys were carried out on 02/26/19, 04/18/19 and 11/04/19 using the Inspire 1 Pro rotary-wing UAV, quadcopter, featuring a Sentera Multispectral Double 4K camera with gimbal for imaging in the visible and near infrared ranges, as described in Table 1.

Table 1: Specifications of each band of the spectral range were obtained with the use of Sentera Multispectral Double 4K Gimbaled imaging

Bands	Wavelength center (nm)	Band width (nm)
Blue	446	60
Green	548	45
Red	650	70
NIR	720	40
Red Edge	840	20

The flight plans were carried out according to technical compliance requirements, so that the results or products of

the aerial survey could be compared on similar bases, equalizing variables such as flight height, pixel size of ground images (Ground Sample Distance - GSD), sensor calibration, percentage of image overlap, wind speed, brightness, shadow positioning, time of day, angle of view, sun position, etc.

The flight plan was parameterized as follows: (i) 70 m flight height; 2 cm GSD; 8 m/s maximum speed, 5 min flight time using battery; lateral and frontal overlap of the images 75% and 85%, respectively. Based on this flight plan configuration, it took 5 flight lines and 74 images to cover the entire area and generate the orthomosaic in the Pix4D Mapper Pro 4.125 software.

In the present study, the NDRE (Normalized Difference Red Edge [8]) and NDVI (Normalized Difference Vegetation Index [9]) were used according to the following equations:

$$NDRE = \frac{\rho_{nir} - \rho_{rededge}}{\rho_{nir} + \rho_{rededge}} \tag{Eq. 1}$$

$$NDVI = \frac{\rho_{nir} - \rho_{red}}{\rho_{nir} + \rho_{red}} \quad \text{Eq. 2}$$

Where ρ_{Green} , ρ_{Red} , ρ_{Blue} , $\rho_{RedEdge}$ and ρ_{NIR} are the spectral bands corresponding to the Green, Red, Blue, Red Edge, and near infrared (NIR) channels, respectively.

i-MulticriteriaAnalysisPlants (iMAP)

Throughout the experiment, the Embrapa Dairy Cattle Remote Sensing and Geoprocessing team used an aggregate index that allows analyzing the agronomic characteristics of any grouping of plants of the same genotype, which can be estimated from the images captured by the sensors embedded in the platform VANT. This index is based on the multicriteria analysis that calculates standardized anomalies between the agronomic characteristics of the canopy such as perimeter, area, height, volume, vigor, uniformity, fresh weight and dry weight. The index equation is given by:

$$iMAP_{IV} = \sum \left(\frac{CA - \bar{CA}}{\sigma_{CA}} \right) \quad \text{Eq. 3}$$

Where: iMAP is the aggregated index of multi-criteria analysis; IV is the designation of the vegetation index selected to assess the canopy vigor of the genotypes; CA is the agronomic characteristic selected for the composition of the aggregate index and calculated for each plot of the trial; \bar{CA} is the mean of the agronomic characteristic distribution for the 66 plots of the trial; σ_{CA} is the standard deviation of the agronomic characteristic distribution for the 66 plots of the trial.

The aggregated indices $iMAP_{NDVI}$ and $iMAP_{NDRE}$ were generated for the NDVI and NDRE vegetation indices, respectively. They express the association of vegetative vigor with the average volume reached by the genotype. Then, correlations between biomass and the aggregated indices $iMAP_{NDVI}$ and $iMAP_{NDRE}$ were examined.

III. RESULTS AND DISCUSSION

Figure 2 shows the spatiotemporal analysis of the elephant grass experimental plots. It shows heterogeneity in terms of growth and vigor of the 22 genotypes distributed in the 66 plots.

It is visible the variability in the shades of green and the exposure of background soil or faults in some plots in the RGB mosaics (Figures 2A and 2D). At the same time, in the images with estimates of NDVI (Figures 2B and 2E) and NDRE (Figures 2C and 2F), the variations in the

indices both within each plot and between plots were evident. These variations may be related to differences in vigor and soil faults or exposure within each net plot that may be imperceptible to an observer in the field. In this case, the influence of decaying organic matter may have occurred along the edges of the planting area (border effect).

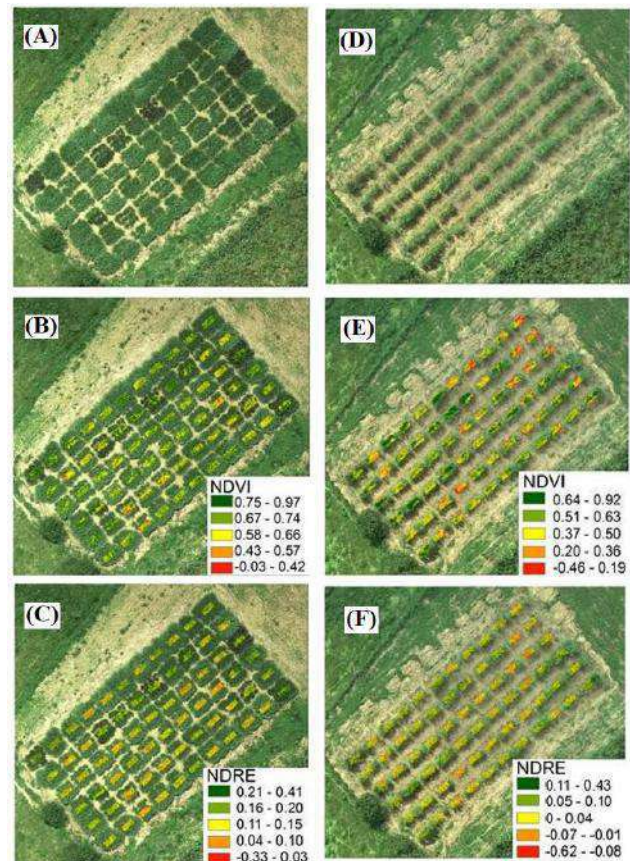


Fig. 2: Monitoring of elephant grass experimental plots using RGB and near infrared (NIR) sensors onboard unmanned aerial vehicle (UAV) to obtain RGB mosaics (A and D) and the vegetation indices NDVI (B and E) and NDRE (C and F) of the net plots. Image dates: 02/26/2019 (Figures A, B, C) and 04/18/2019 (Figures D, E, F).

Analysis of data distribution

Pearson's linear correlation coefficient assumes the existence of a linear relationship between variables, in a way that it can be used to estimate the degree of intensity or strength of this relationship. The existence of data clusters, outliers, sharp left or right asymmetries and other abnormalities must be investigated in advance and, if possible, mitigated. Generally, asymmetry, whether milder or more pronounced, is the problem that is most observed for variables of different natures, and often the use of some transformation, e.g., logarithmic, is enough to make the

distribution approximately symmetrical and favor its use in any statistical analyses.

The variable dry matter yield (kg), which was estimated by the traditional field method and indicates the biomass produced by the genotype, and the variable volume (m³) of the plants showed positive asymmetry with an extension of the right tail, with this deviation being detected by the Shapiro-Wilk test (Figures 3A and 3C, $p < 0.0001$). In both cases, the problem was mitigated by the logarithmic transformation, which made the distributions visibly more symmetrical, as evidenced by the histograms in Figures 3B and 3D and by the descriptive levels (p-values) that reached values greater than 0.19.

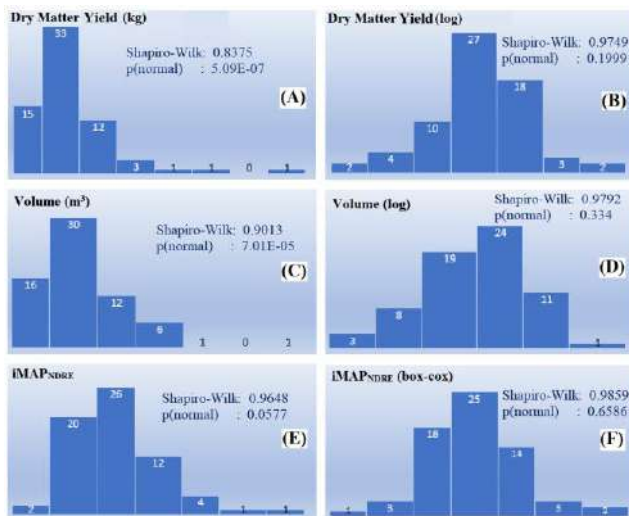


Fig. 3: Histograms of frequency distribution of dry matter yield (A), volume (C) and aggregated index iMAP_{NDRE} (E), as well as their forms transformed by decimal logarithm (B, D) or by Box-Cox power transformation (F), followed by the Shapiro-Wilk Normality Test.

The aggregated index iMAP_{NDRE} showed a slight positive asymmetry, which would not be sufficient to reject the distribution normality hypothesis (Figure 3E; $p=0.0577$). Nevertheless, to maximize as much as possible the linearity between this variable and any other in the study, its values were also transformed by the Box-Cox Transformation, making the distribution even more symmetrical (Figure 3F; $p=0.6586$). On the other hand, the distributions of the NDRE and NDVI vegetation indices, as well as the aggregate iMAP_{NDVI} index, showed only slight asymmetries (Figure 4) and no strong deviations from normality ($p > 0.0809$), ruling out the need for a transformation. Although, in general, all correlations can be refined, specifically from a greater number of aerial surveys, as expected, the iMAP_{NDRE} index showed the

highest correlation with dry matter yield or biomass produced by elephant grass genotypes (Figure 5). This index is a combination of the volume estimates and the NDRE. In addition, this combination enabled better classification of elephant grass genotypes.

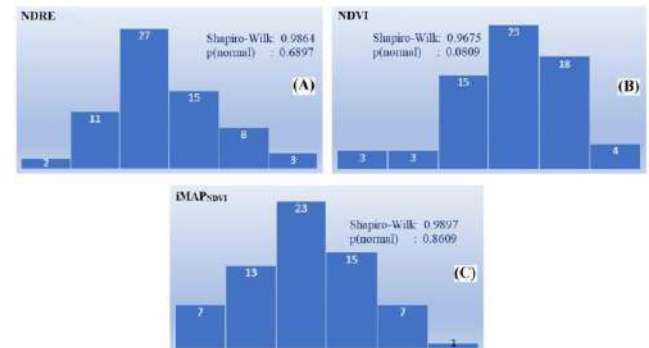


Fig. 4: Histograms of frequency of NDRE (A) and NDVI (B) vegetation indices and the aggregated iMAP_{NDVI} (C) index, followed by the Shapiro-Wilk Normality Test.

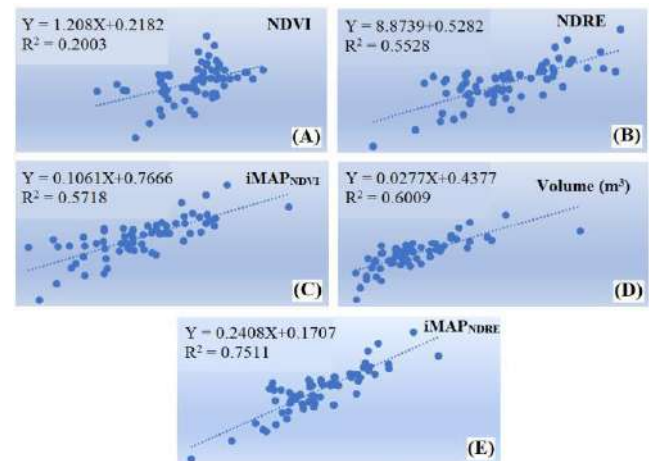


Fig. 5: Scatter plots of the relationship between biomass observed in the field with NDVI (A), NDRE (B), iMAP_{NDVI} (C), volume (D), iMAP_{NDRE} (E) data.

The application of the Scott and Knott's (1974) grouping method to the iMAP_{NDRE} aggregate index data, with a significance level of 5%, allows the discrimination of eight genetic materials (Table 2); and, if biomass (DMY) is used for selection, also at 5% significance level, virtually the same materials are indicated. This agreement of results indicates that, for the samples of materials involved in this study, the aggregated index iMAP_{NDRE} proved to be very useful and effective for selection aiming at the production of biomass.

Table 2: Clustering of means by the Scott and Knott method, $\alpha = 0.05$, for the variables $iMAP_{NDRE}$ and dry matter yield (DMY), emphasizing the selection of the best materials. Standard error of the mean: 0.9 ($iMAP_{NDRE}$) and 1.9 (DMY)

Selection rank	Genotype	$iMAP_{NDRE}$			DMY		
		Mean	Cluster	Rank	Mean	Cluster	Rank
1	BAGCE 19	3.9	a	1	10.9	a	3
2	Cameroon-BAG 38	2.5	a	2	9.3	a	4
3	BAGCE 66	2.1	a	3	11.3	a	2
5	BRS Capiaçú	1.8	a	4	11.6	a	1
4	BAGCE 57	1.7	a	5	9.2	a	5
5	BAGCE 23	1	a	6	8.6	a	6
6	BAGCE 3	0.7	a	7	7.5	b	7
7	BAGCE 62	0.5	a	8	6.4	b	10
	BAGCE 60	0.2	b	9	7	b	8
	BRS Canará	-0.1	b	10	6	b	13
	BAGCE 91	-0.2	b	11	6	b	12
	BAGCE 69	-0.5	b	12	6.3	b	11
	BAGCE 1	-0.7	b	13	6.5	b	9
	PCEC	-0.8	b	14	4.3	b	19
	BAGCE 6	-0.8	b	15	5.2	b	16
	BAGCE 22	-0.9	b	16	5.9	b	14
	Madeira	-1	b	17	4.5	b	18
	BAGCE 64	-1.4	b	18	5.8	b	15
	BAGCE 51	-1.7	b	19	4.7	b	17
	PCEA	-1.7	b	20	3.7	b	20
	BAGCE 59	-2.2	b	21	3.3	b	21
	BAGCE 50	-2.3	b	22	2.7	b	22

Figure 6 describes, in a synthetic way, the data collected for the variables $iMAP_{NDRE}$ and biomass (DMY), allowing an easy comparison between the performances of each genotype. For each genetic material, the boxplot (box and whisker) allows the exact identification of each of the three replications: the minimum of the three values is limited by the lower whiskers; the maximum of them is limited by the upper whiskers; and the remaining value, intermediate between these two, and corresponding to the median of the three, is represented by the thickest horizontal line. Additionally, the set of means, designated by the central points (solid, filled circle), shows the differences between the genetic materials and the decreasing trend between the best-ranked genotype and the one that achieved the worst performance in the experiment. It is noteworthy that, to allow the juxtaposition of the distributions of the two variables of

different natures - $iMAP_{NDRE}$ and DMY (original scales on the right side) - the variables were standardized by subtracting the mean and dividing by standard deviation, to be on a similar scale, having mean 0 and standard deviation 1 (represented by the ordinate axis on the left side).

It is also found that, generally, the eight materials grouped by Scott-Knott as the best based on $iMAP_{NDRE}$ – in addition to BAGCE 60 ranked ninth – were precisely those with a pair of means equal to or higher than the overall means of the two characteristics, $iMAP_{NDRE}$ and DMY, estimated at 0 (s/unit) and 6.66 kg/ha, respectively. In addition, the best of the entire experiment – BAGCE 19 – showed mean around two standard deviations above the overall mean found for $iMAP_{NDRE}$ and achieved mean

above one standard deviation above the estimated overall mean for biomass.

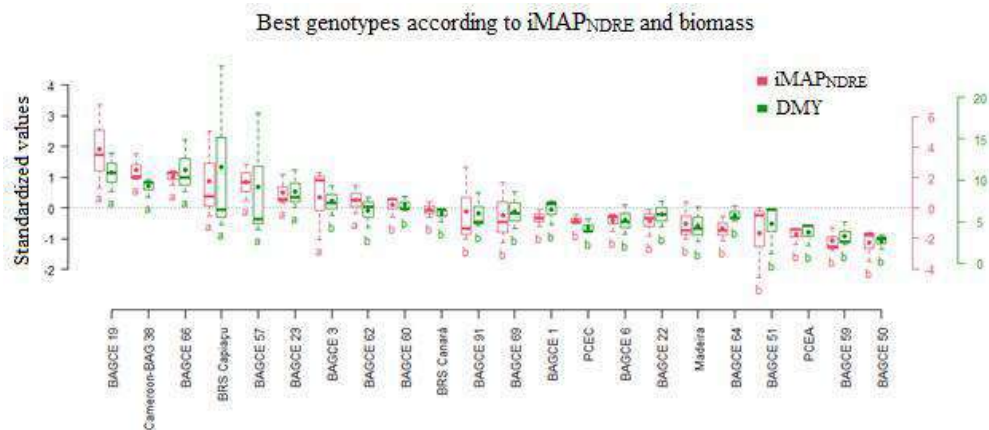


Fig. 6: Boxplot of frequency distributions per genetic material observed for the variables $iMAP_{NDRE}$ and energy biomass (DMY) and arranged in descending order of mean for $iMAP_{NDRE}$. The mean and median of each distribution are represented by the central solid point and the thickest horizontal line, respectively, while the whiskers limit the minimum and maximum values observed for the genotype. Means of the same variable followed by different letters were grouped into distinct clusters by the Scott-Knott method ($\alpha = 0.05$). Variables were standardized (subtracting the mean and dividing by standard deviation) before the juxtaposition, in the figure, with the overall means of the characteristics delimited by the dotted horizontal line.

IV. CONCLUSION

The aggregated index $iMAP_{NDRE}$ showed a strong correlation with the dry matter production observed in the field and has potential application for estimating the biomass of elephant grass genotypes. Thus, the use of sensors onboard UAV platforms can help breeders to select the best elephant grass genotypes for energy use.

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Food Literacy among Adolescents from public schools in Montes Claros, MG, Brazil, 2019/2020

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Keywords— Adolescent, Feeding Behavior,

Abstract — Objective: To evaluate adolescents' food literacy. Methods: The estimated samples were 496 and 497 schoolchildren aged 12 and 15 years old, according to the following parameters: universes 4458 and 4524 respectively; prevalence 50%; confidence level 95% ($Z=1.96$); sampling error 5%; non response rate 10%, and $d_{eff}=1.4$. By simple random drawing, public schools where there were adolescents of the recommended index ages were included. To assess food literacy, questions that addressed access to information, understanding, evaluation, and application of the information about food were considered. The data were collected by trained academics, who used software developed for this

Health Literacy, Health Promotion.

purpose. The descriptive analyses were made using the Statistical Package for the Social Sciences - SPSS, version 25.0. Results: 734 students participated, being 236 aged 12 and 498 aged 15, with response rates of 47.58% and 100%, respectively. It could be observed that, regarding the variable access, 9.3% (n=68) of the schoolchildren reported they had never had access to any information about proper nutrition. The main person / professional who had provided those teenagers with this information was the nurse (91.6% / n= 663), and the radio was the main means (90.2% / n=654). 80.0% of the respondents (n= 585) reported they had had access to the topic "Healthy and unhealthy eating". Most respondents reported difficulties in understanding, evaluation, and application of healthy eating information. Conclusion: Those teenagers' food literacy was adequate in the access dimension, but there were difficulties in the understanding, evaluation and application of information dimensions. Thus, the need to perform health care in a broader way is confirmed, with interventions that provide effective food literacy for adolescents, culminating in better health outcomes.

I. INTRODUCTION

Adolescence is a period of life in which there is food/nutrition consolidation and, therefore, it is considered a very suitable time for active and participatory nutritional guidance, involving both individual and social factors [1]. Among the viable spaces for the development of food education actions aimed at adolescents, the school environment stands out, being a privileged place to carry out actions to promote health and healthy eating practices, where the school community spends an important part of their time [2,3]. In addition to this, schools can implement environmental changes that enable the availability of healthy foods, the practice of physical education and proper eating behavior [4]. The importance of preventing inappropriate eating behaviors during adolescence has been recognized due to its long-term impact on health, such as the development of obesity and other non-communicable diseases [5].

In this context, "food literacy" is fundamental. It is within the field of health literacy, which concerns the personal, cognitive, and social skills that determine people's ability to access, understand, evaluate and apply the necessary information for health promotion, disease prevention and/or good health maintenance [6]. Thus, food literacy corresponds to the skills of reading, understanding and judging information; to seek and exchange knowledge related to the themes of food and nutrition; to buy and prepare food; to critically reflect on factors that influence personal food choices and to understand the impact of those choices on society. There is a difference between food and nutrition literacy, although they are often approached as synonymous. Hence, nutritional literacy is part of food literacy and corresponds only to the skills to understand nutritional information [7].

Policy makers and public health professionals suggest that food and nutrition education inadequacy is one of the main reasons for the ineffective results in adolescents' health [8]. The term "health literacy" is relatively new in the context of health promotion and the term food literacy is even more recent. High levels of "health literacy" and food literacy are desirable when proposing health promotion/health education. Literacy is not just about ensuring that people who have access to information can read and understand, evaluate and apply health-related information. It is a person's inherent state, making them more or less able to access, evaluate and use health-related information [9].

Food literacy emerged as a proposal to link knowledge, skills and capacity related to food [10], which focuses on the person's ability to acquire knowledge related to food and use this knowledge to achieve better food outcomes [11]. It is related to public health, diet and environmental sustainability. Its central concepts revolve around the needed skills to be inserted in the food environment, that is, planning, managing, selecting, preparing and eating healthy foods [12].

In the conceptual line of food literacy, it has the potential to influence eating patterns and promote the population better health [8,10,12]. Thus, our objective was to evaluate the food literacy of adolescents from public schools in Montes Claros – MG, according to the theoretical models of Sørensen et al. (2012) [6] and by Krause et al. (2018) [7], regarding access to information, understanding, evaluation and application of the information about food.

II. METHODS

This is an excerpt from the project “Epidemiological survey on oral health conditions and quality of dental care among schoolchildren in Montes Claros, Minas Gerais, Brazil, 2019/2020” (SBMoc Project). This is a cross-sectional, field study, with a quantitative approach. Public schools with adolescents aged 12 and 15 years old, enrolled in 2019, were selected through a simple random drawing of conglomerates. The estimated samples were 496 and 497 students aged 12 and 15, respectively. The sample size calculation was carried out as proposed by Triolla [13]. The following parameters were considered: universe with 4458 12-year-olds and 4524 15-year-olds; a prevalence of health-related events or states of 50%; a 95% confidence level ($Z=1.96$); a sampling error of 5%; a drawing effect or deff of 1.4 and a non-response rate of 10%. To assess food literacy, questions that addressed access to information, understanding, evaluation and application of the information about food were considered.

Students of both sexes were invited to participate in the research, with the necessary index ages for the study (12 and 15 years old), duly enrolled and attending the selected schools, located in Montes Claros, Minas Gerais. Participants who did not accept to participate in the research or who did not completely fill out the questionnaire, as well as those students who showed some cognitive impairment were excluded. After the Municipal Department of Education (Secretaria Municipal de Educação - SME) and the State Department of Education (Secretaria Estadual de Educação - SEE) approval and authorization to carry out the study, the direction of the selected schools was sensitized through meetings, in which the objectives and methodology of the project were presented.

The field team was trained to carry out their functions, ensuring an acceptable degree of uniformity in procedures. Data collection was carried out by doctoral students, master's students, dentist surgeons and dentistry students. Survey participants were informed about the objectives, relevance and methodology. After making them clear, a Free and Informed Consent Term (Termo de Consentimento Livre e Esclarecido - TCLE) was requested, in which the participant voluntarily accepted to participate in the research with the right to withdraw, without any personal or professional harm.

The application of the questionnaires was carried out individually, in a room reserved for this purpose, with the presence of the team in the room. For data collection, the questionnaire was developed based on the theoretical model that proposes to investigate the access to information, understanding, evaluation and application [7]

of the information related to food. Data were collected through interviews, using a valid and reliable instrument, consisting of 59 items, with answers on a Likert-type scale [14].

To assess food literacy, the following questions about food and nutrition were considered: if they had already had access about food and nutrition, the information provider, access time, understanding, ease of access and information application, since only the application can corroborate to maintain and/or improve people's health. Additionally, other sources of information were investigated, as well as the subject of that information.

Access to information included the options: always, often, sometimes, rarely, and never. The assessment regarding the provider was made by asking the participants about who had provided information about food and nutrition (no provider, parents, family members, teachers, nutritionist, dentist, physician, nurse, community health worker, others). The options for access time were: in the last month, in the last six months, in the last year, in the last two years, more than two years ago. To assess comprehension, the adolescents could choose: I understood everything, I understood almost everything, I understood more or less, I understood little, I did not understand or I did not have access to any information about food and nutrition. As for the ease of access, the options were: I can easily, I can with little difficulty, I can more or less, I can with difficulty, I can not or I did not have access to any information about food and nutrition. To assess whether the teenager could put the received information into practice, they could choose among always, often, sometimes, rarely or never.

As for other sources of information, participants were asked about the means of obtaining them: no source, prescriptions/medical prescriptions, medication inserts, food labels, posters, newspapers, magazines, pamphlets/folders/booklets, school supplies - such as books, internet/mobile/computer (social networks such as Facebook®, Instagram®, Twitter®, WhatsApp®, YouTube®), educational video (including social networks), radio, television, lecture, film/cinema, class, others.

Regarding the theme, the adolescents chose between: no theme; What is food/nutrition?; Healthy and unhealthy eating; Processed foods; Relationship between physical activity and food/nutrition; Relationship of weight gain with consumption of unhealthy foods; Difficulties in following a diet; Health x food/nutrition; Fad diets; Food labels; Concern of eating unhealthy foods with body image; Obesity; Malnutrition; Eating disorders; Fresh

food; Ultra-processed products; Processed products; Food supplements and others.

The results obtained were entered into the software developed during the research for data collection, a software from the SBMoc Project 2019/2020, Research Management System (Sistema de Gerenciamento de Pesquisas - SGP). After collection, those were tabulated and gathered in a single database, for descriptive statistical analysis, presenting absolute and relative frequencies, in the Statistical Package for Social Sciences – SPSS, version 25.0 software. The study was submitted and approved by the National Research Ethics Commission (Comissão Nacional de Ética em Pesquisa) of the State University of Montes Claros (Universidade Estadual de Montes Claros) – Unimontes, under opinion n° 2,483,638.

III. RESULTS

A total of 734 students participated in the study, 236 aged 12 and 498 aged 15, with response rates of

47.58% and 100%, respectively. According to Table 1, it was observed that in relation to the variable access, 9.3% (n=68) of the students reported that they had never had access to any information about food/nutrition. The main person / professional who had provided the information to the adolescent was the nurse (91.6% / n= 663). Regarding the access time, it appeared that the participant had access in the last month by this professional (50.3% / 361). Regarding the adolescent's understanding of the information they had had access to through that person(s), 50.3% (n=362) of respondents reported that they had understood everything that was passed on. As for the ease of accessing the information to which the teenager had access through that person(s), 51.7% (n=373) said they could easily get it. Regarding the application of the offered information, 37.1% (n=267) said they sometimes put it into practice.

Table 1 - Evaluation of access to information, understanding, evaluation and application of information on food and nutrition among adolescents in Montes Claros - MG, regarding access, information provider and time of access, 2021. (All n= 734 / 12 years old n= 236 / 15 years old n = 498).

Variable	All		12		15	
	n	%	n	%	n	%
Have you ever had access to any information about food/nutrition?*						
Always	179	24,4	59	25,0	120	24,1
Often	161	21,9	47	19,9	114	22,9
Sometimes	242	33,0	77	32,6	165	33,1
Rarely	84	11,4	24	10,2	60	12,0
Never	68	9,3	29	12,3	39	7,8
Who provided you with any information about food and nutrition?						
Parents *						
Yes	550	75,5	171	73,1	379	76,7
No	178	24,5	63	26,9	115	23,3
Other family members*						
Yes	469	64,3	147	62,3	322	65,3
No	260	35,7	89	37,7	171	34,7
Teacher*						
Yes	518	71,3	166	70,6	352	71,5
No	209	28,7	69	29,4	140	28,5
Nutritionist*						
Yes	551	75,9	180	76,6	371	75,6
No	175	24,1	55	23,4	120	24,4
Dentist*						
Yes	459	63,3	147	62,6	312	63,7
No	266	36,7	88	37,4	178	36,3
Physician *						
Yes	531	73,2	174	74,4	357	72,7
No	194	26,8	60	25,6	134	27,3
Nurse *						
Yes	663	91,6	217	92,7	446	91,0

No	61	8,4	17	7,3	44	9,0
Community health worker *						
Yes	598	82,7	202	86,3	396	81,0
No	125	17,3	32	13,7	93	19,0
Other(s) *						
Yes	13	1,8	3	98,7	10	2,0
No	710	98,2	231	1,3	479	98,0
When was the last time you had access to any information about food/nutrition through that person/those people? *						
In the last month	361	50,3	115	50,7	246	50,2
In the last six months	170	23,7	38	16,7	132	26,9
In the last year	73	10,2	30	13,2	43	8,8
In the last two years	23	3,2	6	2,8	17	3,4
More than two years ago	21	2,9	6	2,8	15	3,0
I did not have access to any information about food/nutrition	69	9,7	31	13,8	38	7,7
Did you understand the information about food/nutrition you had access to through that person/those people? *						
I understood everything	362	50,3	109	47,6	253	51,5
I understood almost everything	185	25,7	50	21,8	135	27,5
I understood more or less	89	12,4	36	15,7	53	10,8
I understood little	15	2,1	5	2,2	10	2,0
I did not understand	7	1,0	4	1,7	3	0,6
I did not have access to any information about food/nutrition	62	8,6	25	10,9	37	7,5
Can you assess the quality of information about food/nutrition that you had access to through that person/those people? *						
I can easily assess it	373	51,7	113	49,3	260	52,8
I can assess it with little difficulty	92	12,8	29	12,7	63	12,8
I can more or less	118	16,4	36	15,7	82	16,7
I can assess it with difficulty	33	4,6	10	4,4	23	4,7
I can not	41	5,7	16	7,0	25	5,1
I did not have access to any information about food/nutrition	64	8,9	25	10,9	39	7,9
Do you put into practice the information about food/nutrition that you had access to through that person/those people? *						
Always	154	21,4	54	23,6	100	20,4
Often	136	18,9	31	13,5	105	21,4
Sometimes	267	37,1	90	39,3	177	36,1
Rarely	73	10,2	20	8,7	53	10,8
Never	26	3,6	8	3,5	18	3,7
I did not have access to any information about food/nutrition	63	8,8	26	11,4	37	7,6

* Number of respondents less than the number of participants.

Table 2 represents the information regarding the source of the information, that is, the students were asked about the means of obtaining them. The radio was the main one by which adolescents had already heard information about food and nutrition (90.2% / n=654). 49.6% (n=355) of the participants stated that the last time they had viewed, read, listened to or watched such information in printed or electronic materials was in the

last six months. Regarding the understanding of that information using those sources, it was observed that 64.2% (n= 459) reported that they had not understood the information, as well as 50.8% (n= 363) stated that they could assess the quality of the information with difficulty. 39.2% (280) of students rarely put them into practice.

Table 2 – Means of information and aspects related to time, understanding, evaluation and practice of information in Food Literacy among adolescents from Montes Claros – MG, 2021. (All n= 734 / 12 years old n= 236 / 15 years old n = 498).

Variable	All		12		15	
	n	%	n	%	n	%

In which of the media(s) below have you viewed, read, listened to or watched information about food/nutrition?

Prescriptions/medical prescriptions *

Yes	484	66,8	167	71,1	317	64,7
No	241	33,2	68	28,9	173	35,3
Medicine Package Inserts *						
Yes	602	83,3	185	78,7	417	85,5
No	121	16,7	50	21,3	71	14,5
Food Labels *						
Yes	483	66,3	164	69,5	319	64,7
No	246	33,7	72	30,5	174	35,3
Posters *						
Yes	415	57,1	136	57,9	279	56,7
No	312	42,9	99	42,1	213	43,3
Newspapers *						
Yes	542	74,6	177	75,3	365	74,2
No	185	25,4	58	24,7	127	25,8
Magazine*						
Yes	543	74,8	188	80,0	355	72,3
No	183	25,2	47	20,0	136	27,7
Pamphlets/Folders/Booklets *						
Yes	410	56,5	141	60,3	269	54,7
No	316	43,5	93	39,7	223	45,3
School supplies (such as books) *						
Yes	443	60,7	144	61,0	299	60,5
No	287	39,3	92	39,0	195	39,5
Internet/mobile/computer (social networks such as Facebook®, Instagram®, Twitter®, WhatsApp®, YouTube®)*						
Yes	521	71,7	149	63,7	372	75,5
No	206	28,3	85	36,3	121	24,5
Educational video (including social networks) *						
Yes	456	63,0	141	60,3	315	64,3
No	268	37,0	93	39,7	175	35,7
Radio *						
Yes	654	90,2	209	88,9	445	90,8
No	71	9,8	26	11,1	45	9,2
Television *						
Yes	452	61,8	142	60,2	310	62,6
No	279	38,2	94	39,8	185	37,4
Lecture*						
Yes	394	54,3	139	59,4	255	51,9
No	331	45,7	95	40,6	236	48,1
Film/cinema *						
Yes	634	87,7	198	84,6	436	89,2
No	89	12,3	36	15,4	53	10,8
Class *						
Yes	500	68,8	150	64,1	350	71,0
No	227	31,2	84	35,9	143	29,0
Other *						
Yes	11	1,5	2	0,9	9	1,8
No	711	98,5	232	99,1	479	98,2
When was the last time you viewed, read, listened to or watched information about food/nutrition in the printed or electronic materials you mentioned? *						
In the last month	1	0,1	1	0,4	0	0,0
In the last six months	355	49,6	107	46,7	248	50,9
In the last year	166	23,2	46	20,1	120	24,6

In the last two years	80	11,2	29	12,7	51	10,5
More than two years ago	49	6,9	27	11,8	22	4,5
I did not have access to any information about food/nutrition	65	9,0	19	8,3	46	9,5

Did you understand the information about food/nutrition that you viewed, read, listened to or watched in the printed or electronic materials you mentioned? *

I understood almost everything	8	1,1	2	0,9	6	1,2
I understood more or less	26	3,6	11	4,8	15	3,1
I understood little	157	22,0	54	23,7	103	21,1
I did not understand	459	64,2	134	58,8	325	66,7
I did not have access to any information about food/nutrition	65	9,1	27	11,8	38	7,8

Can you assess the quality of information about food/nutrition that you viewed, read, listened to or watched in the printed or electronic materials you mentioned? *

I can easily assess it	60	8,4	18	7,9	42	8,6
I can assess it with little difficulty	116	16,2	42	18,4	74	15,2
I can more or less	113	15,8	35	15,4	78	16,0
I can assess it with difficulty	363	50,8	107	46,9	256	52,6
I did not have access to any information about food/nutrition	63	8,8	26	11,4	37	7,6

Do you put into practice the information about food/nutrition that you viewed, read, listened to or watched in the printed or electronic materials you mentioned? *

Often	132	18,5	50	21,9	82	16,8
Sometimes	148	20,7	33	14,5	115	23,6
Rarely	280	39,2	95	41,7	185	38,0
Never	93	13,0	24	10,5	69	14,2
I did not have access to any information about food/nutrition	62	8,7	26	11,4	36	7,4

*Number of respondents less than the number of participants.

Table 3 shows the topics on food and nutrition mentioned by the participants. 80.0% (n= 585) of them reported that they had had access to the topic “Healthy and unhealthy food”. 47.4% (n=340) stated that they had access to this information in the last six months. As for the themes addressed in this study, 43.4% (n=311) said they

could understand almost everything. 45.4% (n=323) were unable to assess information on food/nutrition and 39.2% (n=281) reported that they rarely put into practice the information obtained on those themes.

Table 3 – Themes/issues about Food Literacy among adolescents from Montes Claros – MG, 2021. (All n= 734 / 12 years n= 236 / 15 years n = 498).

Variable	All		12		15	
	n	%	n	%	n	%
Among the subjects listed below, which one(s) have you already had access to? None *						
Yes	13	1,8	4	1,7	9	1,8
No	706	98,2	228	98,3	478	98,2
What is food? *						
Yes	347	47,7	106	45,1	241	49,0
No	380	52,3	129	54,9	251	51,0
Healthy and unhealthy eating *						
Yes	585	80,0	191	80,9	394	79,6
No	146	20,0	45	19,1	101	20,4
Processed foods (They are ready-to-eat or semi-ready products. Ex.: cans, boxes, etc.). *						
Yes	257	35,2	102	43,2	155	31,3

No	474	64,8	134	56,8	340	68,7
Relationship between physical activity and food/nutrition *						
Yes	300	41,2	103	43,8	197	40,0
No	428	58,8	132	56,2	296	60,0
Relationship of weight gain with consumption of unhealthy foods *						
Yes	296	40,7	112	47,7	184	37,3
No	432	59,3	123	52,3	309	62,7
Difficulties in following a diet *						
Yes	368	50,4	124	52,8	244	49,3
No	362	49,6	111	47,2	251	50,7
Health x food/nutrition *						
Yes	346	47,5	123	52,3	223	45,1
No	383	52,5	112	47,7	271	54,9
Fad Diets (They are miracle diets, which guarantee rapid weight loss in a short time).*						
Yes	462	63,5	163	69,4	299	60,6
No	266	36,5	72	30,6	194	39,4
Food labels *						
Yes	446	61,3	142	60,4	304	61,8
No	281	38,7	93	39,6	188	38,2
Concern of eating unhealthy foods with body image *						
Yes	424	58,2	149	63,4	275	55,8
No	304	41,8	86	36,6	218	44,2
Obesity (overweight) *						
Yes	375	51,7	130	55,1	245	50,0
No	351	48,3	106	44,9	245	50,0
Malnutrition (underweight) *						
Yes	386	52,9	129	54,7	257	52,0
No	344	47,1	107	45,3	237	48,0
Eating disorders (Measures used for weight loss. Eg bulimia, anorexia, etc.)*						
Yes	473	65,0	172	73,2	301	61,1
No	255	35,0	63	26,8	192	38,9
Fresh foods (Foods consumed in their natural state). *						
Yes	444	61,0	158	67,5	286	57,9
No	284	39,0	76	32,5	208	42,1
Ultra-processed products (They are created by industries with various synthetic products). *						
Yes	496	68,3	170	72,6	326	66,3
No	230	31,7	64	27,4	166	33,7
Processed products (These are ready-to-eat products. Ex.: canned products). *						
Yes	433	59,6	157	67,1	276	56,1
No	293	40,4	77	32,9	216	43,9
Food supplements (Used for sports or weight gain). *						
Yes	446	61,4	156	66,4	290	59,1
No	280	38,6	79	33,6	201	40,9
When was the last time you had access to this information about food/nutrition?*						
In the last month	9	1,3	4	1,7	5	1,0
In the last six months	340	47,4	96	41,4	244	50,2
In the last year	182	25,3	53	22,9	129	26,5
In the last two years	81	11,3	32	13,9	49	10,0
More than two years ago	40	5,5	20	9,0	20	4,0
I did not have access to any information about food/nutrition	66	9,2	25	11,1	41	8,3
Did you understand the information about food/nutrition you had access to? *						
I understood everything	3	0,4	2	0,9	1	0,2

I understood almost everything	311	43,4	92	39,7	219	45,2
I understood more or less	190	26,5	53	22,8	137	28,2
I understood little	115	16,0	47	20,3	68	14,0
I did not understand	32	4,5	11	4,7	21	4,3
I did not have access to any information about food/nutrition	66	9,2	27	11,6	39	8,0
*Can you assess the quality of information food/nutrition you have had access to? *						
I can easily assess it	113	15,8	42	18,1	71	14,7
I can assess it with little difficulty	140	19,5	41	17,7	99	20,5
I can more or less	47	6,5	18	7,8	29	6,0
I can assess it with difficulty	26	3,5	12	5,2	14	2,9
I can not	323	45,4	100	40,3	223	47,5
I did not have access to any information about food/nutrition	67	9,3	29	10,9	38	8,4
Do you put into practice the information about food/nutrition you had access to? *						
Often	118	16,5	47	19,3	71	14,6
Sometimes	138	19,2	34	13,6	104	22,4
Rarely	281	39,2	91	38,2	190	39,8
Never	114	15,9	40	16,5	74	15,6
I did not have access to any information about food/nutrition	66	9,2	30	12,4	36	7,6

* Number of respondents less than the number of participants.

IV. DISCUSSION

The stage of adolescence involves biological, psychosocial and physical changes. It is a period of great transformations, requires the need to listen to this public in their needs including significant knowledge about nutritional food health. Hence, there is a need to present an approach centered on the understanding of food literacy by teenagers, in order to enhance the integration of knowledge, attitudes and choices that will impact their health in this life cycle.

This study explored adolescents' perspectives on food literacy, that is, the abilities to read, understand and judge information. It was found that the study participants had had access to information, but when evaluated for understanding, evaluation and application, most respondents reported that they "understand almost everything" or "understand more or less", and "rarely put it into practice". From a life-course perspective, interventions aimed at food literacy early in life offer the greatest potential for impact throughout life [15].

Addressing food literacy among adolescents and young adults can be particularly impactful, as it is a period of development in which they experience food independence, establishing their own identity and building health-related habits throughout life [16]. Consequently, teenagers' participation in the construction of their own decisions is of paramount importance for them to be involved as well as the subject to this process.

Regarding the difficulty presented by the students concerning the understanding, assessment and application reported by them during the answers, it appeared that many adolescents had not applied dietary guidelines on a

daily basis due to lack of skills and/or beliefs that this is important for their adult age [17]. Worsley (2002) [18] indicated that food knowledge can play a small but fundamental role in the adoption of healthier eating behaviors, but indicated that eating skills are important so that it can allow knowledge to be put into practice.

The adolescents who took part of this research reported difficulties not only with access, but also with sources of information about eating habits. Some of them critically analyzed information related to nutrition, but according to Ronto et al. (2016) [19], most recognized that not all sources related to food and nutrition are reliable, and still stated that regarding nutritional information, they mainly trust their parents and only the teachers who teach subjects related to food and nutrition, thus diverging from the present study, as the main person/professional who provided the information regarding eating habits was the nurse, as well as the main means was the radio.

Therefore, schools can play a vital role in filling this gap through the adolescents' "skills improvement" [17,18]. Furthermore, this would allow teenagers to act as agents of change [20,21]. Participation in classes that address the theme "healthy eating" or similar topics has been associated with higher levels of dietary knowledge in adults, suggesting that this could bring learning and lasting application in food literacy [22].

This was the most reported theme by students, consequently confirming the importance of the school environment to work with different issues related to the students' health [23]. The National Guidelines for the Comprehensive Health Care of Adolescents and Youth in

the Promotion, Protection and Recovery of Health (As Diretrizes Nacionais para a Atenção Integral à Saúde de Adolescentes e Jovens na Promoção, Proteção e Recuperação da Saúde) [24] highlight the role of the school as one of the pillar structures in health education for adolescents, the need to promote intersectoral actions, articulating the co-responsibility of educators and health professionals to act in facing the demands of health education, taking into account sociocultural issues.

Furthermore, the study found a significant relationship, even with descriptive parameters of the relationship between food literacy and health promotion behavior. This is supported by the study by Chahardan-Cherik et al. (2018) [25] who found that there is a significant relationship between health literacy and all dimensions of the health promotion scale, and nutrition falls under those themes. Limited health literacy is associated with less participation in health promotion and disease detection activities, riskier health choices, poor medication adherence, increased hospitalization and re-hospitalization, increased morbidity and premature death [23].

It is important to pay more attention to teenagers in the health literacy area and health promotion behavior so that they can have a better quality of life, especially regarding eating habits. This way, food literacy has become a differential for adolescents, as it highlights their vulnerability to healthy lifestyle choices and habits, choices and attitudes that may remain throughout life, thus stimulating their empowerment in relation to decisions about their bodies and health.

However, some limitations were observed, and the main one was the Coronavirus pandemic (Covid-19) which made it impossible to carry out the field research properly, suspending classes. Therefore, private and rural schools were not evaluated, and there was a need to carry out a new sample calculation, in which only municipal and state public schools in the urban area were included. Another factor is the recent issue theme regarding food literacy, especially for adolescents, whose studies on the skills of reading, understanding and judging information for this audience are still scarce. In this context, producing health with teenagers and young people having food literacy as one of the pillars is to bring them to the center of the process as subjects of rights.

V. CONCLUSION

The adolescents who took part of this study have had access to information regarding food literacy. However, they had difficulties in understanding, evaluating and applying information about food. Thus, it confirms the need to provide health care in a broader way,

promoting interventions that have an effect on the factors that determine people's health conditions, especially teenagers. Health education remains a fundamental tool in health promotion, disease prevention and people's autonomy. Nutritional education activities can help in those educational practices for adolescents, as well as considering the school environment with a potential transforming role to work on issues related to health issues, therefore promoting educational campaigns and strategies regarding eating behavior.

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A New Look at Worker Health: Reflections for the construction of an intervention proposal

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Abstract—*The present study aims to seek preventive measures that minimize the impacts on workers' health. The theoretical dialogues are structured from the concepts that make up the field called Occupational Health. Under this approach, it has an interdisciplinary character and is epistemologically based on a social constructivist conception. Theoretical reflections on the subject go beyond the foundations that influence and shape the theoretical plan and advance towards the construction of an intervention proposal for the work relationships that cause illness. As a result, it can be concluded that workers, exposed to occupational hazards in their work environment, must constitute a concern for Brazilian public health, and must be a constant object of public policies and effective measures that ensure the fundamental right to health of the worker.*

I. INTRODUCTION

Worker's Health in Brazil requires a new look at this field of knowledge, whose theoretical approach should dialogue with several other areas in order to achieve its main purpose, which is to analyze and intervene in work relationships that cause diseases and injuries to workers' health.

In Brazil, development policies have traditionally been restricted to economic aspects and have been traced in a parallel or poorly articulated way with social policies, with the latter bearing the burden of possible damage to the health of the population, workers in particular and the environment.

From this point of view, the integrated approach to the interrelationships between issues of worker safety and health, the environment and the development model adopted in the country, translated by the production-consumption profile, currently represents a major challenge for the Brazilian State.

It is true that the scarcity and inconsistency of information on the real health situation of workers make it difficult to define priorities for public policies, the planning and implementation of workers' health actions, in addition to depriving society of important instruments for improving the living and working conditions.

In this context, Occupational Health is an area in permanent construction, referenced by the concepts of promotion, surveillance and participation in health, which aim at the recovery and rehabilitation of the health of workers subjected to risks and injuries arising from the environment and working conditions. (MARTINS et al, 2017).

On the other hand, as an area within the scope of Brazilian public health, studies on workers' health are insufficient when compared to their challenges, among them the limited effectiveness of State policies to face the risk conditions to the health of workers. (MINAYO-GOMES et al., 2018).

Thus, the present study was motivated by the need to deepen this debate in the academic and scientific sphere, aiming at the implementation of prevention measures that minimize the impacts on workers' health.

II. WORKER'S HEALTH

The relationship between work, health and illness was not always a focus of attention. During antiquity, slave labor was interpreted as punishment or stigma, synonymous with tripalium or instrument of torture. With the advent of the Industrial Revolution, the relationship with work was modified. The "free" worker starts to sell his work force, becoming hostage to the capitalist production system, being subjected to strenuous working hours, human agglomeration and unhealthy environments conducive to the proliferation of infectious diseases and the dangerousness of the machines that were responsible for mutilations and deaths (MINAYO-GOMEZ; THEDIM-COSTA, 1997).

In this context, the field that came to be called Workers' Health was constituted from two different conceptions of health and work: Occupational Medicine and Occupational Health.

Occupational Medicine, as a medical specialty, emerged in the 19th century in England with the Factory Act, being the first relevant legislation in the field of worker protection. Thus, the presence of a doctor inside the factories represented both an investigation of the causes that led to the illness, as a way of recovering workers' health, fundamental for the emerging production line and industrialization. Centered on the figure of the doctor, within the scope of work, it reflects a propensity to isolate specific risks and act on their consequences, medicalizing their symptoms or associating them with a legally recognized disease. Likewise, the diagnosis of diseases in the selection phase works as a way of preventing the hiring of individuals whose health is compromised (MINAYO-GOMEZ; THEDIM-COSTA, 1997).

In the teachings of Mendes and Dias (1991, p. 341): "the consumption of the workforce, resulting from the submission of workers to an accelerated and inhuman process of production, demanded an intervention, under penalty of making the survival and reproduction of the process itself".

According to the authors, the concern with promoting medical services to workers also began to be reflected in the international scenario with the creation, in 1919, of the International Labor Organization (ILO), which started to propagate the proposal of Occupational Medicine, through the Recommendations 97 and 112 which deal, respectively,

with the Protection of Workers' Health and Occupational Medicine Services.

From the point of view of Lacaz (2007), occupational medicine services play an important role in the study of the causes of absence from work, in the recruitment of personnel and in the analysis of occupational diseases and accidents, aiming at a healthier workforce, the control of absenteeism and the rapid return to production.

The gigantic industrial effort undertaken during and after the Second World War evidenced the relative impotence of the field of occupational medicine in the intervention of health problems caused in that period, resulting in significant changes in the productive process from the technological evolution and the emergence of new diseases. to workers' health (MENDES; DIAS, 1991).

Therefore, Occupational Health emerges as a more comprehensive proposal than Occupational Medicine:

The rational, "scientific" and apparently unquestionable answer translates into the expansion of medical practice aimed at the worker, through intervention in the environment, with the instruments offered by other disciplines and other professions. "Occupational Health" appears, above all, within large companies, with the trait of multi and interdisciplinarity, with the organization of progressively multiprofessional teams and the emphasis on "industrial" hygiene, reflecting the historical origin of medical services and the prominent place of industry in "industrialized" countries (MENDES; DIAS, 1991, p. 343).

Despite this significant expansion to the field of Occupational Health, in practical terms, the same limitations related to the field of Occupational Medicine occur, since protection measures end up being restricted to specific interventions on the most evident risks. The use of individual protection equipment is emphasized, to the detriment of other collective protection instruments. Safety standards are established as a form of symbolic prevention, attributing the burden of accidents and illnesses to the workers themselves, resulting in a double penalty (MACHADO; MINAYO-GOMES, 1995).

Indeed, the discussion on Workers' Health in Brazil emerges from Collective Health, which seeks to know and intervene in work and health-disease relationships:

By opposing the knowledge and practices of Occupational Health, it aims to overcome them, identifying itself from concepts

originating from a bundle of dispersed discourses formulated by Latin American Social Medicine, related to the social determination of the health-disease process; for Public Health in its programmatic aspect and for Collective Health when addressing the suffering, getting sick, dying of social classes and groups inserted in productive processes (LACAZ, 2007, p. 758).

Power relations give Occupational Health a greater ability to control capital over work, contributing to a scenario of worker alienation and to the construction of the counter-hegemonic field of Workers' Health (LACAZ, 2007).

In a context of critical reflection, the concepts and practices of the models in force until then, related to Occupational Medicine and Occupational Health, are overcome, generating a new way of dealing with the work-health relationship in work environments and introducing care practices to workers' health (MINAYO-GOMEZ et al, 2018).

From a theoretical-conceptual point of view, the following position is adopted in this study:

Workers' health is configured as a field of interdisciplinary strategic practices and knowledge - technical, social, political, human - multiprofessional and inter-institutional, aimed at analyzing and intervening in work relationships that cause diseases and injuries. Its reference frameworks are those of Collective Health, that is, promotion, prevention and surveillance (MINAYO-GOMEZ et al, 2018, p. 1964).

Therefore, Workers' Health arises from the need for the State to intervene more effectively in the relations of the production process, in order to promote more dignified working conditions for workers.

According to Draibe (2012), studies focused on economic development have opened a new course of investigation, where social policy is thought of in the broader context of the relationship between the State, economic development and social protection systems. The institutions of the social protection system in late-developing countries, together with wage labor, are instruments of compensation through a social security system, where health policies are presented as one of the main models of social policy, as this is the case of workers' health in Brazil, which will be discussed below.

III. WORKER HEALTH IN BRAZIL

In Brazil, public health emerged as a social issue at the beginning of the 20th century, together with capitalism, in the midst of the coffee export economy, reflecting the advancement of the division of labor, the emergence of wage labor and the acceleration of urbanization and industrial development. (BRAGA; PAULA, 2006).

The construction of the field that came to be called Worker's Health, as a public policy in Brazil, was built on the different combinations of force between capital, work and the State (RAMMINGER; NARDI, 2007).

The Brazilian Sanitary Reform Movement was fundamental for the definition of the area, which at the end of the 70's came to be called Collective Health, a new field of knowledge and practices in health (MARSIGLIA, 2013).

The theoretical-conceptual development of Collective Health emerges in a scenario of crisis in public health, influenced by the assumptions of Latin American social medicine and by the Brazilian Health Reform Movement, which defended universal health systems of a public and equitable nature (PAIM; TEIXEIRA, 2006).

Collective Health represents a bet on new assumptions, methods and social practices, which since its origin has three disciplinary areas of training: social sciences (more recently, human and social sciences), epidemiology and administration and planning (more recently, called policy and planning), which consequently must dialogue with each other to build a health system that is intended to be universal, equitable, comprehensive and public (MARSIGLIA, 2013).

In this light, it is necessary to consider that public policies, especially health policy, is a state policy and not a government policy, and as such, it must assume the defense of the constitutional principle of health as a right of all and State duty.

Law No. 8,080 of September 19, 1990, includes Worker's Health in the field of action of the SUS and enshrines, within the scope of the objectives of the SUS, work as a determining and conditioning factor, among others.

According to article 6, §3, worker's health means:

[...] a set of activities aimed, through epidemiological and sanitary surveillance actions, at the promotion and protection of workers' health, as well as aimed at the recovery and rehabilitation of the health of workers subjected to the risks and aggravations arising from the working conditions [...] (BRASIL, 1990).

Worker's Health begins to be debated as a public policy from the I National Conference on Workers' Health (CNST), held in 1986, months after the VIII National Health Conference, considered fundamental milestones for the constituent process of 1988 (CRUZ, FERLA and LEMOS, 2018).

The 1988 citizen's constitution, in the section related to Health, provides in its article 200 caput, items II and VIII, that the Unified Health System (SUS) is responsible, in addition to other attributions, to carry out Worker's Health actions and collaborate in the protection of the environment, including work (BRASIL, 1988).

The II National Conference on Workers' Health (CNST), held in 1994, aimed to discuss advances and challenges in the field of Workers' Health, with emphasis on the construction of a national policy on workers' health and equal participation of union entities. and popular organizations, meeting the constitutional principle of participatory democracy in the SUS (MINAYO-GOMES et al, 2018).

The III National Conference on Workers' Health (CNST) was only held in 2005, eleven years after the 2nd CNST. As a central theme, it presented an integrated proposal from the Ministries of Health, Labor and Welfare for the implementation of the National Policy on Workers' Health, representing an advance in the process of unifying actions in Workers' Health; (MINAYO-GOMES; LACAZ, 2005).

Guided by the assumptions of collective health, workers' health arises from the need to intervene more effectively in the relations of the production process, adopting the basic principles of the SUS: universality, integrality, equity and social participation.

It is an area under permanent construction, referenced by the concepts of promotion, surveillance and participation in health, which aim at the recovery and rehabilitation of the health of workers subjected to risks and injuries arising from the environment and working conditions (MARTINS et al. , 2017).

The historical process of building a health policy expresses, through public agendas, the different political, economic and social moments that involve the relations between the State, society and the market (ANDRADE et al, 2012).

As noted, worker protection in Brazil occurs late, when compared to developed countries. It was only in 2004 that the movement to build a public policy aimed at workers' health gained strength, an intersectoral movement, composed of Working Groups with representatives appointed by the Ministries of Planning, Health, Social

Security, Labor and Finance, which culminates in the National Policy on Safety and Health at Work (PNSST), which is now implemented by the Ministries of Labor and Employment, Health and Social Security (ANDRADE et al., 2012).

IV. NATIONAL OCCUPATIONAL HEALTH AND SAFETY POLICY (PNSST)

The publication of the National Policy on Safety and Health at Work (PNSST), through Presidential Decree No. 7,602, of November 7, 2011, represents a historic milestone in work-health and disease relations in Brazil. It is the first official document that deals with the responsibilities and actions that must be developed by the government for the protection and recovery of workers' health and presents the following objectives:

the promotion of health and the improvement of the worker's quality of life and the prevention of accidents and damage to health arising from, related to work or that occur in the course of it, through the elimination or reduction of risks in the work environments (BRAZIL, 2011, p. 9).

In its initial proposal, the PNSST defines guidelines, institutional responsibilities and mechanisms for financing, management, monitoring and social control, within the scope of workers' health. In this way, Occupational Health is placed as a broad and collective responsibility of the State, whatever its form of insertion in the labor market, whether formal or informal, private or public (ANDRADE et al., 2012).

The policy guidelines include: I - Expansion of OSH actions, aiming at the inclusion of all Brazilian workers in the health promotion and protection system; II - Harmonization of norms and articulation of actions to promote, protect and repair workers' health; III - Precedence of preventive actions over repairs; IV - Structuring an Integrated Network of Information on Workers' Health; V - Restructuring of Training in Workers' Health and Safety at Work and encouraging the training and continuing education of workers responsible for the operation of the PNSST; VI - Promotion of an Integrated Agenda for Studies and Research in Occupational Safety and Health.

The guidelines listed express a set of prioritized common objectives and explain the respective fundamental strategies for their operationalization, and imply the triggering of actions that, embodied in a work plan, will be instruments for implementing the Policy.

In this context, the guidance for the State to fulfill its role as employer, ensuring protection measures in the field of Workers' Health, should be highlighted:

[...] in guaranteeing basic citizenship rights, it is necessary that the formulation and implementation of government policies and actions be guided by transversal and intersectoral approaches. From this perspective, worker safety and health actions require a multiprofessional, interdisciplinary and intersectoral action capable of contemplating the complexity of production-consumption-environment and health relations (BRASIL, 2004, p. 3).

The PNSST stands out for being a universal and inclusive policy, as it includes in its role of protection "all men or women who carry out activities to support themselves and/or their dependents, whatever their form of insertion in the market of work, in the formal or informal sector of the economy" (BRASIL, 2004, p. 4).

In this sense, the National Plan for Safety and Health at Work published in April 2012, aiming to facilitate the implementation of this Policy, details its operational aspects, listing as its first objective the "inclusion of all Brazilian workers in the National System of Promotion and Protection of Safety and Health at Work - OSH". To this end, among its strategies, it included the "preparation and approval of OSH legal provisions for Workers in the three spheres of government" (BRASIL, 2012).

On the other hand, the constitutional text defines the powers of the Union, States and Municipalities. The Union organizes, maintains and carries out labor inspection exclusively (article 21, XXIV) and legislates, privately, on labor law (article 22, I). The Union, together with the States, the Federal District and Municipalities, take care of public health and assistance, the protection and guarantee of people with disabilities (art. 23, II). The Union, the States and the Federal District legislate concurrently on social security, health protection and defense (art. 24, XII).

It should be noted that the Union's exclusive competence to legislate on Labor Law does not overlap, nor does it conflict, with the competence of States and Municipalities to issue, in a supplementary way, norms for the protection and defense of health, in particular of the worker, as they are located in different, autonomous fields, although connected by the legal interest that is intended to be protected.

Despite the vast existence of protective norms aimed at workers' health in Brazil, it is noted that many categories of workers still live in conditions similar to slavery, and their health-work relationship is not prioritized by state action.

It is in this sense that the effort to define a government policy is inserted, which articulates the competences and norms in the scope of Work, Social Security and Health, to which, more recently, the actions of the Ministry of the Environment have been added.

Indeed, the PNSST aims to promote the improvement of workers' quality of life and health, through the continuous articulation and integration of Government actions in the field of production, consumption, environment and health relations.

V. CONCLUSIONS

In view of the above, it can be concluded that the field called Worker's Health is consolidated from the implementation of preventive actions capable of transforming the main causes of illness into epidemiological information that promote constant improvement in workers' health care, as opposed to the hegemonic conceptions of medicine and occupational health.

Indeed, workers, exposed to occupational risks in their work environment, must constitute a concern for Brazilian public health, and must be a constant object of public policies and effective measures that ensure the fundamental right to health, according to constitutional dictates. .

Theoretical reflections on the subject go beyond the foundations that influence and shape the theoretical plan and advance towards the construction of an intervention proposal for the work relationships that cause illness.

This study is of great relevance to expand and discuss workers' health from the perspective of a State with greater effectiveness in public policies aimed at workers, which, despite playing a fundamental role in society, did not have their health-work relationship prioritized.

That said, without intending to exhaust all the developments contained in this study, it is expected that its reflections will serve as a bridge to new proposals aimed at workers' health care.

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Way Leman River Flood Control in Buru Regency

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Keywords— *River Flood, BMKG, flood water level.*

Abstract — *Way Leman River is located at the watershed of Way Leman covering with an area of 167.24 Km². During the rainy season the Way Leman river flow has the potential to disrupt community activities. Material losses and crop failure are inevitable in the event of a flood. Therefore, it is necessary to identify the cause of the disaster. From the rainfall data used at the climatology (BMKG) Namlea station for 20 years, namely in 2000 - 2019, statistically with the Gumbel distribution for the 25 years return period, the planned rainfall 250.31 mm /year and the Melchior method found a planned flood discharge of 290.85 m³/sec. From the simulation results of the Way Leman river cross section using the 25-Year Planned Debit with the Melchior Method, it cannot accommodate the flood discharge that occurs because the elevation of the flood water level exceeds the elevation of the river bank. In order to control the flood, the Way Leman river was normalized and made a river reinforcement building with gravity wall type. The results of analysis showed that the selection of the type of structure was permitted.*

I. INTRODUCTION

Flood is an event that overflows water from a container such as rivers, lakes, reservoirs, and so on. Flooding is caused by a large increase in the volume of water which is not balanced by the capacity of the cross-section or containers in the cross-section of the water causing the overflow of water. The Way Leman River whose flow has a large potential for damage. In the rainy season the flow in the Way Leman River is very large and has the potential to disrupt the activities of the farming community in Buru Regency. Material losses and crop failure are inevitable in the event of flooding. Therefore, identification is needed to find out the cause of the disaster. By identifying the cause of flooding, a flood control study can be conducted to reduce the destructive power of the Way Leman River.

II. LIBRARY REVIEW

▪ Watershed

To determine the boundary of the watershed, it is necessary to have a topographic map containing all information about a particular area, whether roads, cities,

villages, rivers, types of plants, land use complete with contour lines, a map with a scale of 1:50,000 is considered sufficient. From the map, the highest points around the intended main stream are determined, each point is connected to each other so as to form a solid line that meets the end of the base. The line is the watershed boundary at a certain control point.

▪ Rainfall Analysis

To get an estimation about great forecast of flooding that will happened in a cross-section of the river, the depth of the rain that occurs must also be known. What is needed is the depth of rain that occurs throughout the watershed. So it is not only the amount of rain that occurs in a rain measurement station, but data also on therein depth data from several rain stations scattered throughout the watershed.

▪ Parameters Statistics

Statistical parameters used in the analysis of hydrological data are: arithmetic mean, standard deviations, coefficients of variation, skewness coefficient and kurtosis coefficients.

The Design of Flood Discharge

The design of flood discharge is the maximum discharge on a river with a certain return period. Sumarauw (2013) stated that flood discharge plans are usually obtained

By several methods, including:

1. Debit Data Available

The method that can be used is the Frequency Analysis Method from the available discharge data, the analysis can use the most appropriate distribution functions such as Normal, Normal Log, Gumbel or Pearson III Log.

2. No Debit Data Available

If discharge data is not available, then the analysis is carried out by calculating the planned rain in advance by entering rainfall data for at least 10 years, after the planned rain is obtained, the results of the planned rain are converted into discharge plans using various methods include:

- a. The method of hydrograph unit synthesis, which forms the unit of hydrograph from watershed characteristic data such as river length (L), river length to center of gravity (Lc), watershed slope, and others. This method is usually used if the size of the watershed includes a medium to large watershed.
- b. Rational Methods. This method is usually used for small watersheds. In this study, discharge data is available so that frequency analysis method will be used.
- c. The Design Flood Method Uses Der-weduwen, Haspers, Melchior with a watershed size greater than 100Km².

Hydraulic Analysis

Flow is said to be steady if the speed does not change during a certain interval of time. Natural flow is generally irregular, this is due to the geometric shape of the channel, irregular rivers in the field, the presence of plants on the channel cliffs, the presence of water buildings, changes in the base of the channel, and others. Components in this model are used to calculate the water level profile at steady flow conditions. Components in steady flow can model the surface profile of the water face in conditions of subcritical, supercritical and combined flow systems.

III. RESEARCH METHODOLOGY

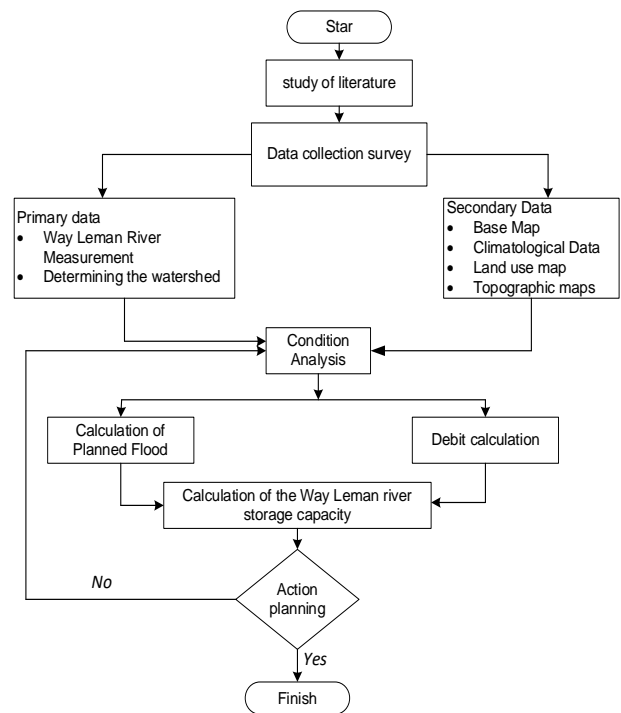


Fig.1. Research flow chart

IV. RESULTS AND DISCUSSIONS

The area of the Way Leman Watershed is 167,24km².

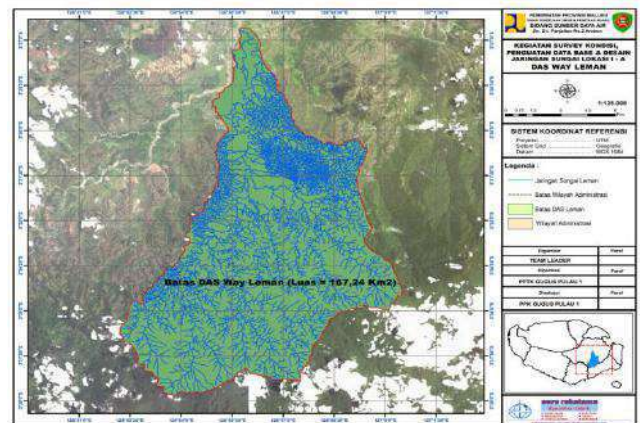
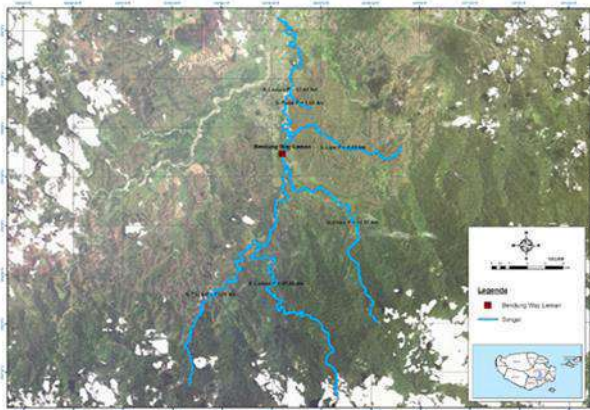


Fig. 2. Way Leman Watershed



No	Distribution type	Condition	Calculation	Conclusion
1	Normal	CS ≤ 0 CK = 3	CS = 0.280 CK = 0.372	Does not meet the
2	Log Normal	CS = 1.104	CS = 0.280	Does not meet the
3	Log Pearson III	CV = 5.24 CS ≠ 0	CV = 0.440 CS = 0.280	Does not meet the
4	Gumbel	CS ≤ 1.139 CK ≤ 5.4	CS = 0.280 CK = 0.440	Approach Does not meet the

Rainfall analysis plan with the type of spread gumbel selected to plan the flood discharge plan.

Table 1. Rain Plan with each repeat

No	Tr	Xt
1	10.00	221.936
2	25.00	250.308
3	50.00	279.714
4	100.00	295.290

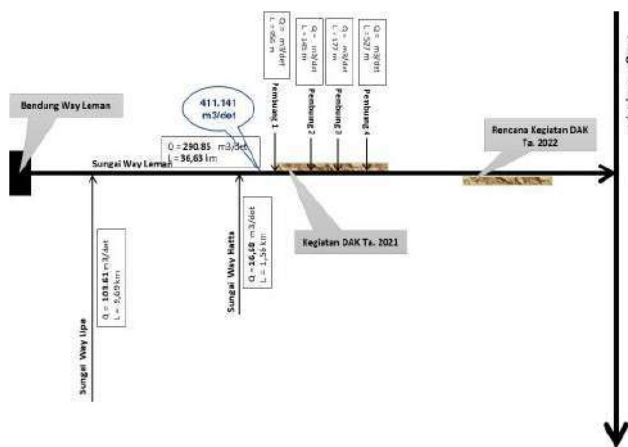


Fig.3. River Way Leman Scheme

Analysis of Draft Flood Peak Discharge Forecast

One of the final results of the Hydrological analysis is the estimated magnitude of the design flood discharge for a flood amount needed to calculate water buildings. This is expected if there is a flood of such magnitude not to damage the planned building. This flood discharge can be in the form of peak discharge, flood volume, high water level or hydrograph. In order to determine the flood discharge plan, analysis is carried out by several methods, among others; Rational, Der-weduwen, Haspers, Melchior.

Flood Discharge Analysis

Characteristic Parameters of Way Leman's Watershed

Watershed Characteristics	Parameter
Accommodate	Way Leman River
Area (Km ²)	167.24
River length (Km)	36.63
Slope	0.0002
Forest type	Forest, shrubs, rice fields
Land use coefficient	0.65 - 0.70

No	Debit method	Q25 (m ³ /det)	Area (Km ²)
1	Rasional	290.24	40 -80
2	Der-Weduwen	174.73	< 100
3	Haspers	544.77	< 100
4	Melchior	290.85	> 100
5	HSS Snyder	977.61	Medium Watershed
6	HSS Nakayasu	418.13	Medium Watershed

Rainfall data used is monthly rain data at climatology (BMKG) Namlea station for 20 years, namely in 2000 - 2019.

An analysis of rainfall frequency is performed to determine the amount of rainfall designed for a 25-year-reperiod.

The type of rainfall distribution depends on the value of statistical parameters i.e. average count or mean, standard deviation, coefficient of dissgetation, coefficient of variation and coefficient of kurtosis

From the flood method of the plan analyzed, the Melchior method is selected and in accordance with the parameters of the Way Leman Watershed.

High Water Level Simulation with Program HEC-RAS Computer

The simulation results showed that some cross-sections of the Way Leman River reviewed were unable to accommodate the flood discharge that occurred for a 25year repeat, because the elevation of the flood water level exceeded the elevation of the river cliffs.

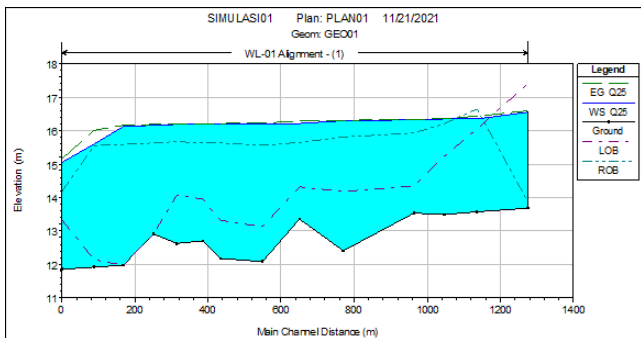


Fig.3 Cross section extending the riverWay Leman

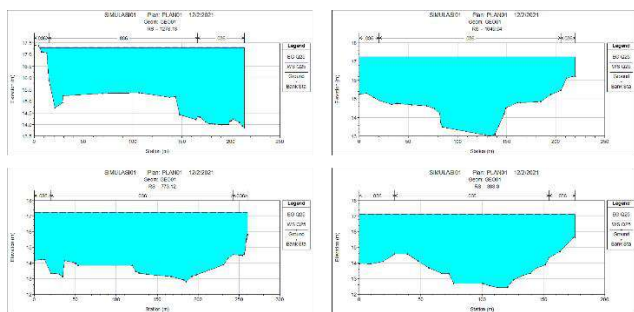


Fig.4 Some cross-sections the river Way Leman.

Flood Control System

In building planning activities, structurally requires the type and number of river construction buildings and their completeness with materials and numbers must be in accordance with their needs. Types of river construction that are reviewed from their usefulness .Common jobs are done including embankments.

Due to changes in the height of the water level that resulted in river flooding, the normalization of the river is carried out. Handling floods by normalization is carried out on cross-sections of rivers whose capacity has not met the flood discharge that passes through.

After normalizing the conditions and strengthening the normalization condition of the Way Leman river as shown below.

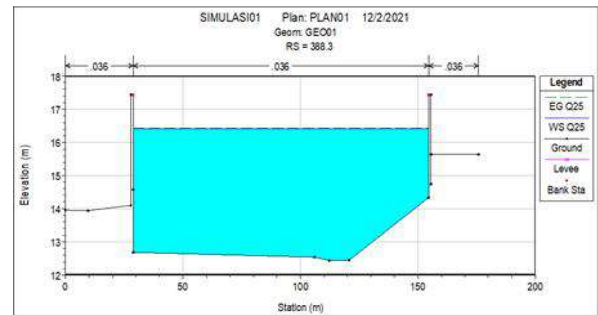
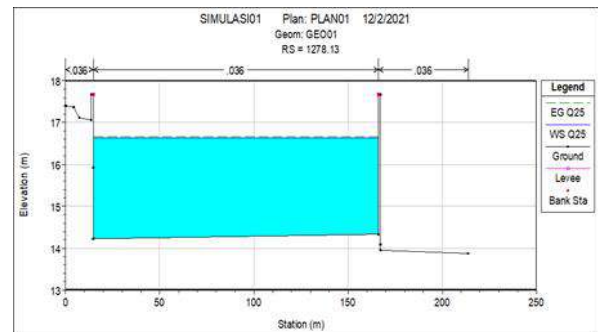


Fig.5 Cross-section of the Way Leman river after normalization

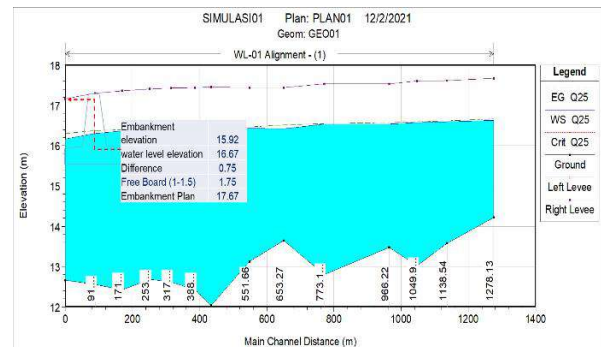


Fig.6 Normalization of rivers and embankment plans

Selection of strengthening type

The selection of slope retrofitting types that match the Way Leman River depends, among others, depending on the dimensions of the river, the speed of water currents, the cross-sectional shape of latitude, the slope of the riverbed, the depth of water, the type of soil to be protected, and the state of the foundation soil. Based on topographic conditions, hydrolysis, and the situation on the banks of the Way Leman River and geotechnical, the strengthening of the cliffs is planned with the Gravity Wall type.

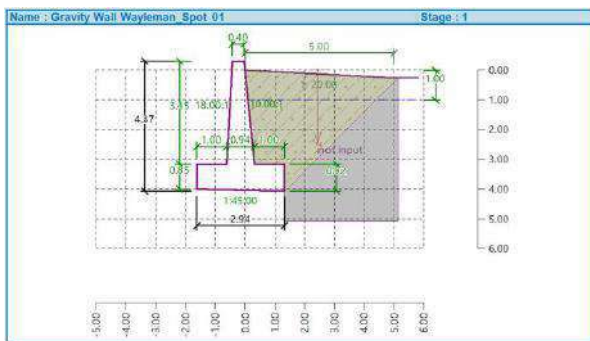
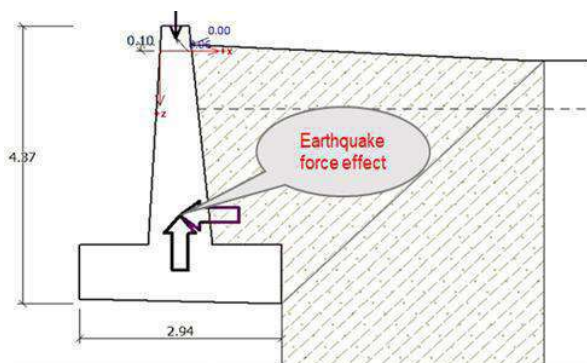
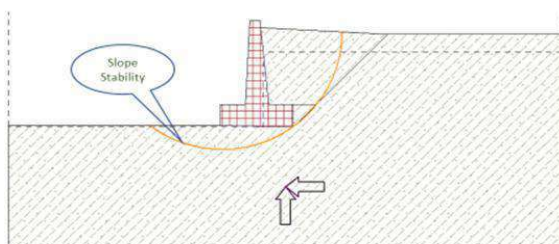


Fig.7 Gravity Wall Dimensions



Force	F _x [kN/m]	F _z [kN/m]	Applic. point	
			x [m]	z [m]
Weight - wall	0.00	4.13	0.23	-0.19
Earthq - constr.	-0.04	-0.04	0.23	-0.19
Active pressure	0.00	0.00	0.45	-0.10
Water pressure	0.00	0.00	0.45	-0.10
Earthq - act.pressure	0.00	0.00	0.45	-0.10

Fig.8 Gravity Wall Dimension Review of Earthquake Load



Slope stability verification (Bishop)
 Sum of active forces: $F_a = 191.52$ kN/m
 Sum of passive forces: $F_p = 231.92$ kN/m
 Sliding moment: $M_a = 926.97$ kNm/m
 Resisting moment: $M_p = 1020.46$ kNm/m
 Utilization: 90.8 %
 Slope stability ACCEPTABLE

Fig.9 Gravity Wall Dimensions review of slopes.

V. CONCLUSION

- 1) From the results of cross-sectional simulation of the Way Leman river that uses the 25-Year Debit Plan with the Melchior Method, it can not accommodate the flood discharge that occurs because the elevation of the

flood water level exceeds the elevation of the river bank.

- 2) In order to control the flood, the Way Leman river was normalized and made a river reinforcement building with a gravity wall type.
- 3) In addition to flood control with a structure, it can also be carried out in a non-structure such as watershed management, controlling erosion and sedimentation, regulation and the role of community

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Acoustic waves testing to evaluate the compressive strength of ceramics bricks

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Keywords— *Acoustic wave, ceramic, compressive testing*

Abstract— *The present study seeks to develop a simple methodology capable of relating the propagation of acoustic waves with the compressive strength of ceramic sealing bricks. For this purpose, were captured acoustic signals generated by the impact of a steel sphere on the surface of ceramic bricks from three different origins. With the acoustic signal as a function of frequency, was possible to identify the main amplitude peak, which increases with the increase in compressive strength. Other characteristics of the acoustic signal, such as for instance a greater number of amplitude peaks presented below 5 mHz, could be also related to the compressive strength of the bricks indicating a possibility of fast and non-destructive testing.*

I. INTRODUCTION

The Brazilian civil building industry is among those that most consume ceramic products. This fact is associated to the large number of buildings that use various types of ceramic materials for coverings, in addition to the sealing and structural bricks that have a prominent position. According to the National Association of Ceramic Tile Manufacturers, Brazil occupies the 3rd position of the production and in the 2nd position of consumption of ceramic materials in the world [1]. That is because there is an ease of obtaining ceramic materials due to the abundance of raw materials available in the country [2].

The ceramic bricks are produced using clay (with or without additives) and generally has a reddish color. In the manufacturing process, the bricks must be fired at controlled temperatures between 800 °C and 1000 °C. This temperature range increases the mechanical strength of the bricks by decreasing the internal porosity [3]. However, it

is known that many bricks are produced by some potteries that use empirical procedures for dosing and firing. In this case, there is a possibility to compromise the mechanical properties of the final product, also influencing the quality of the building with the use of materials that do not comply with the technical standards.

Among the main requirements for a ceramic sealing brick, the followings stand out: regular geometry, water absorption capacity and compression strength [4]. The absence of these requirements can directly influence the mechanical strength of masonry, which affects the installations, frames and building coatings. Thus, it is important to carry out testing to determine the geometric characteristics, water absorption and compressive strength of ceramic bricks.

For the compression testing, it is recommended use a press that is in accordance with the descriptions in Annex C of [5], in addition to taking care with the receipt, preparation and packaging of the bricks that will be used

as bodies of proof for rupture. Generally, these procedures demand more time and cost to acquire the results.

An alternative that could reduce the time and cost of preparing samples for the compression testing is the possibility of using non-destructive tests, especially those that use ultrasonic waves (frequency above 20 kHz) to determine the mechanical properties of ceramic materials [6, 7, 8]. However, techniques that use acoustic waves with frequencies below 20 kHz have been used for investigating compressive strength and other properties that can be associated to the behavior of the acoustic signal propagated in the material [9, 10, 11].

Therefore, according to the above reports, this study sought to develop a proposal for a fast and non-destructive methodology to determine the compressive strength of ceramic sealing bricks. Recent publications about the subject and the use of a simple technique based on the theory of acoustic waves propagation were motivators to this study.

II. MATERIAL AND METHODS

2.1 Characteristics of the samples for the acoustic testing

To execute the test with acoustic waves were acquired commercially twelve samples of ceramic bricks used for sealing masonry. The bricks were chosen by visual analysis, which allowed the identification of samples free from systematic manufacturing defects, such as superficial cracks, burrs and square deviations. After this, the bricks were divided into 3 groups according to the provenance of the pottery. Table 1 shows the physical characteristics of the samples and the origin of the batch.

Table 1: Physical characteristics of the samples

Pottery	Batch	Sample	Dimensions (mm)	Average weight (kg)
A	CC	04	240 x 90 x 190	2.770 ± 0.015
B	MZ	04	240 x 90 x 190	2.830 ± 0.079
C	CM	04	240 x 90 x 190	2.905 ± 0.068

The average weight of the samples from each batch was determined using an analytical balance with a resolution of 0.1 g. For to verify the approximate dimensions of the samples (length, width and height) was used a pachymeter with a resolution equal to 0.005 mm.

Then, the samples of each batch were identified such as T1, T2, T3 and T4.

2.2 Generation and capture of acoustic waves

After measuring the dimensions and weight, two small flat regions (~ 6 cm²) were delimited at ends of one the lateral faces on the samples. The flat regions were obtained by polish that favored the surface wear. Afterwards, the samples were supported on the sides opposite to the polishing to carry out the test with acoustic waves generated using the impact of a steel sphere.

For analyze the propagation of acoustic waves on the surface of the samples, a simple methodology was used which consists of using a steel sphere and a free software [12]. This methodology has been used in the study of different materials, such as ceramic tiles, concrete and steel [10, 11, 13]. In the present study, the methodology was adapted and the brick samples were impacted using a steel sphere with 5.5 g and 23 mm diameter. The acoustic signals generated by the strike with the steel sphere were captured with the Soundcard Oscilloscope software. This software represents a digital oscilloscope with a visual interface similar to the conventional oscilloscope. The average acoustic signal for the batches was obtained from 20 measurements. For this, were performed 5 measurements on each one of the 4 bricks belonging to the respective batch.

The amplitude of the signals measured (in the arbitrary unit a.u.) was investigated as a function of the acoustic wave propagation time in the range between 0 and 20 milliseconds (ms). A stereo phone Plug P2 was used as a receiver for the acoustic signals. The phone was positioned in one of the polished regions to capture the signal produced by the deferred impact with the sphere at the other end of the sample. The setup of the experiment is illustrated in Figure 1. Figure 1(a) shows the computer with Soundcard Oscilloscope software installed. The impact locations with the sphere and the capture of acoustic signals can be seen in the top view shown in Figure 1(b). A detail of the polished region is shown in Figure 1(c).

In Figure 2 there is an example of an acoustic signal captured on the side of the bricks and presented on the computer screen. The type of headphone used as a signal receiver does not have sensitivity to capture noise or external vibrations that could be transmitted to the digital oscilloscope and interfere with the measurements. The red line represents the signal on the computer screen before the measurements, while the green line represents the acoustic signal after the sphere impact. Thus, the absence of noise or external vibrations was verified before taking the measurements.

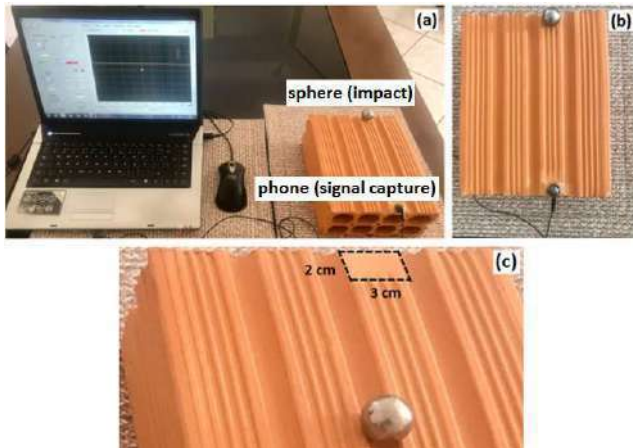


Fig. 1: Set up of the experiment to generate and capture the acoustic signals: (a) system used, (b) top view and (c) detail of the polished region

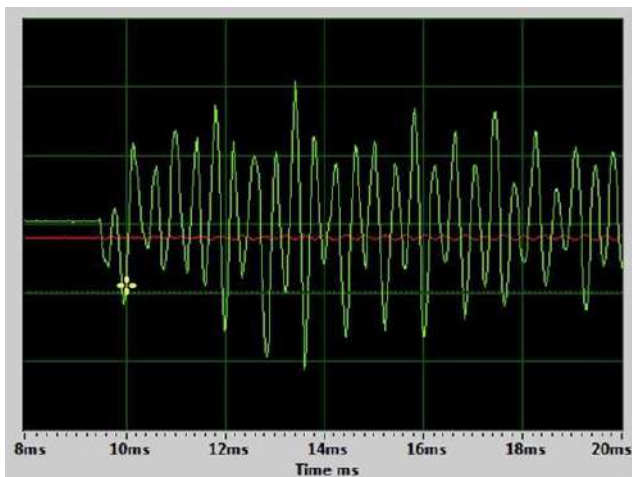


Fig. 2: Example of the acoustic signal on the sample

The data collected in the experiment were analyzed in the Origin® program. Thus, it was possible to decompose the temporal function of the acoustic signal in the frequency domain, using the Fast Fourier Transform (FFT) method. The FFT method is widely used in the study of signals processing and other applications in physics and engineering [14, 15].

The FFT method was performed to relate the frequencies excited in the acoustic signal with the average values of compressive strength of the bricks (fbm). For the compressive strength testing were used 13 ceramic bricks from A, B and C potteries. These bricks presented visual and physical similar characteristics to the samples used on the test with acoustic waves. The compressive strength testing was carried out with a hydraulic press following the procedures described in [5].

III. RESULTS

The average signals as a function of the acoustic wave propagation time on the surface of the bricks is shown in Figure 3. Each curve presented in the figure represents the average acoustic signal, in arbitrary unit (a.u.), obtained with 5 measurements on the samples. Analyzing the results, it can be seen that the average signals obtained in each of the 4 samples of the CC batch are quite reproducible, with only small variations in the amplitudes of the signals, as can be seen in Figure 3(a). Although there are small variations in the amplitude values, the 26 peaks presented in the acoustic signals of the samples are located in practically the same positions in relation to the time axis between 8 ms and 20 ms.

The behavior of the acoustic signals observed in samples from CC batch is also similar to that presented by samples from CM batch, whose results are shown in Figure 3(b). However, the mean signal obtained from the T1 sample has a much smaller amplitude compared to the mean signal amplitude from the T2, T3 and T4 samples. It is known that in the proposed methodology, the signal amplitudes are very dependent on the impact energy caused by the strike with the steel sphere on the brick surfaces. However, the hypothesis that T1 sample was strike with a much lower impact energy than the other samples was discarded in this study. With the performance of 5 measurements per sample it is evident that the average signal obtained in the T1 sample is more attenuated and this fact was considered an intrinsic characteristic of this sample.

Comparing the shape of the acoustic signals, the results obtained in samples from MZ batch were different in relation to samples from batches CC and CM. The mean signals found in the samples from MZ batch is shown in Figure 3(c). In the result, the amplitude peaks increase and decrease together for all samples. This behavior can be observed in the region of the time axis between 9 ms and 15 ms. On the other hand, the increase and decrease of amplitude peaks behave randomly in the region between 15 ms and 20 ms, but without modifying the location of the 26 amplitude peaks on the time axis. For all batches investigated it was found that the acoustic signal consists of 26 amplitude peaks, indicating that this behavior can be a characteristic of ceramic bricks, regardless of the origin of the pottery.

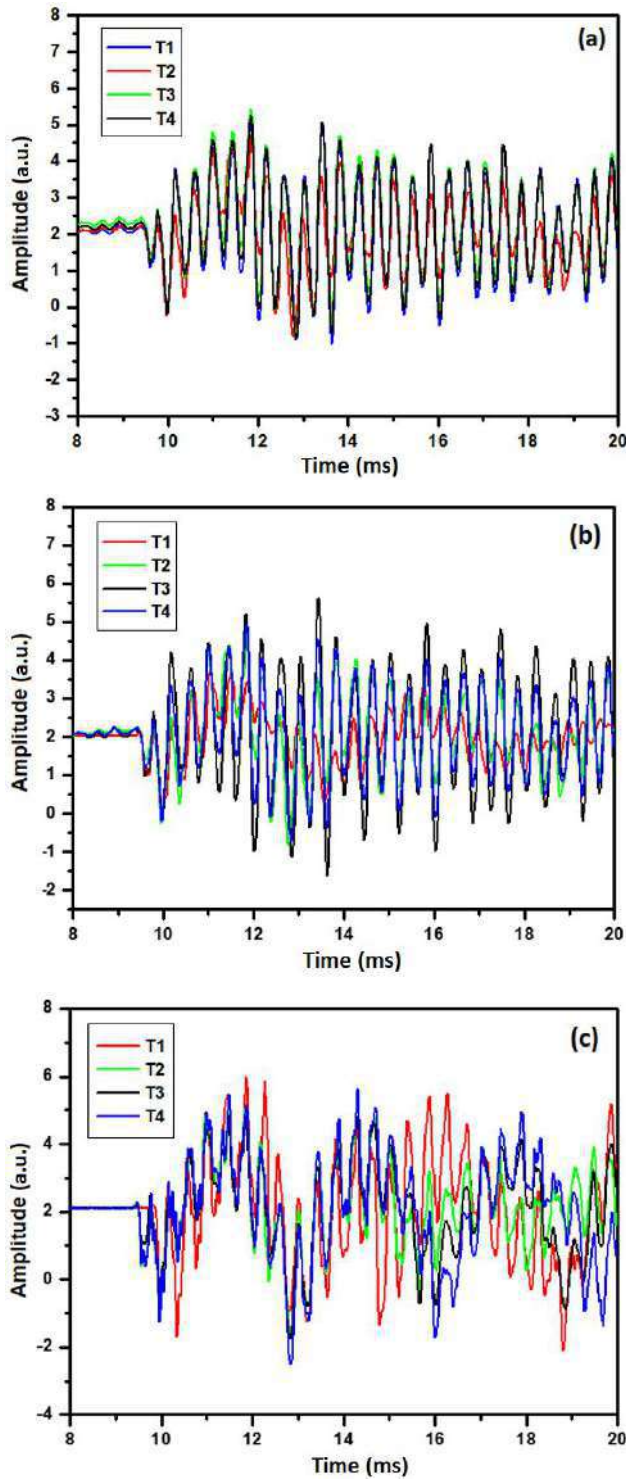


Fig. 3: Average acoustic signal of the batches: (a) CC, (b) CM and (c) MZ

The acoustic signals as a function of time did not present significant differences that could be related to the values of compressive strength of the bricks. Therefore, an attempt was to analyze the amplitudes of the acoustic signals as a function of vibration frequencies. The results are shown in Figure 4. Thus, it was found that the acoustic signals for CC, CM and MZ batches are constituted by a

different number of amplitude peaks, which are present in a low frequency range between 1 mHz and 8 mHz. Figure 4(a) shows the signal with the characteristic vibration frequencies for the CC batch samples. The result shows 19 amplitude peaks, where 15 peaks are present in the region between 1 mHz and 5 mHz, and the other 4 peaks are between 5 mHz and 8 mHz. The locations of the amplitude peaks (in mHz) on the frequency axis are reported in detail in parentheses inserted in the figure.

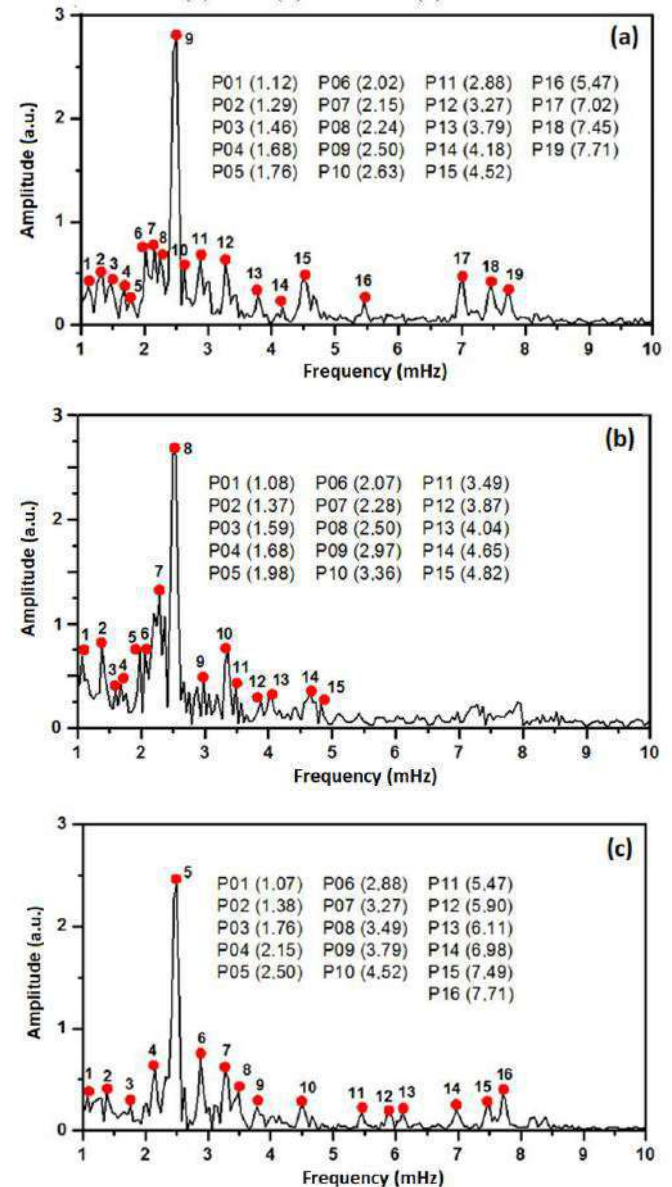


Fig. 4: Average acoustic signal as a function of frequency: (a) CC, (b) CM and (c) MZ

The characteristic vibration frequencies for the CM batch samples are shown in Figure 4(b). In this case, only 15 amplitude peaks are observed on the frequency axis and all are present in the region between 1 mHz and 5 mHz.

For the samples from the MZ batch, 16 amplitude peaks were observed, with 10 peaks in the region between 1 mHz and 5 mHz and the other 6 peaks between 5 mHz and 8 mHz, as shown in Figure 4(c).

Some differences were identified using the representation of acoustic signals as a function of vibration frequency. For example, where the number of amplitude peaks and the frequency range are presents. Furthermore, only one peak of greater amplitude, located at a frequency of 2.5 mHz, was present in the acoustic signals associated to batches CC, CM and MZ. These peaks correspond to peaks P09, P08 and P05 shown in Figures 4(a), 4(b) and (c), respectively. For better visualization, the amplitude values for characteristic peaks shown in parentheses were overlapping in Figure 5. In this way, it was possible to verify more clearly the differences between the acoustic signals obtained in the different batches.

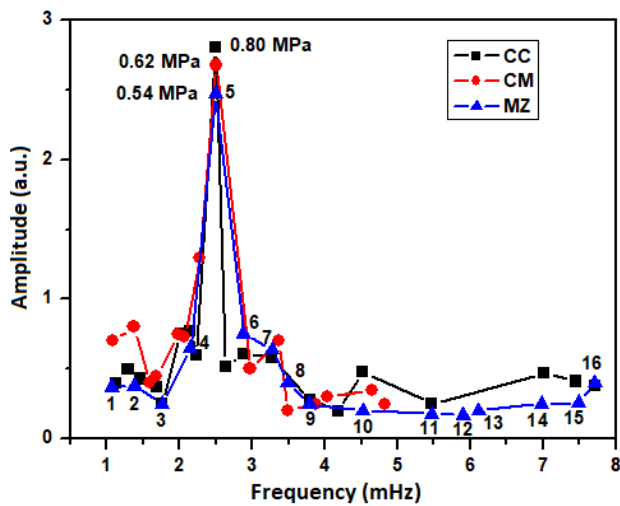


Fig. 5: Overlapping the amplitudes of the average acoustic signals

In Figure 5 it is noticed that the main peak (at a frequency of 2.5 mHz) has a greater amplitude for the CC batch. However, the amplitude value decreases consecutively for CM and MZ batches. This behavior seems to agree with the results of the compressive strength testing performed on samples of ceramic bricks from the same potteries, what are: CC batch ($fbm = 0.80 \text{ MPa} \pm 0.05 \text{ MPa}$), CM batch ($fbm = 0.62 \text{ MPa} \pm 0.02 \text{ MPa}$) and MZ batch ($fbm = 0.54 \text{ MPa} \pm 0.03 \text{ MPa}$). It is observed that the mean strength values (fbm) are below 1.5 MPa, that is the value recommended in section 4.3 of part 1 of [4] standard. This result is probably related to the empirical dosage and burning procedures adopted in potteries.

Other peaks observed in the acoustic signals were also related to the compressive strength, but none of them

appeared simultaneously in all the signals obtained in the lots and in the same position in relation to the vibration frequency. Furthermore, all other peaks had completely random amplitude values. Table 2 shows the values of average compressive strength (fbm), as well as some characteristics of the acoustic signals.

Table 2: Compressive strength (fbm), Amplitude (A) and characteristics of acoustic signals

Batch	fbm (MPa)	A (a.u)	N° peaks (< 5 mHz)	N° peaks (> 5 mHz)	N° total peaks
CC	0.80 ± 0.05	2.88	15	4	19
CM	0.62 ± 0.02	2.71	15	0	15
MZ	0.54 ± 0.03	2.49	10	6	16

The compressive strength to the batches is supposedly not associated with the number of amplitude peaks in the acoustic signal, but with the presence of a greater number of amplitude peaks located in the frequency range below 5 mHz and with the greater amplitude of the main peak at 2.5 mHz. This assumption is reinforced by the characteristics presented in the acoustic signal of the MZ batch, which has the lowest compressive strength value and the combined effects of smaller main peak amplitude and smaller number of peaks with amplitudes located below 5 mHz. The combined effects can be more clearly observed by analyzing the indicative numbering of the amplitude peaks (from 1 to 16) presented in the acoustic signal of the batch MZ, as previously shown in Figure 5.

IV. CONCLUSION

The main amplitude peak at frequency of 2.5 mHz and observed in the batches, may be associated with an intrinsic characteristic of the ceramic bricks that does not depend on the origin of the pottery. Furthermore, a greater number of amplitude peaks at frequencies below 5 mHz and the greater amplitude of the main peak can be also combined effects that are associated to value of the compressive strength. The proposed methodology, although simple, demonstrated a possibility of non-destructive testing for ceramic bricks. However, it is still necessary to carry out more studies to reaffirm the results and prove the feasibility of the method for estimating the compressive strength of ceramic sealing bricks.

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Burden of proof on civil procedure law and its application and inversion in the administrative process

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Keywords— *Brazilian legal system, burden of proof, civil procedure, reversal in administrative procedure.*

Abstract— *With the elaboration of this article, it is expected to contribute to the discussion and reflection on the burden of proof of Brazilian civil procedural law and its application in the administrative process, including the possibility of its inversion. This will be dealt with in the development of the article, which will use the deductive method, based on bibliographic and exploratory research, and on the examination of constitutional and legal texts, having as a theoretical framework the constitutional model of process. After the study, it can be inferred that in the Brazilian legal system, the existence of the constitutional right to proof, as a result of the fundamental rights of contradictory and ample defense, was enshrined in the Constitution of the Federative Republic of Brazil, in its art. 5th, Inc. LV (BRAZIL, 1988). In the same sense, the right to proof, also not explained, is one of the guarantees inherent to due process of law, since there is no due process of law without the interested party being able to exhaust its right of defense with the production of the necessary evidence to prove it. of the alleged facts. Therefore, in light of these considerations, proof means demonstrating the allegations made by each of the parties, whether in the judicial process or in the administrative process.*

I. INTRODUCTION

With the preparation of this article, it is expected to contribute to the discussion and reflection on the burden of proof of Brazilian civil procedural law and its application in the administrative process, including the possibility of its inversion.

This will be addressed in the development of the article, which will use the deductive method, based on bibliographical and exploratory research, and on the

examination of constitutional and legal texts, having the constitutional model of process as a theoretical framework.

This work is structured, starting, initially, from the understanding of the legal institute of evidence in civil proceedings, from the concept, object, means and sources and the definition of fundamental right. Next, the study of the burden of proof in civil proceedings. Then, to understand the theory of the burden of proof in the administrative process. Afterwards, the reversal of the burden of proof in the administrative process will be dealt

with. In the final considerations, an attempt will be made to summarize the application of the burden of proof and its inversion in the administrative process.

II. THE PROOF LEGAL INSTITUTE

For a better understanding of the legal institute of evidence in civil proceedings, as well as the object, means and source and, subsequently, the development of the theme within the scope of the Constitution of the Republic, as a fundamental right (BRASIL, 1988).

With regard to the term legal institute, the clarification of Ronaldo Brêtas, citing Arruda Alvim: "the legal entity is called the legal figure, created by a legal command, which involves a legal regime, of certain complexity, thanks to which they can emanate, or, where juridical relationships, 'based' or 'reported' to that reality, are conjugated. This is the abstract and indicative designation of such a reality, which differs from the institution, which in turn, must be considered as a legal institute hosting a certain value (of special significance and, generally, with great historical weight)." (BRÊTAS, 1998, p. 94, note 163).

Next, it is possible to understand evidence in civil proceedings, based on the concept, object, means and sources and the definition of fundamental right.

2.1 PROOF: CONCEPT, OBJECT, PRODUCTION AND SOURCES

It is important to note that, morphologically, Moacyr Santos teaches, proof derives from the Latin "probatio" which means proof, essay, verification, inspection, examination, argument, reason, approval, confirmation, coming from the term probare (probo, as, are) with meaning to prove, rehearse, verify, examine, recognize by experience, approve, be satisfied with something, persuade someone of something, demonstrate (SANTOS, 1952, p.3-4).

For Rosemiro Pereira Leal, the juridical institute of the evidence must be configured by the "conjunction-guarantee of the legal principles of equality, broad defense, contradictory and due process of law". Therefore, "the right to process rights claims through the normative connection of a democratic source and not through the legal relationship between the procedural subjects" (LEAL, 2005, p. 53).

The evidence "is a factor of visibility of legal arguments", as it imposes "the procedural logical participation of the parties in the preparation of the provision (sentence and not as taxable persons deprived of procedural freedom)" (LEAL, 2005, p. 54-55).

Rosemiro Pereira Leal understands that a legal institute is "a set of principles that are unified by the normative connection of their meaning and application". So:

The evidence, therefore, as a legal institute, to fulfill its purpose of "fixing the facts in the process", is enunciated by the logical contents of approximation of the following principles: a) indictability (characterized by the integrative elements of the reality objectified in space); b) ideation (intellectual exercise of apprehending elements through the means of thinking about time); c) formalization (means the instrumentation of reality conceived by the legal form). (LEAL, 2018, p. 268-269).

In the legal sense, the word proof, as Moacyr Amaral dos Santos puts it, can mean "the production of acts and the means by which the parties or the judge intend to assert the truth of the alleged facts (actus probandi); it means the action of proving, of making the test" (SANTOS, 1952, p. 11).

Moacyr Amaral Santos, therefore, proof is the conviction of the truth, generated by certain means and with obedience "to certain principles, many of them provided for by law, others enshrined in the doctrine, whether in terms of availability, form, or its probative value, constituting what can legitimately be called 'probative right'" (SANTOS, 1952, p. 17).

Eduardo Cambi summarizes:

Legally, the word "evidence" is multi-significant, as it can be referred to in more than one sense, alluding to the represented fact, the evidentiary activity, the means or source of evidence, the procedure by which the procedural subjects obtain the means of evidence or, still, to the result of the procedure, that is, to the representation that derives from it (more specifically, to the judge's conviction) (CAMBI, 2001, p. 41).

From this approach to meanings presented by Moacyr Amaral, three categories of evidence appear, namely, proof as a means, proof as activity and proof as a result.

Regarding evidence as activity, first category, Hernando Devis Echandía defines evidence as: "activity of the judge and the parties or as the various methods used to obtain the judge's conviction about the existence or non-existence of the facts about which he will pronounce their decision, the evidences are procedural legal acts, because they involve the human will" (ECHANDÍA, 1976, p.19). Still with this notion, Francesco Carnelutti understands proof as the action of proving the existence of a fact, that is, the procedure used to verify the accuracy of what is stated (CARNELUTTI, 2000, p. 495-496). Note also, as taught by Vinícius Lott Thibau, adherence to the notion of proof as an activity by the following authors: Giuseppe

Chioyenda, José Alberto dos Reis, James Goldschmidt, Adolf Schönke and Antonio Dellepiane (THIBAU, 2011, p. 31-33). Therefore, for these defenders, says Camilla Paolinelli, "evidence is human activities developed by different subjects, through which the means of evidence communicate when judging knowledge of the facts, in an appropriate way to influence the judgment" (PAOLINELLI, 2014, p.43).

The second category, called proof as a means, teaches Rosemiro Pereira Leal: "to prove in law is to represent and demonstrate, instrumenting, the elements of proof by the means of proof" (LEAL, 2018, P. 270). Enrico Tullio Liebman defines them as means that serve to give knowledge of a fact, and therefore provide the demonstration and to form the conviction of the truth of a specific fact (LIEBMAN, 2003, p. 80). Camilla Paolinelli states that "evidence would be all the means of communication that transmit the evidential facts to the knowledge of the jurisdictional body. These are testimonies, documents, personal testimonies of the parties, expert reports" (PAOLINELLI, 2014, p. 44). Other exponents, Vinícius Lott Thibau pointed out, adopt this notion in the same sense, namely, Eduardo Couture, Antônio Carlos de Araújo Cintra, Ada Pellegrini Grinover, Cândido Rangel Dinamarco, Luiz Guilherme Marinoni, Sérgio Gruz Arenhart and Eduardo Talamini (THIBAU, 2011, p. 31-33).

As for the third category, considered proof of result, Camilla Paolinelli defines that "evidence would not be an act or an activity that would lead to a result regarding the facts stated in the procedure, nor would proof be a means or a set of means tending to obtain this result. ". But, conceptualized "as the very result to which action and means tend" (PAOLINELLI, 2014, p. 44). This current, thesis Vinícius Lott Thibau, is adopted by João de Castro Mendes, Tércio Sampaio Ferraz Júnior and Misael Montenegro Filho (THIBAU, 2011, p. 31-33). These authors who support this theory, concludes Rui de Freitas Rangel, "are based on the device principle that dominates our process, concluding that the proof is not discovery, but confirmation of something that was previously formulated" (RANGEL, 2006, p. 36).

Ronaldo Brêtas de Carvalho Dias argues that the test is directed at the process as the main and direct recipient, since "it is in the process - understood as a shared, cognitive and argumentative procedural space - that each part presents its factual narratives and respective evidence [...]" (BRÊTAS, 2015, p. 190-191).

In the Brazilian legal system, the existence of the constitutional right to proof can be inferred since 1891, but it was enshrined in the Constitution of the Federative

Republic of Brazil, in its art. 5th, inc. LV (BRASIL, 1988), as a result of the fundamental rights of the adversary and the broad defense (CAMPOS, 2016, p. 78).

The production of proof builds the technical structure that identifies the procedure, the proof is not only incorporated into the procedure, but it is constituted as its morphological unit, from a technical and scientific point of view. Based on the Constitution, it is advocated that the right to proof is the foundation of the Democratic State of Law (SANTOS, 2017, p. 42).

Therefore, in light of these considerations, proof means demonstrating the allegations signed by each of the parties, whether in the judicial process or in the administrative process.

Once the proof is conceptualized, it is necessary to define, in sequence, what must be the object of proof in a process, including registering the controversy regarding what exactly it is.

All the facts alleged by the plaintiff constitute objects of evidence, provided that they are accurate, controversial, relevant and pertinent, and notorious facts, confessed by the opposing party, uncontroversial or that have a legal presumption of existence or veracity, are not considered as an object of evidence. according to art. 374, of the CPC 2015 (BRASIL, 2015).

As for the object of the test, Rosemiro Pereira Leal warns that:

It seems wrong to teach that the object of the evidence is the "fact narrated in the action or in the defense", because the object of the institute of evidence is the production of the structure of the procedure as a causality requirement of the legal basis (art. 93, incs. IX and X, CF/1988) of the provision (decisional act), therefore, not being the "fact" which, as we have seen, is merely evidence (LEAL, 2018, p. 270).

In this context, register the academic discussion regarding the object of the test: "because it is not always made up of allegations, it is enough to remember the facts that can be considered by the judge" (NEVES, 2018, p. 729). While another portion understands that they are the claims of fact, as "the veracity exclusively affects the claims of fact, which can be false or true" (NEVES, 2018, p. 729).

Note, however, that the provisions of art. 374, caput, of CPC 2015 (BRASIL, 2015) adopts the first understanding. Thus, the object of proof is the unrecognized or notorious facts (CHIOVENDA, 1965).

Daniel Amorim Assumpção Neves argues that the best, therefore, "is to state that the object of evidence is not the facts or allegations, but the points and/or questions of fact

brought to the process by the parties or ex officio by the judge himself" (NEVES, 2018, p. 729).

Regarding the means of proof, in the process, it should be noted that they must be legally reputable (art. 369, CPC/15). José Carlos Barbosa Moreira teaches that "means are the techniques developed to extract evidence from where it flows" (that is, the source) (MOREIRA, 1996, p. 115). Therefore, "bridges through which facts pass to reach, first, the senses, then the judge's mind" (MOREIRA, 2006, p. 212).

Sources of proof, for José Carlos Barbosa Moreira, are "things, people and phenomena" (MOREIRA, 1996, p. 115).

For Francesco Carnelutti, regarding means and sources of evidence, he emphasizes that "until a better terminology is not proposed, I call on my own means of evidence the activity of the judge through which he seeks the truth of the fact to be proved; and source of proof to the fact that one uses to deduce the truth itself" (CARNELUTTI, 2002, p. 99).

In addition, says Carnelutti, sources of evidence can be classified into two categories: a) sources of evidence in the strict sense, therefore, the "facts that serve to deduce the fact to be proved and that are constituted by its representation"; b) sources of presumption, understood as "facts that serve to deduce the fact to be proved and that are not constituted by its representation" (CARNELUTTI, 2002, p. 99).

Thus, the first, representative facts that directly demonstrate the occurrence of another fact, the second, secondary facts or circumstances that only indirectly point to the possible occurrence of another fact (DIDIER JÚNIOR et al, 2018, p. 50).

Santiago Sentis Melendo adds that "the sources belong to the litigant, apart; the means touch the judge" (MELENDO, 1979, p. 16). Therefore, "it is not the judge's role to look for the sources, this is up to the party. The fonts correspond to the parts; the means, to the judge. It is not that the parties cannot propose or require that certain means of proof be practiced; but it is difficult for the judge to go out in search of sources, as was said, this is not his role [...]. People or things are known by the parties, they are sources, but their inspection or recognition by the judge is a means (MELENDO, 1979, p. 17).

As for the recipient of the evidence, it is intuitive to claim to be the magistrate. The magistrate is not, however, says Cleber Almeida, "the only recipient of the evidence. The parties are also recipients of the evidence, as they are entitled to a decision based on the evidence contained in the file" (ALMEIDA, 2011, p. 53).

For Cleber Almeida, the evidence also has society itself among its recipients. "The evidence, therefore, has an endoprocedural (in relation to the judge and the parties) and an extra-procedural (in relation to society) function. The evidence is a guarantee for the judge, the parties and society of the decision as close as possible to reality" (ALMEIDA, 2011, 54).

Warns Santiago Sentis Melendo, "the test cannot be front one party or for one party; nor for the judge. The proof is for the process. Here we are also faced with the concept of disposition: a part may have a proof; but the moment it produced this proof, the process will have acquired it; there is no proof of either part [...]. The acquisition principle means precisely that the evidence is acquired for the process" (MELENDO, 1979, p. 20).

2.2 FUNDAMENTAL RIGHT TO PROOF

The Constitution of the Federative Republic of Brazil of 1988 includes in items LV and LVI, of art. 5, of Title II - Individual Rights and Guarantees, Chapter I - Individual and Collective Rights and Duties, fundamentally that:

Art. 5 [...]

LV - litigants, in judicial or administrative proceedings, and the accused in general, are assured of an adversarial and full defense, with the means and resources inherent to it;

LVI - evidence obtained by illegal means is inadmissible in the process; (BRASIL, 1988).

As for the contradictory and broad defense principles, they are intrinsically inserted in the context of the principle of due process, as a way to guarantee the litigious parties the full exercise of the right of defense. In the same sense, the right to proof, also not explained, is one of the guarantees inherent in the due process of law, as there is no due process of law without the interested party being able to exhaust its right of defense with the production of evidence necessary for proof of the alleged facts.

In fact, the importance of due legal process, espoused in constitutional law is followed in CPC/2015, when in art. 7 of Chapter I - Of the Fundamental Rules of Civil Procedure, provides that: "The parties are guaranteed parity of treatment in relation to the exercise of procedural rights and faculties, the means of defense, the burden, the duties and the application of procedural sanctions, it is up to the judge to ensure the effective adversary" (BRASIL, 2015).

Articles 8, 9 and 10 of CPC/2015, enshrine guarantees to litigants, so that they are observed the constitutional principles inherent to due legal process, as well as proportionality, reasonableness, legality, publicity and efficiency (BRAZIL, 2015).

In this context, "the purpose of the evidence is the facts deduced by the parties in court, and the legal order provides for the legal means of production of evidence in order to obtain the truth about the facts on which the request or defense is based". Therefore, says Fernando César da Silva, "this set of rules establishes the basis for evidentiary instruction and forms an orderly system that guarantees, on the one hand, the production of evidence, effectiveness of the process and the search for the truth, and on the other, the prohibition of the use of illicit means of proof" (SILVA, 2017, p. 18).

Take note, also, that in the context of civil proceedings, the right to proof may be abstracted from the content of article 8, item I, of the 1969 American Convention on Human Rights (Pact of San José de Costa Rica), whose content was approved by the National Congress on May 26, 1992, pursuant to Legislative Decree 27, with full compliance determined by Decree 678, of November 6, 1992.

Registering that the taking of evidence, avoiding an affront to the principle of due process of law, there will be observance of guarantees provided for in the constitutional order or contrary to the provisions of procedural rules.

III. BURDEN OF PROOF IN THE CIVIL PROCESS

It should be noted that onus is what implies an overload, giving someone a disadvantage. De Plácido e Silva states that: "burden has as a legal technical meaning, any charge, duty or obligation that weighs on a thing or a person, by virtue of which he is obliged to respect or comply with them. It is a encumbrance" (DE PLACIDO E SILVA, 1982, p. 282-283).

Currently, teaches Camilla Paolinelli, "the conceptual autonomy of the aforementioned category is recognized. However, for a long period of time, the institute was confused with the notions of obligation, duty, subjective law, faculty [...]" (PAOLINELLI, 2014, p. 50). However, the idea of incumbent is confused with the common sense of the expression onus (PAOLINELLI, 2014, p. 50) which, etymologically, includes the notion of "charge, burden, obligation or duty" (CREMASCO, 2009, p. 23).

But, according to Luiz Eduardo Boaventura Pacifico, "the conceptual autonomy of the onus is a relatively recent achievement, although its notion already existed in Roman law, precisely due to the principles then in force regarding the burden of proof". He further informs that "in the Middle Ages, the referred notion was restored by glossers and post-glossers; and, in the Modern Age, it would influence the Napoleonic Code and the other civil codes of the 19th century" (PACÍFICO, 2001, p. 20-21).

Luiz Pacífico clarifies that, only in the 20th century, the onus concept was cleared:

[...] it started in Austria and Germany, due to the difficulty encountered by the doctrine of these countries in reconciling the Roman notion - inherited from common law, which identified the burden of proof with the need to prove (*necessitas probandi*) - with the reality of a process in which broad instructive powers were recognized for the judge and given extreme freedom in the assessment of the evidentiary result. (PACÍFICO, 2001, p. 21).

And, later, the concept started to be studied also in Italy and France, which predominated the dispositive principle (PACÍFICO, 2001, 21).

For Hernando Echandía, the concept of procedural burden is highlighted with the definition of process as a legal relationship (ECHANDÍA, 1976, p.8), which, in turn, is structured as a reflection of the obligatory relationship of private law (PAOLINELLI, 2014, p. 51). When it comes to procedural burden, James Goldschmidt made an important contribution to the study, as he conceptualized it as an imperative of its own interest (GOLDSCHMIDT, 1936, p. 201-203).

To clarify the distinction between burden and obligation, the doctrine of Gian Antonio Micheli: "is precisely that of burden understood as a legal entity distinct from obligation, in the sense that in certain cases the rule sets the conduct that is necessary to observe, when a subject wants to achieve a legally relevant result". And it defends "a certain behavior of the subject is necessary for the legal purpose to be reached, but, on the other hand, the subject is free to organize his own conduct as best he sees fit and, consequently, also possibly in the opposite direction to that foreseen by the norm" (MICHELI, 1961, p. 60).

For Hernando Devis Echandía, onus "is a power or a faculty (in a broad sense), to perform, freely, certain acts or adopt a certain conduct provided for in the norm for benefit and self-interest." And, more, "without subjection or coercion and without another subject who has the right to demand its observance, but whose non-compliance will entail unfavorable consequences" (ECHANDÍA, 2000, p. 195).

James Goldschmidt asserts that burdens are "situations of need to perform a certain act to prevent a procedural loss. In other words, these are 'self-interest imperatives'". Therefore, "the procedural burdens are closely related to the procedural 'possibilities', since every 'possibility' imposes on the parties the burden of being diligent to avoid their loss" (GOLDSCHMIDT, 1936, p. 203).

The study of the procedural burden, in Brazil, is conceptualized by Pontes de Miranda as a relationship in itself, whose satisfaction is that of the interest of the encumbered itself (MIRANDA, 1982, p. 322).

The distribution of the burden of proof, in the Brazilian Code of Civil Procedure, became the object of the legislative proposal of Alfredo Buzaid, then Minister of Justice, approved in 1973, which argues the admissibility in the distinction between constitutive, modifying, impeding and extinctive oriented by the Italian procedural legal system (BUZOID, 1972, p. 76-77).

Once these considerations regarding the procedural burden are noted, according to Fredie Didier Júnior, the burden of proof is "the burden attributed to a subject to demonstrate certain factual allegations". And he adds, "the attribution made by the legislator is prior and static (invariant according to the peculiarities of the cause); the distribution made by the judge or by the parties is considered dynamic, because it is made in light of a concrete situation" (DIDIER JÚNIOR, et al., 2018, p. 126).

In the definition of Cândido Rangel Dinamarco, "the burden of proof is the burden attributed by law to each party, to demonstrate the occurrence of facts of its own interest for the decisions to be rendered in the process" (DINAMARCO, 2009, p. 73).

In this context, the 2015 Code of Civil Procedure now provides:

Art. 373. The burden of proof is:

I - to the author, as to the fact constituting his right;

II - to the defendant, as to the existence of an impeding, modifying or extinguishing fact of the author's right.

§ 1 In cases provided for by law or in the face of peculiarities of the case related to the impossibility or excessive difficulty of fulfilling the charge under the terms of the caput or the greater ease of obtaining proof of the contrary fact, the judge may assign the burden of proof in a manner otherwise, provided that it does so by reasoned decision, in which case it must give the party the opportunity to discharge the burden assigned to it.

§ 2 The decision provided for in § 1 of this article cannot generate a situation in which the discharge of the charge by the party is impossible or excessively difficult.

§ 3 The different distribution of the burden of proof may also occur by agreement of the parties, except when:

I - fall on the party's unavailable right;

II - make it excessively difficult for a party to exercise the right.

§ 4 The convention referred to in § 3 may be entered into before or during the process. (BRAZIL, 2015)

It is noted that the aforementioned article maintained the wording, in its caput, of art. 333, of CPC/73; however, the four added paragraphs defined the theme of evidence in the Brazilian civil procedure. It should be noted that this dissertation will have as reference the first and second paragraphs, which deal with the standardization of the technique of distribution of the burden of proof.

In this sense, §1 of art. 373, of the CPC (BRASIL, 2015), in this case, if one of the parties is in a better position to produce evidence, the court may redistribute the evidential burden.

It is noteworthy, as to §2 of art. 373, of the CPC (BRASIL, 2015), which establishes the impossibility of dynamization in case it generates a situation of impossible or excessively impossible discharge, prohibiting redistribution in case of "diabolical evidence".

In this sense, the plaintiff will be responsible for proving what it alleges and the defendant will be responsible for proving, recognizing the existence of the fact alleged by the plaintiff, the impeditive, extinguishing or modifying matter.

For a better understanding of the issue, it is fundamental to understand, below, the theory of the burden of proof in the administrative process, as it is important for proceduralists and administrators.

IV. BURDEN OF PROOF IN THE ADMINISTRATIVE PROCESS

Note that the administrative process, governed by Law n. 9,784/99 (BRASIL, 1999), as well as the judicial process (Law n. 13.105/15), has the right to proof one of its constitutional postulates, therefore, of greater importance. It is provided for in art. 5, item LV, of CR/88, and reissued in the Administrative Procedure Law, especially in arts. 2, item III, 36 and 37 (BRASIL, 1999).

It is important to remember, at this moment, the meaning of the test, which, for Felipe de Almeida Campos, consists of "rebuilding, in the democratic procedural environment, the acts or facts that have already taken place in time. Therefore, it is through proof that the past is presented in the process" (CAMPOS, 2016, p. 94).

The Administrative Procedure Law (Law n.9.784/99), in art. 29, deals with and regulates the institute of evidence, aiming to delimit the facts alleged in the process:

Art. 29. Instructional activities aimed at ascertaining and verifying the data necessary for decision-making are carried out ex officio or upon impulse by the body

responsible for the process, without prejudice to the right of interested parties to propose evidentiary actions.

§ 1 The competent body for the instruction will include in the records the data necessary for the decision of the process.

§ 2 The acts of instruction that require the action of interested parties must be carried out in the least onerous way for them. (BRASIL, 1999).

This guarantee is administered before the Public Administration, allowing for the production of evidence, in addition to having the allegations against the interested party proven.

What, for Felipe de Almeida Campos, “is certain that the participation of interested parties in the administrative process must occur in an unrestricted way, in perfect harmony with the institutional principles of the process” (CAMPOS, 2016, p. 94). Therefore, as explained, provided for in the Due Constitutional Process.

About the burden of proof in Law n. 9,784/99, provides article 36:

Art. 36. It is up to the interested party to prove the facts that he has alleged, without prejudice to the duty attributed to the competent body for the investigation and the provisions of art. 37 of this Law.

Art. 37. When the interested party declares that facts and data are registered in documents existing in the Administration responsible for the process or in another administrative body, the competent body for the instruction will provide, *ex officio*, to obtain the documents or respective copies. (BRASIL, 1999).

Nelson Nery Costa states that, in the administrative process, “the burden of proof is on the person alleging the fact. If the administrator, it is up to him to prove what he claims” (COSTA, 2011, p. 230).

Therefore, the burden of proof, provided for in Law n. 9784/99 (BRASIL, 1999), which deals with the administrative process, is also in the same sense as the Code of Civil Procedure, in its art. 373 (BRASIL, 2015).

Thus, it is the responsibility of the party, with the purpose of instructing the process with evidence and arguments.

V. REVERSAL OF THE BURDEN OF PROOF IN THE ADMINISTRATIVE PROCESS

The reversal of the burden of proof as a result of the principle of presumption of legitimacy of administrative acts is defended by Romeu Felipe Bacellar Filho, as he maintains that “the legal system assumes, until proven

otherwise, the regularity of the exercise of the state function. This is a result of the principle of presumption of regularity of legal norms issued by the State [...]”. Furthermore, he understands that it is “an important feature of normative discourse: the reversal of the burden of proof”. (BACELLAR FILHO, 2014, p. 186).

The author understands that, despite being the Public Administration who accuses, the act is considered as if it had already been proven, exempting it from the duty to prove it (BACELLAR FILHO, 2014, p. 189). However, Romeu Bacellar Filho warns that the burden of proof lies with the administrator only as long as there is no doubt on the part of the Administration about the inaccuracy of the act (BACELLAR FILHO, 2014, p. 192).

Maria Sylvia Di Pietro alleges that the presumption of veracity reverses the burden of proof in administrative proceedings: “From the presumption of veracity there are certain effects: 3. the presumption of veracity reverses the burden of proof; [...]; in this case, [...], the judge will assess the nullity if argued by the party” (DI PIETRO, 2011, p. 241-242).

Marçal Justen Filho defends, regarding the challenge of an administrative act, that the presumption of legitimacy:

[...] is relative, which is equivalent to an inversion of the burden of proof. It means, therefore, that the Public Administration does not need to prove that the content of the act is legitimate, with the third party having the burden of proving that it is illegitimate. (JUSTEN FILHO, 2015, p. 397).

Marçal Justen Filho states, with regard to the occurrence or not of facts asserted by the Administration, that it would not be up to the accused to prove the existence of the fact either, as no evidence of negative or unfounded facts is produced. (JUSTEN FILHO, 2015, p. 397).

In the words of Daniel Ferreira, the burden of proof is on the Administration, in view of the guarantee of the presumption of innocence of the accused until proof to the contrary. And, in addition, he adds that: “it is always the Public Administration, so that if the typicality is not well proven (substantially objective [and subjective, as the case may be]), the competent authority must decide to archive the fact. The reason, then, is evident: *in dubio pro reo*” (FERREIRA, 2009, p. 280). However, for the plaintiff, even in acts of God or force majeure, if the accused is insufficient, the burden of proof cannot be his responsibility, it being the duty of the Public Administration to prove the defendant's capacity (FERREIRA, 2009, p. 294, 324).

In order to reinforce this doctrinal position, Sérgio Ferraz and Adilson Abreu Dallari affirm "that the probandi onus of the illicit act falls on the Administration, since the imposition of a sanction is only constitutionally admitted upon observance of the due legal process, including the right to motivation and decision based on firm evidence" (FERRAZ; DALLARI, 2012, p. 205).

This, then, is the legal basis on which the dynamic distribution of the burden of proof in the administrative process must be examined.

VI. CONCLUSION

After the study, it can be inferred that in the Brazilian legal system, the existence of the constitutional right to proof, as a result of the fundamental rights of contradictory and ample defense, was enshrined in the Constitution of the Federative Republic of Brazil, in its art. 5th, Inc. LV (BRAZIL, 1988).

In the same sense, the right to proof, also not explained, is one of the guarantees inherent to due process of law, since there is no due process of law without the interested party being able to exhaust its right of defense with the production of the necessary evidence to prove it. of the alleged facts.

It is noteworthy that it will be up to the plaintiff to prove what he claims and to the defendant to prove, recognizing the existence of the fact alleged by the plaintiff, the impeding, extinguishing or modifying matter.

The Administrative Procedure Law (Law n.9.784/99), in art. 29, deals with and regulates the institute of evidence, aiming to delimit the facts alleged in the process. This guarantee of the administered before the Public Administration, to allow the production of evidence, in addition to having the allegations against the interested party proven.

Then, the burden of proof, provided for in Law no. 9,784/99 (BRASIL, 1999), which deals with the administrative process, is also in the same sense of the Civil Procedure Code, in its art. 373 (BRAZIL, 2015).

Therefore, in light of these considerations, proof means demonstrating the allegations made by each of the parties, whether in the judicial process or in the administrative process.

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Clinical and epidemiological data of brain death diagnoses occurred in Brazil - Literature review

Dados clínicos e epidemiológicos dos diagnósticos de mortes encefálicas ocorrido no Brasil – Revisão de literatura

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Keywords— Brain death, investigation, information.

Palavras chaves— Morte encefálica, investigação, informação.

Abstract— The concept of death was linked to the absence of heartbeats or spontaneous breathing movements. Diagnosis of brain death is complex, requiring a series of initial factors as prerequisites, such as: knowledge of the cause of the coma, absence of hypothermia and absence of action of central nervous system depressant drugs. Objective: to verify the clinical incidence and epidemiology of brain deaths in Brazil. Methodology: these are exploratory, retrospective observational or experimental studies of literature recovery and critical analysis that were carried out through a search of electronic documents published between 2010 and 2020, using scientific articles, dissertations and theses. Thirty-three articles were analyzed that dealt with the subject discussed, which deepened the knowledge about it, human beings were not involved in the research, thus dispensing with the use of the free informed term. Results: The activities carried out by the brain define all the structures of the body. The patient's vital functions are freely and spontaneously linked and linked to the heart and lungs. The most common causes for the evolution of brain death are traumatic brain injuries (TBI) resulting from car accidents or physical aggression. The act of being an organ donor is characterized as solidarity with others. The family authorizes, however, the patient must agree in life with the act of donating their organs to other people. It is important to remember that not all patients who progress to brain death can be organ

donors, around 1 to 4% of patients who die in hospital clinics throughout Brazil are selected. Conclusion: It is concluded that, during the research, it was found that it was difficult to find the strengthening of the health care network that would help in the formulation of public policies aimed at the capture and transplantation of organs and that took into account the strategies that promoted discussions between professionals and society. Another difficulty is carrying out multidisciplinary training in public and private networks to understand possible pitfalls and analyzes of possible organ donors.

Resumo— O conceito de morte esteve atrelado à ausência de batimentos cardíacos ou movimentos respiratórios espontâneos. O diagnóstico de morte encefálica é complexo, demandando uma série de fatores iniciais como pré-requisitos, tais como: conhecimento da causa do coma, ausência de hipotermia e ausência de ação de medicamentos depressores do sistema nervoso central. **Objetivo:** é verificar a incidência clínica e epidemiologia das mortes encefálicas ocorrida no Brasil. **Metodologia:** trata-se de estudos exploratório, observacionais retrospectivos ou estudos experimentais de recuperação e análise crítica da literatura que foi realizado por meio de uma pesquisa em documentos eletrônicos publicado entre 2010 a 2020, sendo utilizado artigo científicos, dissertações e teses. Foram analisados 33 artigos que se tratava do assunto abordado o qual foi aprofundado o conhecimento sobre o mesmo, não foi envolvido seres humanos na pesquisa sendo assim dispensado o uso do termo de livre esclarecido. **Resultados:** As atividades desenvolvidas pelo cérebro defini todas as estruturas do corpo. As funções vitais do paciente estão ligadas e vinculadas ao coração e ao pulmão de forma livre e espontânea. As causas mais comuns para evolução de morte encefálica são os traumatismos crânio-encefálicos (TCE) decorrentes dos acidentes automobilísticos ou agressões físicas. O ato de ser um doador de órgão caracteriza-se como solidariedade com o próximo. A família autoriza, porém, o paciente deve concordar em vida com o ato de doar seus órgãos para outras pessoas. É importante lembrar que nem todos os pacientes que evoluem para morte encefálica podem ser doadores de órgão, cerca de 1 a 4% dos pacientes que morrem em clinicas de hospitais espalhadas no Brasil são selecionados. **Conclusão:** Conclui-se que, no decorrer da pesquisa, constatou-se a dificuldade de encontrar fortalecimento da rede de atenção à saúde que auxiliasse na formulação de políticas públicas voltadas à captação e transplante de órgãos e que levassem em consideração as estratégias que promovessem discussões entre os profissionais e a sociedade. Outra dificuldade é a realização de treinamento multiprofissional em redes públicas e privadas para entender possíveis armadilhas e análises de possíveis doadores de órgãos.

I. INTRODUCTION

Brain death or brain death (BD / MC) is the complete and irreversible loss of brain function, defined as the cessation of activity in the cortex and brainstem. During brain death, the deterministic loss of the cerebral cortex and brainstem function will gradually and irreversibly affect the homeostasis of the body, leading to the disappearance of heartbeat or breathing

(HIRSCHHEIMER, 2016; CFM, 2017; WESTPHAL, VEIGA & FRANKE, 2019).

According to Freire et al (2012) the concept of brain death has changed, as it is currently possible to maintain the vital functions of human beings for long periods, even without the functioning of the brain (CFM, 2017).

Decree No. 9,175, of October 18, 2017, reinforced the task of the Federal Council of Medicine (CFM) to

determine the standards of ME. Subsequently, CFM Resolution No. 2173, of November 23, 2017 (CFM, 2017).

The most common causes of BD are: brain trauma (TBI) and cerebrovascular accident (CVA), the diagnosis is of a clinical nature and in case of aggravation or evolution the BD must be notified to the responsible family member, as it can become a donor of organ. After confirmation of BD, patients are submitted to confirmation of the diagnosis by complementary imaging tests, neurological tests and notification to the National Organ Capture and Donation Center (CNCDO). Early diagnosis of brain death can protect tissues and organs (HIRSCHHEIMER, 2016; CIOATTO & PINHEIRO, 2017; CUNHA, 2018; PINHEIRO et al., 2020). Stroke (CVA) is one of the biggest causes of death and dysfunction in the world. In some parts of Brazil, it is still the leading cause of death. It is characterized by sudden onset and rapidly evolving neurological deficits, usually focal, caused by localized damage in certain regions of the brain, which may be ischemic (AMORIM et al., 2017; HOC, 2019).

Head trauma (TBI) is responsible for 15% to 20% of deaths among people aged 5 to 35 years and 1% of all deaths among adults, having a huge impact on the health of the general public and is notorious for its importance in the morbidity and mortality. It is considered the main reason for the evolution of patients with BD (MELO et al., 2019). It is important to emphasize that the cause of death must be known and well defined and that the diagnosis of BD must be compulsorily notified to the Organ Capture and Donation Notification Center for transplantation (FREIRE et al., 2012; SEMIÃO, 2019).

Currently, 90% of transplant operations in Brazil are performed by the Unified Health System (SUS) (RIBEIRO SCP, et al., 2017). In 2019 there were approximately 23,957 organ transplants performed, such as: cornea, kidney, liver, heart and lung. Despite the growing number of transplants, the demand for donations is also increasing, but the waiting list for transplants exceeds its effectiveness, resulting in a shortage of organs. The state of Rondônia corresponds to 3.67% of organ donations (cornea) in the year 2019 (ABTO, 2019).

Given the above, interest was awakened in verifying the clinical incidence and epidemiology of brain deaths that occurred in Brazil in the last ten years, based on the collections already published.

II. MATERIALS AND METHODS

The present work is a narrative review of the literature carried out through a bibliographic review, with the

purpose of analyzing publications in journals about the clinical and epidemiological indicators of the diagnoses of brain death occurred in Brazil with key words such as: Brain death, investigation, information.

Bibliographic research has the problem of asking: What were the clinical and epidemiological indications of brain death (BD) diagnoses that occurred in a public hospital in Brazil? In the inclusion criteria, it was possible to search for articles that sought to explain about All notifications related to brain death (BD) patients treated in Brazil. Exclusion criteria for everything that was incongruent and notifications that do not have the necessary information for the study. Articles that are in English were used on the online translation site (<https://translate.google.com.br/>).

The research was structured and is carried out between May and June 2020. In this way, the literature review study provided a direction for researchers in relation to the topic addressed, so that they could create hypotheses and formulate more precise problems or that can be researched by further studies.

Data were extracted from a journal available on electronic data platforms such as: LILACS, BVS, SciELO, REBEN, which were adequate according to the result and fit the objectives of this research. 45 articles were analyzed on the topic, in the end, 33 articles containing publications between the years 2010 to 2020 were evidenced, which had more to do with the objective of the article.

No data collection instrument was used, as, as reported throughout the text, the study is a literature review, so, not being necessary to use it, all data for the analysis were written in Microsoft Word®.

III. LITERATURE REVIEW

Finding brain death in a patient.

The concept of death is to say that human body functions such as pulmonary and cardiac have lost their actions and are not essential for survival. The activities carried out by the brain define all the structures of the body, thus the life and death of the individual, as their neurological functions, when they do not perform their actions, evolve into what we know as brain death (PUCA, 2012; SILVA et al., 2016).

The patient's vital functions are connected and linked to the heart and lung in a free and spontaneous way, but as science is evolving more and more, it is possible to maintain a patient for a long time even without the functioning of the neurological system (brain) by the artificial respirator (FREIRE, 2016). Once brain function stops, mechanical pulmonary ventilation must be

performed to maintain blood circulation and other important functions, but regardless of the intensity of treatment support, irreversible cardiovascular failure will occur after a few hours or days, because although some organs have their own pacemakers, they can maintain certain functions after BD diagnosis, and the nervous system is responsible for the unity of the human body, even with all possible artificial support, the nervous system can die in a short time (HIRSCHHEIMER, 2012).

According to CFM Resolution No. 1.346/91, the Federal Council of Medicine defines that brain death is the irreversible total stop of all brain functions of the individual's body, which is very often verified in an indisputable way.

According to Castro (2010); Puca (2012) the first theory on brain death was presented in 1959 by French neurologists, the same, through the condition that a brain with brain death was found in a living human was known at the time of *depassé*. They realized that even the brain being dead, the cardiorespiratory functions temporarily maintained (HIRSCHHEIMER, 2016).

The most common causes for the evolution of brain death are traumatic brain injuries (TBI) resulting from car accidents or physical aggression. Next, it can be considered that diffuse brain lesions, subarachnoid hemorrhage, aneurysms, massive spontaneous cerebral hemorrhage, fulminant encephalitis, meningoencephalitis are causes that can also progress to brain death (GUETTI & MARQUES, 2007; SILVA et al., 2016).

Brain injuries (TBI), cerebrovascular accidents (CVA) and hypoxic-schemic brain injuries are responsible for about 90% of the progressions to brain death in Brazil (SILVA et al., 2016).

Research conducted in Piauí cites the most frequently evolved causes for brain death are: car accidents, brain aneurysm, stab wounds, renal and cardiac complications and respiratory failure (PAZ et al., 2011). Brain trauma has a high contribution rate for organ and tissue donations in Brazil (NORONHA et al., 2012; SILVA et al., 2014).

Potential Organ Donor

The act of being an organ donor is characterized as solidarity with others. The family authorizes, however, the patient must agree in life with the act of donating their organs to other people without this posing a risk to their physical and mental integrity (SILVA et al., 2014; HIRSCHHEIMER, 2016).

It is important to remember that not all patients who progress to brain death can be organ donors, about 1 to 4% of patients who die in hospital clinics throughout Brazil are selected and 10 to 15% in intensive care units are

considered candidates to be organ donors (MATIA et al., 2010; WESTPHAL, 2016; (SOUZA, BENTO & MILAGRES, 2019). According to the Brazilian Association of Organ Transplants, about 10.7% of patients who are found to have died The demand for organ capitation is greater than transplantation, that is, greater than the supply, thus many patients waiting for transplantation die waiting in line (MATIA et al., 2010; SILVA et al., 2014). According to Westphal (2016), organ transplantation is often the only alternative for patients with terminal illnesses who are registered in programs, in this sense it is observed that the demand is very large and execute the transplantation rate is still very low.

Brazil is the country with the largest number of compatible donors in Latin America, but there is still a large number of people in waiting lists awaiting transplantation of organs in good condition for transplantation (ABTO, 2011; BRASIL, 2012a; BRASIL, 2012b). After finding BD, patients are submitted to confirmation of the diagnosis by complementary imaging tests, neurological tests and notification is made to the National Organ Capture and Donation Center (CNCDO), after being notified, CNCDO itself triggers the Organization for Organ Procurement (OPO) and Intra-Hospital Organ and Tissue Commission (CIHDOTT) (PAZ et al., 2011).

The existence of potential donors and effective donors in Brazil compared to other developed countries, refers to the high rates of indices caused by victims of traffic accidents and violence aged between 1 and 39 years (SILVA et al., 2014; HIRSCHHEIMER, 2016; PINHEIRO et al., 2020). More recent studies do not agree that the incidence of age group for the main candidates for organ capitation are between 41 and 60 years of age, the authors quote that deaths occur more frequently, and many of the patients have healthy organs (PEACE et al., 2011; MENDES et al., 2012).

Nursing care in the maintenance of potential organ donors

Nurses have an extremely important role in providing care aimed at patients with brain death, not only theoretically or practically, but extremely important in the physical, psychological, biological, economic, spiritual, sociological and historical aspects that are fully linked to professionalism, that is, it makes the nurse a mediator, to provide adequate and continuous care (ARAÚJO et al., 2017; COSTA et al., 2018).

The provision of subsidies to the assistance team in intensive care is extremely important in the recognition and validation of a potential organ donor. Valuing the team is also fundamental because the effectiveness and success

of the donation is proportional to the following steps, filling in documents and filling in data (WESTPHAL, 2016; ARAÚJO et al., 2017).

The nurse must have theoretical and practical knowledge in identifying physiological changes, because, as part of patient-oriented care, they spend most of their time monitoring and providing care to the patient and must know the physiological changes of brain death that can act in a way acceptable in closing the diagnosis of brain death, thus enabling the process and streamlining contact with possible teams for capitation of organs, in this part it is noted that the nurse has a great role as a member of the multidisciplinary team (LONGUINIÈRE, 2016; SOUZA, BENTO & MILAGRES, 2019).

Having a dialogue and knowing how to pass on important and extremely important information. Nurses with experiences directly linked to realities can indicate strategies for optimizing the acquisition of possible organs and tissues, one should always have good communication and make nurses from other sectors aware of and sensitize to help in the process. The lack of materials of important use in hospital sectors is a reality experienced daily by professionals, creating obstacles, creating an obstacle in the identification of a possible donor, carrying out a quality examination and poor communication with family members (MORAES, 2014; LIMA et al., 2017).

Nurses are faced daily with several ethical conflicts related to the organ donation process, such as: difficulty of some medical professionals in accepting the diagnosis; not disconnecting the mechanical ventilator from patients who developed BD, but donation, ignorance of brain death protocols, professionals' neglect of potential donors, lack of materials, communication failure and religion are not potential (ARAÚJO & MASSAROLLO, 2014; FREIRE, 2015).

IV. FINAL CONSIDERATIONS

It is concluded that, during the research, it was found that it was difficult to find the strengthening of the health care network that would help in the formulation of public policies aimed at the capture and transplantation of organs and that took into account the strategies that promoted discussions between the professionals and society. Another difficulty is carrying out multidisciplinary training in public and private networks to understand possible pitfalls and analyzes of possible organ donors.

Another important issue concerns the carrying out of further research related to this topic, so that nursing professionals can become more fully integrated in these fields and clarify the relevance of their functions.

In this article, we intend to encourage readers to deepen their understanding of EM and its diagnostic criteria. Considering the importance of the topic for the patient's life and the family's comfort in this situation, health professionals are obliged to inform themselves and use legal means.

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Licuri Milk Production and Conservation Treatments

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Keywords — *Almonds, Pasteurization,
Licuri, Vegetable milk, Vitamins.*

Abstract — *The licuri milk is obtained from the almonds of the palm tree, which is widely distributed in the Caatinga biome, occurring mainly to the east of the São Francisco River. The objective of the research was to identify the main parameters for the conservation of vegetable milk from licuri and the most suitable method to increase the shelf life of the milk. Quality control analysis were carried out in order to determine purity, pH, acidity and colorimetric index using methods from the IAL Food Manual. The results obtained showed that the treatment in sample B (pasteurization at 90°C for 30 minutes) was significant compared to the other treated samples. From a chemical point of view, it was observed that treatment B prevented major changes in the milk, demonstrating that pasteurization is a viable treatment for increasing the shelf life of vegetable milk.*

I. INTRODUCTION

The licuri tree is a natural palm from the Brazilian territory, its fruits are almonds that belongs to the *Arecaceae* family known botanically as *Syagrus coronata* (Martius) Beccari, the plant has 115 genera and 1550 species [1]. It occurs as spontaneous vegetation in the semiarid of the states of Pernambuco, Alagoas, Bahia and in the northern region of Minas Gerais [1]. In different regions of Brazil, the almonds of the licuri tree are also known as Alicuri, Aricuri, Nicuri and Ouricuri. The size of the plant can change according to the conditions of the region and the present nutrients in the soil, reaching up to 8 meters in height per 1 meter of crown [2].

The fruit of this species has a drupe with abundant endoderm, ovoid and fleshy, before ripening, its endosperm is made up of a liquid that becomes solid throughout the ripening process. At the end of this stage, the fruit presents a color that varies from light yellow to orange and, as a characteristic, ripe fruits have a yellow, sticky and sweetish pulp [3]. Inside the fruits, the dry seeds have a dark color and a hard tegument, which coats the

almond rich in oil. Fruiting occurs throughout the year; however, May and August are the best in terms of quantity and quality. At the same time, the fruiting phenomenon of licuri occurs during a long period of the year and is correlated with rainfall, which varies from place to place, constituting an important factor to ensure the supply of fruits throughout the year [4].

The milk from licuri almonds is obtained in an artisanal and extractive way, mostly by residents and cooperatives in the Caatinga region of northeastern Brazil [1]. This raw material contains 83.2% of saturated fatty acids, a value higher than the saturated fatty acids of coconut milk (*Cocos nucifera*) and palm (*Elais guinensis*), which presents, respectively, on average, 80% and 50%; and compared to other vegetable milks, they revealed an average percentage of saturated fatty acids below 25% [5]. According to Queiroga et al. [6], in addition to saturated fatty acids, almonds have a high lipid content, around 49% (11.5% of the almond consists of lipids) and 13.2% of total carbohydrates in the fruit pulp. According to Ramalho [5], the pulp of licuri milk can be consumed “*in natura*”, or

even used in the preparation of typical dishes from the Northeast region, it is also common to use licuri oil as an alternative to soy oil and milk for the preparation of beverages.

With great importance to the country people, this palm supports the intense and prolonged drought, in addition to flowering and fruiting throughout most of the year, presenting itself as a source of food for sheep and goats, wild animals, birds and human beings. The entire plant can be (re)used for making brooms, hats, bags, handicrafts, etc., as well as for the extraction of wax from the leaves of the licuri tree, which has the same purpose compared to the wax from the leaves of carnauba (*Copernicia prunifera*) [4], its use is highly defended, not only for its cultural appeal and a whole history of use, but also for its perfume and flavor that is much desired and appreciated by consumers. In industrial terms, there are some private initiatives for the processing of oil and milk destined only for the production of soap, cosmetics and food [5].

As it is a recent product, few studies have been done and there is no efficient technology for the conservation of licuri vegetable milk [3]. In this context, the present work aimed to study the application of heat both in the cooking process and in pasteurization and the associations of conventional industrial methods such as pasteurization, the use of preservatives and the association of these two methods to evaluate their efficiency in increasing the shelf life of licuri milk through physicochemical analysis and identify the best conservation method.

II. MATERIAL AND METHODS

The raw material was obtained from a cultivated area of the Escola Técnica Família Agrícola under an agroecological system in the municipality of Monte Santo (Bahia), approximately 296 km from the capital of Bahia. The analysis were carried out in the analytical chemistry laboratory of the Instituto Federal de Educação, Ciências e Tecnologia do Sertão Pernambucano, Petrolina campus, in partnership with the Centro de Agroecologia e Energias Renováveis e Desenvolvimento Sustentável (CAERDES), of the Science and Technology Department of Campus III from the State University of Bahia, from December/2019 to January/2020 in a period of 28 days.

In the present work, the production with variations in a factorial experiment was adopted. The fruits selected for analysis were kept at low storage temperature (approximately 10° C) and isolated from light and humidity with a non-toxic plastic cover. The methodologies used to obtain the vegetable milk from licuri were through the extraction "*in natura*" by processing with crushing in an industrial blender for 05

minutes at a maximum power of 900 watts, and thus, subjected to two distinct cooking processes (without and with a pressure of 1.44 atm equivalent to 1487.52 kg.cm⁻²). Prior to the process, filtration of the crushed mass of the licuri almonds occurred in a mesh of 0.5mm at different times, specific for each method (at the beginning of the cooking, in the middle of the cooking process of the licuri almonds and at the end of the cooking process) [8].

The pre-analysis procedure was applied to all 07 treatments and their 03 repetitions, they were identified from A to G (Treatment A – control; B – pasteurization at 90°C/30 min.; C – pasteurization at 69°C/30 min.; D - pasteurization at 64°C/30 min. and addition of 0.12g of vitamin C and E; E - pasteurization at 64°C/30 min. and addition of 0.06g of sodium benzoate; F - 1.2001g of sodium benzoate sodium; G - 0.012g of vitamin C and E). Since, at this stage, initial mass values were obtained for the determination of purity through weighing, that is, the licuri milk was extracted from the almonds and the pre-analysis for the purity test was carried out before applying it to the [9]. The weighings were made on an analytical balance brand Shimadzu - Model BL 320 H. The filtration was made with cotton fabric and subjected to torsion to release the fluid. A Phoenix autoclave model AV-75 was used for the pasteurization process.

The analysis were carried out according to methods adapted from the Adolfo Lutz Institute Food Manual [9] at room temperature of 30°C, applicable to crude and refined vegetable oils and milk. The pH analysis were performed at time 0 (on the 1st day of analysis) and repeated on the 7th, 14th and 21st day. Acidity analysis were performed at time 0 (on the 1st day of analysis) and repeated on the 7th, 14th, 21st and 28th day. Color analysis using the calorimetry test were performed at time 0 (on the 1st day of analysis) and repeated on the 14th and 28th day. The results were treated according to Reginato D'Arce et al. [10], the results for the construction of the graphs were obtained from the average of the 03 repetitions of each Treatment with the respective periods (1st day to 28th day) of analysis [11].

Treatment A consisted of 50 mL of "*in natura*" milk, only with the process of crushing, filtering and cooking, and classified as a witness (control), necessary to know the efficiency of the other treatments tested, or even to test the effectiveness of treatments known but not consistent under all test conditions. Treatment B consisted of 50 mL of pasteurized milk at 90°C for 30 minutes; Treatment C consisted of 50 mL of pasteurized milk at 69°C for 30 minutes; Treatment D consisted of 45 mL of pasteurized milk at 64°C for 30 minutes, subsequently with the addition of 0.12g of vitamin C and vitamin E, then adding more pasteurized milk according to Treatment D until

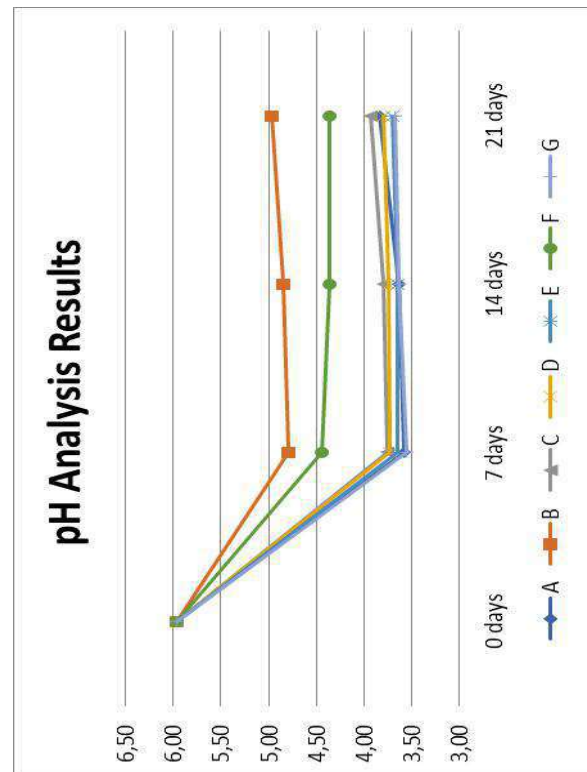
reaching the volume of 50 ml; Treatment E consisted of 45 mL of pasteurized milk at 64°C for 30 minutes with the addition of 0.06g of sodium benzoate, then adding more pasteurized milk according to Treatment E until reaching a volume of 50 mL; Treatment F consisted of 1.2001g of sodium benzoate plus addition of milk according to Treatment A until reaching a volume of 50 mL; Treatment G consisted of 0.012g of vitamin C and vitamin E plus addition of milk according to Treatment A until reaching a volume of 50 mL [8].

The acidity index was determined by titration with NaOH 0.01 N and 1% phenolphthalein as indicator. The pH indices by immersion in an electrode of the TECNOPON brand digital pHmeter and the colorimetric index using the DeltaE brand colorimeter to measure only LAB values (L*= Luminosity; a*= red/green coordinate; b*= yellow coordinate/blue) according to the Commission Internationale de l'Eclairage [1][12].

III. RESULTS AND DISCUSSION

Based on the average efficiency data of 20% of the milk by pressing [13], it is possible to identify that the simplified crushing and filtration process surpassed this data, presenting 24.9% efficiency using the cooking technique. After this procedure, it can be identified that Treatments A, B and C had 100% purity, Treatments D, E and G had 99% purity and Treatments F had 98% purity, due to the addition of preservatives in the Treatments D to G the purity content of the samples were reduced by 1% to 2% according to the method applied in each treatment, that is, the addition of preservatives reduces the purity of the milk [10][11].

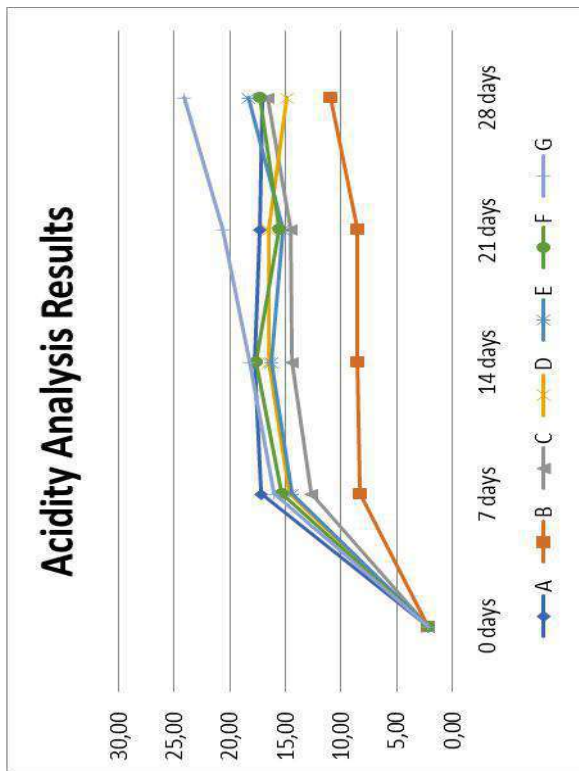
Graph.1: Results of pH analysis of licuri milk samples.



*Treatment A – witness; B – pasteurization at 90°C/30 min.; C – pasteurization at 69°C/30 min.; D – pasteurization at 64°C/30 min. and addition of 0.12g of vitamin C and E; E – pasteurization at 64°C/30 min. and adding 0.06g of sodium benzoate; F - 1.2001g of sodium benzoate; G – 0.012g of vitamin C and E. Source: Developed by the authors of this work.

It was observed that Treatment B presented a pH conservation curve compared to the samples of the initial analysis at time 0 (T0) (1st day of analysis), in this way, and according to the ICMSF (International Commission Of Microbiological Specifications For Foods) which characterizes the proliferation of microorganisms in vegetable milk as a very variable behavior in relation to the time interval, in which the growth takes place, that is, the bacteria grow faster (optimal pH) in the range above 7.0 at 8.0; yeasts between 4.5 and 6.0 and fungi between 3.5 and 4.0 [14]. Therefore, the average results of Treatment B, presented itself as the best conservation method for the pH characteristic.

Graph 2: Results of the titratable acidity analysis of licuri milk samples.



**Treatment A – witness; B – pasteurization at 90°C/30 min.; C – pasteurization at 69°C/30 min.; D – pasteurization at 64°C/30 min. and addition of 0.12g of vitamin C and E; E – pasteurization at 64°C/30 min. and adding 0.06g of sodium benzoate; F - 1.2001g of sodium benzoate; G – 0.012g of vitamin C and E.

Source: Developed by the authors of this work.

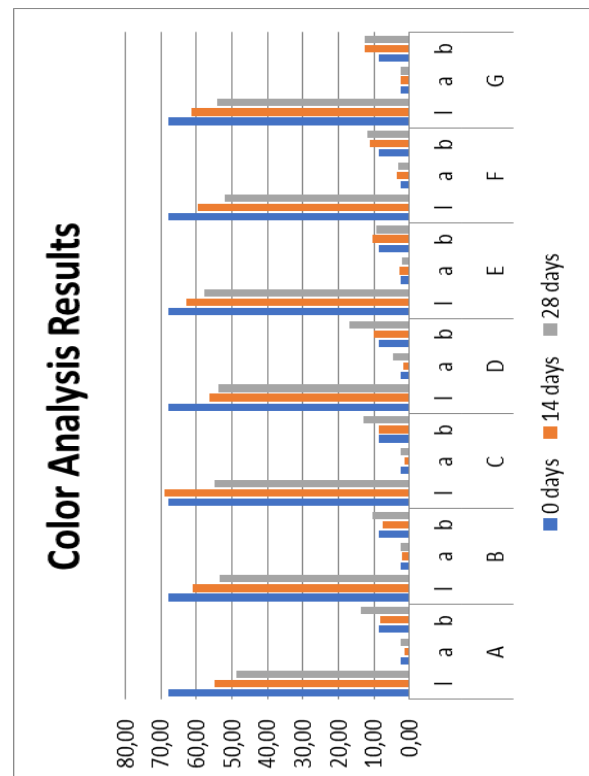
Milk rancidity is usually accompanied by the formation of free fatty acids [15], which may be the main characteristic to determine and to determine its shelf life. The titratable acidity in Treatment A started with low acidity, peaking on the 7th (seventh) day of storage and growing exponentially. In Treatment B, the initial values were the lowest due to the combination of thermal conservation; proportional behavior to the pH analysis, keeping characteristics similar to the initial time 0 (1st day of analysis), that is, the acidity values remained stable for 28 days.

Observing the curves of Treatments C, D, E, F and G it was found that there is a certain coincidence in the behaviors, with a marked increase in acidity from the 7th day and with correlation to the values of the pH analysis during the 28th days of analysis.

There was no advantage in using treatments with additives (vitamins), as shown in the data presented for

acidity and pH. According to the work by Zambazi et al. [16] whose titratable acidity values for the product with preservatives ranged from 30% to 50% more than the initial time (1st day) of the analysis, that is, the maximum and minimum acidity ranges never exacerbated in relation to the conservation of the product, however, the existence of methods that manage to keep the growth range for the acidity characteristic to a minimum, presents itself as the best choice in conservation.

Graf.3: Results of colorimetric analysis of licuri milk samples.



L* indicates luminosity and a* and b* are the chromatic coordinates. (L* = Luminosity; a* = red/green coordinate (+a indicates red and -a indicates green) b* = yellow/blue coordinate (+b indicates yellow and -b indicates blue).

Source: Developed by the authors of this work.

Another feature that provides information about the conservation status of milk, since the concentration of hydrogen ions can be altered during milk decomposition from phenomena such as hydrolysis, fermentation and oxidation, leading to milk deterioration, making it the more acidic, however, this decomposition of glycerides can also be accelerated by factors such as the action of light and temperature. Thus, using calorimetry analysis, with the L*a*b* color space, according to the theory of

opposite colors, where two colors cannot be green and red at the same time, or yellow and blue at the same time [16].

The colorimetric measuring instrument was able to easily quantify these color attributes ($L^*a^*b^*$), thus identifying Treatments B and G as those that presented colorimetrically in spectral data conservation in the object's color coordinates in the color space $L^*a^*b^*$.

IV. CONCLUSION

Licury milk can have its shelf life extended with the use of pasteurization at 90°C for 30 minutes (Treatment B), without the addition of preservatives for up to 28 days.

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Effect of Corrosion on Mild Steel in Food Processing Industry: A Review

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Keywords — *Corrosion, Mild Steel, Tomatoes, Food Processing Industry.*

Abstract— *Corrosion is a watch word when it comes to the deterioration of material exposed to chemical, electrochemical or biochemical substances in the environment, this results to electron loss in metal as they come in contact with oxygen and water. Mild steel is one of the major materials exposed to this corrosion in humid air, acidic and other environment, it finds its application in construction work in the industry because of its low cost, it is chosen as a material of choice even in food processing industry. The aim of the work is to review literature on the effect of corrosion of mild steel in food processing industry, the tomato fruit which is also a vegetable was used as a case study to carried out the review, the review highlighted the detection, prevention, method, inspection and control method to tackle corrosion problem. The review also explained the different forms of corrosion and how they affect metals.*

I. INTRODUCTION

Corrosion have been in existence over the years, it is regarded as a gradual degradation or deterioration of metal, as it interact with the environment, (Hamzat et al., 2020). This interaction causes loss of electrons in metal as it comes in contact with oxygen and water which causes the breaking down of mechanical properties in the material due to chemical reaction.

According to report United States spends \$274 billion annually (3.1% of the GDP) on corrosion associated cost which is very devastating, This impact has affected the food processing industry because of the contamination of products. Other challenge encountered as a result of corrosion include plant shutdown, equipment breakdown and loss of production time (Udochukwu Ofoegbu et al., 2011), corrosion attack can appear in different forms such as pitting corrosion, galvanic corrosion, intergranular corrosion, selective leaching.

Mild steel is an alloy composed of 2% carbon and 95% of iron (Fe), other additives include 1.65% manganese (Mn), 0.6% copper (Cu) and 0.6% silicon (Si), there are also a little bit of other metals such as vanadium, cobalt,

chromium, and nickel present in the alloy, mild is corrosive as a constructional material because of the amount of carbon content in it.

Mild steel finds its useful application in the industry because of its weldability, malleability and amenability to heat treatment process, to change its mechanical properties (Badmos & Ajimotokan, 2009) mild steel has been extensively used for metallic structures in the industry, because of its low cost (Fuente et al., 2010), regardless of all this wonderful application of mild steel and its properties it is also faced with a big challenge when it comes to corrosion attack, this problem come in various corrosion attack such as fatigue, stress corrosion and lot more.

Battling the effect of corrosion of metallic materials is now a major problem especially in the food processing industry because of the bacteria growth in food, the struggle to ensure food quality and avoiding other related health issues that comes with it (Hamzat et al., 2020). The chemical composition of this metals is also a crucial aspect to be considered in the choice of selecting material in the construction of processing industry this helps to determine

the possible corrosion reaction and the corrosion product formed (Ofoegbu, 2021).

A lot of researchers have investigated the effect of corrosion metal immersed in various food substance such as, tomatoes, cassava, orange and lots more, to know the reaction of metals when they come in contact with these fluids.

corrosion resistance of nickel plated iron carbon steel in tomato fluid was studied by (Oluwole & Olawale, 2010) for 30 days, weight loss and electrode potential were adapted to carry out the experiment. The result showed that the nickel-plated steel had decreased corrosion attack when the weight of nickel coating was increase, this shows also that thinly plated low carbon steel had no significant change on the unplated steel

(Hamzat et al., 2020) studied the corrosion of mild steel immersed in fruit environment, they adopted weight loss technique to determine the rate of corrosion in cashew fluid, pineapple and orange for period of 25days, taken 5days interval, the result showed that cashew fluid had the highest corrosion rate at 0.7mmpy, followed by the pineapple fluid, the lowest corrosion rate was observed in the orange fluid at 5.00mmpy.

(Dey & Agrawal, 2017) used weight loss technique to investigate the behaviour of Tinplate in when exposed to corrosion in fruit juice. The structure of corrosion products and morphology were characterized by scanning electron microscope (SEM). The samples were immersed in different type of fruit juices after the weight was known, natural fruit juice and water. For a period of 20days, taken 6days interval to measured the weight, result obtained showed a significant degradation of template sheet. This was as a result of the sweet fruit juice which is acidic in nature. Packed fruit juice with preservative was most corrosive follow by natural fruit and water.

This work aims at providing a review on the effect of corrosion in the food processing industry by briefly summarizing previous literature on the interaction of mild steel in different fluid media. It explained the different types of corrosion that occur on metals in food processing industry. Then it gives the inspection and control methods. Finally the paper gives the conclusions.

II. DESCRIPTION OF TOMATOES

Tomatoes are one of the major fruits processed in the food industry, it is a fleshy berry (lycopersiconescufentan) which belong to the night shade family, other crops in this family include, potato and egg plant.

Tomatoes is the second most important fruit or vegetable crop next to potato with approximately 1823 million tons

produced yearly (FAOSAT, 2019), they are rich in minerals, vitamins, sugar, vitamin B and C, essential amino acids, dietary fibres, iron and phosphorous.

Tomatoes are consumed as everyday diet because of their nutritional values but they also contain citric and malic glutamic acid as one of their prevalent acid, there is also methionine and S-Methionine, which make it a corrosive environment for metals.



Fig 1 mild steel exposed to tomato fluid.

III. TYPES OF CORROSION

According to ASM 2000, corrosion occurrence is classified in three different forms.

- i. Nature of the corrodent: This could be “wet” or “dry” environment depending on the medium, an aqueous or moisture corrosion is mostly seen in the former, while dry corrosion occur in high temperature gas environment.
- ii. Mechanism of corrosion: This requires the presence a chemical reaction or electrochemical reaction.
- iii. Appearance of metal corrosion: This is physical look of the metal, it could be uniform, and the metal corrodes at even rate over the entire surface, or it can be localized.

3.1 Uniform Corrosion:

Uniform corrosion is a type of corrosive attack that is distributed evenly over the entire surface of the metal, it can also be seen as a dissolution of metallic component into metallic ions, the effect of this type of degradation causes the material to become thinner and gradually fails. It is a big effect on waste of metals on the bases of tonnage, although it is not an aggressive type of corrosion but this type of deterioration can have a serious impact on the economy compared to the aggressive ones. (Hauge, 2015)(Sandvik, n.d.)(Jirarungsatian & Pratepasen, 2010)



Fig 2. Uniform Corrosion (Mgonja, 2018)

3.1.1 Preventive or Reduction Method of Uniform Corrosion:

1. Proper material coatings.
2. Cathodic protection
3. Use of Inhibitor

3.2 Galvanic Corrosion:

This involves material contact between two dissimilar metals resulting to one giving up more electrons to the other during the process of transmission, this is also known as electrochemical process (*Corrosion Considerations in Connector Development*, n.d.). Galvanic corrosion has an accelerating effect which increases corrosion in metal exposed to electrolyte. It is particularly seen in outboard motors boats, Galvanic corrosion can be seen in old apartments where modern copper piping are joined to the aging existing carbon steel lines. Although Mg is the highest structural materials which helps in light weighting in automobile, it is very prone to galvanic corrosion when used along with the aluminum (Al) or steel.



Fig 3 Galvanic corrosion (Mgonja, 2018)

3.3 Crevice Corrosion:

this a localized type corrosion that happen in confined spaces, the attack is usually caused by stagnant solution which is as a result of lap joint, hole appearance, gasket surfaces, surface deposits and crevice under bolts and rivet head, it can also be referred as corrosion that occur when a

small volume of stagnant corrosive fluid is trapped in the interface between two material in a shielded region, (Sandvik, n.d.) (Rashidi et al., 2007) (*Corrosion Considerations in Connector Development*, n.d.) Crevice corrosion occur in most engineering structure. Consequently, crevice corrosion has the peculiarity of occurring in only a few microliters of electrolyte (Christian, 2020). Crevice corrosion can be also be caused by biofouling deposits like iron hydroxide (Abdel et al., 2018).



Fig 4: Crevice corrosion

3.4 Pitting corrosion:

It is a form of extremely localized corrosion of a material surface confined at an area, the pit holes are formed quickly on metal surface which eventually makes the material to fail. pit holes can be isolated or close to each other which makes the metal surface look rough, they can appear in large or small diameter but in most cases in small diameter, pitting is a very dangerous form of metal corrosion, in extreme cases pit corrosion can lead to sudden break down of the material, (Fontana, 1987). Pits can be in the form of covered or uncovered pit with a semi-permeable membrane product of corrosion. Pit appear cupshaped or hemispherical (*NACE International "pitting Corrosion"*, n.d.).

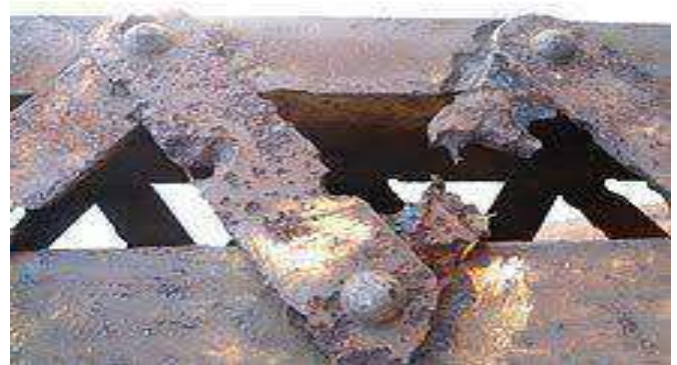


Fig 5 Pitting Corrosion

3.5 Intergranular corrosion:

Intergranular corrosion occurs with relatively little grains of corrosion, it's a localized attack that occurs in the premises of the grain boundaries of a metal, this is caused by chromium depletion, which is as a result of precipitation of chromium carbides in the grain boundaries or chemical segregation effects. the precipitation hence produces zones with decrease corrosion resistance in the immediate vicinity (*NACE International "intergraualar Corrosion"*, n.d.), intergranular corrosion is strongly associated with the properties and microstructure of a metal (Smithells, 2004). Intergranular corrosion is quite different from pitting corrosion even though it may be initiated from a pit, it grows more rapidly than pitting corrosion along susceptible intergranular pathways. (Birbilis & Hinton, 2011)

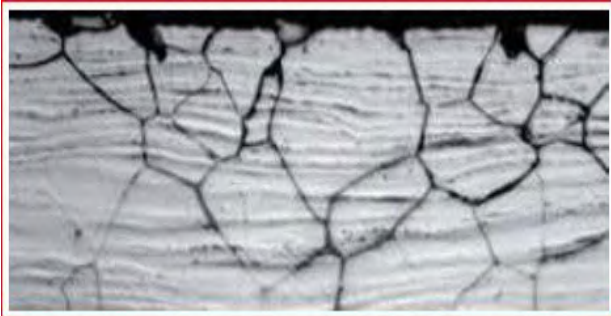


Fig 6: IntergranularCorrosion

3.6 Erosion corrosion:

Erosion corrosion is an increased degradation of metal surface due to mechanical action or attack on a metal which is caused by rapid movement between the metal surface and the corrosion fluid (Fontana, 1987), it is as a result of turbulence at a particular site due to a disruption in the flow pattern, which causes mechanical near effects or abrasion. On the metal surface (Fontana, 1987) (*Corrosion Atlas Case Studies (General Aspects of Corrosion, Corrosion Control and Corrosion Prevention)*, 2020), erosion corrosion is caused by drops of small particles with inertia, which causes material loss because of strikes on the metal surface [7]. The rate of this type of corrosion is also subject to fluid speed (Sandvik, n.d.).



Fig 7: Erosion Corrosion

3.7 Stress corrosion cracking (SCC): Stress Corrosion Crack are distortion of metals subjected to tensile stress in a specific corrosive environment (Fontana, 1987). This causes corrosion reaction that lead to crack increase at the tip of the metal, The crack increased because of the consumption of reaction of the material at the crack tip, stress corrosion crack occurs suddenly with little or no evidence of corrosion attack on the metal surface (Sandvik, n.d.). Examples of SCC include aluminum alloys steels in chloride solutions, neutral aqueous solutions, cracking of austenites stainless steels in the presence of chlorides.



Fig 8: Stress Corrosion

3.8 Atmospheric corrosion: this is a natural occurrence on metal surface, it is an electrochemical process that is caused by the presence of electrolyte, is a corrosion attack on metal exposed to air and its pollutants. Atmospheric corrosion occurs at atmospheric relative humidity which has exceeded the equilibrium relative humidity over a saturated solution visible on a metal surface, it could occur as dry, damp and wet corrosion. (Ahmad, 2006).

IV. PREVENTION OF CORROSION

Food processing industries have always been faced with the problem of corrosion. In other to reduce these

problems preventive methods are adapted as an effort to reduce the accident that occur as a result of pipe leakage and fracture, most industries now employ the use of cathodic protection and coating as a method of protection (Baker, 2008) (Enani, 2016).

4.1 Cathodic Protection:

Cathodic protection is a proven way of protecting metal against deterioration of underground metallic pipes and offshore structures, in the oil and gas industry, structural foundations and utility lines (Ahmad, 2006), it applies current to pipes to disarray the flow of electrons from anodes to cathode, creating a cathodic field over pipes, cathodic protection is applied by one of two methods: power imposed current or sacrificial anodes. For cathodic protection to be effectively carried out, polarization must take place by applying the positive and negative DC on the structure.

4.2 Coatings

High performance coating has proven to be more effective method of coating by applying the coating to a surface abrasive blast cleaned to a white or near white metal surface finish in conjunction with effective cathodic protection. The surface abrasive blast cleaning promotes good coatings adhesion, the basic function of the cathodic protection system is to protect the bare area on the metal from corrosion (Beavers & Thomposon, 2006) (Baker, 2008).

Inadequate coating has been a major contributing factor to the corrosion susceptibility in the food processing environment, the standard follows that "the purpose of coating is isolate the external surface pipe from the environment, to improve (protection) current distribution and minimize cathodic protection requirement".

Below are the common interior coating types:

4.2.1 Coal for Enamel:

Coal for enamel (CTE) have coal tar pitch as their basic ingredient, they contain stable molecules which are generated at 1300°C during cooking operation, the coal and fillers add strength and product flexibility. Most of the necessary characteristics necessary to produce pipeline corrosion protection are due to the molecular arrangement provided by CTE. This includes water resistant, stable chemical structure, resistant to cathodic disbanding, most pipelines are protected using impressed current or sacrificial metal anodes, high electrical resistance is another factor that shields cathodic current, adhesion help to form a stiff bond to the material surface which resists bacteria attack, aquatic organism and root penetrations (Malley, 2018).

4.2.2 Cement Mortar Lining:

The cement mortar composite has a wide range of application in masonry work, patching rendering, it has a long-term reliability and less expense, the main advantage of cement mortar is the user friendly type of application. cement mortar linings protect the steel pipes by providing a stable hydroxide film at the interface of the steel-mortar even at discontinuous pipe joints, the cement mortar linings is known to hold water for an extended period of time, it follows the quality water standard procedure (Malley, 2018). cement mortar lining can influence significantly the stiffness of the steel and deflection forces resistance. When calculating stiffness, the mortar lining and steel strength can be added together.



Fig 9. Cement Mortar Lining

4.2.3 Liquid Applied Epoxy: This involves the following.

1. chemically cured type of epoxy coating, more than two types of coating of similar part.
2. A single coat of two-part.
3. A chemically cured two-part epoxy primer with more than one coating of dissimilar two-part and a top coat.

However, epoxies are mainly applied on floors, warehouse and automotive facilities, it contains a polyamide or amine agent and needs a near white blast cleaned surface (Nace, 2007). Coal-tar epoxies have coal tar pitch added to the epoxy resin. A coal tar epoxy cured with a low molecular weight amine serves as resistance especially in alkaline environment, example is the occurrence of cathodic protection structure. Some coal-tar epoxies become brittle on exposure to sun rays (Beavers & Thomposon, 2006).

4.2.4 Fusion Bonded Epoxies:

Fusion bonded epoxies are composed of a powdered coating used to provide pipeline protection, they are heat curable and thermoset polymers in nature and are mostly used when no volatile organic compounds (VOCs) are needed.

FBE is usually applied above 450°F after the heating process to avoid excessive pipe cooling (if cooling is done below 450°F the FBE curving process may not be fully completed) and it needs not more than one minute or less to dry to the touch and three minutes to be fully cured depending on the material formulation (Malley, 2018), fusion bond epoxy coating were introduced in 1959 but was commercialized in 1961, the coating film is usually applied to large and smaller diameter pipes (Mgonja, 2018).

4.2.5 Polyurethane Coating:

The aromatic polyurethanes are 100% solids material with VOCs content. Polyurethane materials ensure economic high production rates which makes them cure faster, they have good physical and mechanical properties, and products coated with polyurethane have reliable service life span. They provide strong adhesion to well-prepared steel surface and ferrous steel. Polyurethane coating requires the pipes to be thoroughly cleaned for in-service pipe before application.

4.2.6 Wax Coating:

Wax is known for centuries, for coating fruits, pipes and cars, they serve as waterproof and protect the material from sunlight UV ray, the microcrystalline wax coatings are mostly used with a protective overwrap. The prevalent application of wax coating is in a combination of machine that cleans, coats, wraps and lowers into the ditch in one operation (Beavers & Thomposon, 2006). Wax coatings are product from different variety of chemicals which may not be suitable for consumption but can be removed by evaporation during drying operations. One can also find the useful application of wax coating in cartons for frozen foods, butter and margarine (Mitsuhiro, 1990).

4.3 Corrosion Inhibitors:

According to (Durowoju et al., 2014) inhibitors are chemical compounds added to gas or liquid, to reduce the corrosion rate of the material, they are selected depending on the type of acids, metal expected temperature and choice of protection time when added in small concentration to an environment, the selection of an inhibitor is also controlled by its economic availability, its efficiency inhibits the substrate materials and its environmental side effect (Durowoju et al., 2014), example is the injection of inhibitor substance into the stream of hydrocarbon (oil or gas) close to the wellhead to decrease rate metal degradation in the steel pipe. Inhibitors can be of different types including passivators (anodic inhibitor), Cathode, organic, precipitation inhibitors and vapour-phase inhibitors.

V. CORROSION INSPECTION AND CONTROL METHOD

Different corrosion inspection and control methods have been adopted to inspect pipes in food processing industry, they include hydrostatic retesting, direct assessment, and inline inspection (Beavers & Thomposon, 2006).

5.1 Direct Assessment (DA): DA is essentially a structural process that does not cause any clogging in the pipeline operation (Mgonja, 2018). It is the most widely accepted method of inspection used globally and it has proven to follow protocols guiding pipeline integrity operation, it determines the presence of corrosion in a system by assessing the overall condition of the pipeline and coating (Pillai, 2011), DA is a structured process that combined data integration, use of existing survey tools modeling for identifying areas where corrosion is more likely to occur and physical examination of the pipe (Kowalski & Beavers, 2011).

5.2 Hydrostatic testing: this involves testing component such as piping system, gas cylinder and pressure vessel for strength and leaks, it is done by applying pressure to verify the integrity of the pipeline, it is used mostly for testing pipe and pressure vessel, the operation is carried out by filling up the component with water and initiating pressure to examine the strength of pipe without bursting it (Sankara, 2014). It is one of the quality-control measures which ensures that installed pipes are reliable for service. (Mgonja, 2018).

5.3 In-line Inspection (ILT) device: These are "smart or intelligent" pigs devices used as preventive maintenance method to examine pipelines for cracks, corrosion identification, and other defects, that might lead to major breakdown of the structure, it is also a non-destructive type of test. (Corrosionpedia, 2021)

5.4 Magnetic flux leakage tools: According to Wikipedia, it is a non-destructive type of testing that applies magnetic flux to detect corrosion and pits in steel structures, they are widely used in the industry for assessing the quality and structural integrity of ferromagnetic components in underground pipelines (Chandra & Bhagi, 2014), it detects cracks in both circumferential and axial direction and are used to measure the change in magnetic flux lines produced by the defect, they are of two types, high resolution magnetic flux leakage tool and standard resolution MFL (Mgonja, 2018) to carry out testing MFL testing, magnetizing unit and sensor are scanned together as a single unit at constant velocity and the sensor response is recorded and interpreted continuously. The magnitude of MFL

signal is strongly related to defect depth (Chandra & Bhagi, 2014).

5.5 Ultrasonic tools (UT): this is a non-destructive examination technique that uses high frequency ultrasonic waves to detect flaws in a steel pipe. (Wikipedia, 2017) it evaluates stress state using the influence of the strains respectively, they are used to measure the thickness of materials and the size of defects (Onyekpe, 2002), ultrasonic (UT) uses high frequency sound waves (ranging from 0.5 to 15MHz) to examine and take measurement. It can be used to measure the thickness of material and the size of defects, ultrasonic techniques find useful application in nondestructive testing, radiography, acousto-optics, microscopy etc.

VI. CONCLUSIONS

The effect of corrosion of mild steel in food processing industry have been presented, corrosion has been a watch word used throughout the paper presentation. This is because of the challenges industries and society in general faced as a result of material deterioration. It has been explained that the mild steel which is one of the cheapest metals used in food processing industries is attacked majorly by corrosion which occurs in different forms. The effect of corrosion has led to contamination of food which can cause serious health challenges. The study has shown that corrosion related problems constitute 33% of all failures in the food processing industry, reports show that the annual cost of corrosion is alarming as industries and countries like the US have spent billions of dollars to take care of the problems of corrosion. Preventive measures have been put in place to curb the effect of corrosion which has been effective to some extent. The keys to effective corrosion control in the food industries and proper material selection, quality design and installation of equipment, use of high technological corrosion monitoring techniques and assigning maintenance and monitoring to trained professionals.

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Reflections of the New Brazilian Forest Code: Amazon in Focus

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Abstract— *Law 12.651, of May 25, 2012, establishes norms for the protection of native vegetation in areas of permanent preservation, legal reserve, restricted use, forest exploitation and related matters. The objective of this research is to make a critical reflection on the impacts of the New Brazilian Forest Code for the biomes in the Brazilian territory, with special attention to the Amazon. In this direction, we seek to analyze and discuss some critical points, conceptualizing the main aspects that negatively impact soil, hydrography, fauna and flora and water resources. The methodology adopted for this research is based on a documentary bibliographic reference, of the descriptive-analytical type, anchored in a qualitative-quantitative approach, as well as an evaluation of in-situ work in the West of Pará. [...] The results presented are based on official data from the National Institute for Space Research (INPE), collected through the system (PRODES and DETER) of the Institute of Man and Environment of the Amazon (IMAZON) and field research. The numbers show that the presence of private capital has been promoting a growing deforestation in the Amazon. And this is generated by the advancement of a multitude of real estate projects, agricultural (soybean and corn planting), extensive livestock and mining services. However, what drew the most attention was the deforestation data for the last three years. In other words, they are high projects (2019-2021) and do not represent improvements in the rate of progress in the Brazilian Amazon. Notwithstanding this, we still live with degrading problems of social and public health indices. In this dire juncture, it is understood that development does not mean transformation of the natural landscape of forests, water courses, pollution of rivers, creeks and streams, as well as extinction of fauna in biomes in general. We need to take better care of the Amazon and this involves changes in the Brazilian Forest Code. Institutional support is needed for inspection, applicability of laws and, if necessary, punishment for violators.*

I. INTRODUCTION

Brazil is a continental country composed by six biomes with distinct characteristics: Amazon, Caatinga, Cerrado, Atlantic Forest, Pampa and Pantanal. Each of these environments shelters different types of vegetation and fauna, as well as presents grandiose hydrographic basins and different relief characteristics (BRASIL, MMA, s/d).[...] As vegetation is one of the most important components of the biota, its state of conservation and continuity define the existence or not of habitats for the species, the maintenance of environmental services and the provision of essential goods for the survival of human populations. (Idem).

Therefore, for the perpetuation of life in biomes, it is necessary to establish public environmental policies, the identification of opportunities for the conservation, sustainable use and sharing of benefits from biodiversity. In this sense, the study in question has like its keystone to bring to light a critical reflection on the Brazilian Forest Code approved by approved by the New Law N°. 12.651, of May 25, 2012 (BRASIL, 2012), which establishes norms for the protection of native vegetation in areas of permanent preservation, legal reserve, restricted use, forest exploitation and related matters, insofar as, the “development” needs to be rethought.

In this context, we list several concepts foreseen in its text and, we critically analyze how the changes reflect negatively on the environment. In other words, it seeks to promote information and reflections with the purpose of bringing citizens closer to the debate in the search to strengthen the socio-political means of confrontation and resistance to the dismantling of what has been achieved in recent decades, such as the reduction of pollutants, plant protection and many other achievements arising from international conferences marked mainly from Rio 92 and Agenda 21, as well as those promoted by the World Forums on the climate.

In this political conjuncture and global in scope, the Brazilian Forest Code, popularly known as a set of laws that imposes the rules on how to manage Brazilian native vegetation, also refers to the number of areas that must be preserved, in addition to the regions authorized to receive the different productive arrangements for the rural environment. For these reasons, it is one of the most important instruments for the effective control of advances in environmental degradation in various sectors of the economy. However, what has been seen lately is a flexibilization of this policy by the Brazilian government, supported by the decisions of the National Congress, it is mentioned, as an example, the recent approval of Bill 2510 of April 24, 2019 - PL 2510/2019 (BRASIL, 2019), which

amends laws 12.651 of May 25, 2012 (BRASIL, 2012), which provides for the protection of vegetation, 11.952, of June 25, 2009 (BRAZIL, 2009), which provides for land tenure regularization in union lands, and 6.766, of December 19, 1979 (BRASIL, 1979), which provides for the subdivision of urban land, to resolve about permanent protection areas in the urban perimeter and in metropolitan regions, which is observed with great concern by the scientific community and independent national and international organizations.

The first Brazilian Forest Code created in 1934 (BRASIL, 1934a) was an extremely important document in Brazilian history, because its creation was due to the need of preservation of forests for economic purposes, since the coffee production that occurred at the time harmed the vegetation, mainly in the southeastern region of the country. As the forests held all the materials that the industry needed, then, a way was created to alleviate the excessive wear and tear of its natural resources and make their use more rationally.

In a second moment, more precisely in 1965, in an attempt to improve and advance this Code, a new debate arises that would lead to the proposal for the creation of a new law that would protect the environment from predatory actions in past times, thus justifying new changes. In this direction, the Forest Code arising from Law 4.771/65 (BRASIL, 1965), was revoked by the Law 12.651 of May 25, 2012 (BRASIL, 2012). This new update brings with itself two important elements such as Legal Reserves (RL) and Permanent Preservation Areas (APPs) destined for rural properties.

From these temporal and legal insertions, we elaborate some questions that guide this research: Does the New Brazilian Forest Code promote advances or setbacks for Brazilian environmental policy? Has the Amazon biome been protected by the new law? Do the investments provided by the Brazilian government have the desired effects? What do international and national organizations and the scientific community say about the changes and their effects?

II. METHOD

The present study is based on documentary bibliographic research. According to Gil (2008), the objectives of a descriptive research focus on identifying characteristics of a particular population or object of study. Descriptive-analytical provides a study with more in-depth evaluation aspects of the information available in the perspective of explaining the context of a phenomenon, through a qualitative approach, because, it involves intensive and long-term observation in a natural

environment, the accurate and detailed recording of what happens in the environment, the interpretation and analysis of data using descriptions and narratives (THOMAS; NELSON, 1996) and quantitative that primes by collecting information and/or data that can be translated into numbers for further analysis. As well as the *in situ* work in the field of research object. We use primary and secondary sources. As primary sources, unstructured interviews were conducted with Health Secretaries, Secretaries of Administration, Department Directors of City Halls, Social Workers and Councilors of the Guardianship Councils of the visited municipalities Itaituba, Novo Progresso, Trairão, Rurópolis and Santarém.

III. RESULTS

The insertion of the Tapajós Integration Region (RI) in the territorial dynamics of the Amazon Biome

According to data from The Brazilian Institute of Geography and Statistics (IBGE), the Brazilian Amazon shelters an approximate population of 28 million people, of which 75% live in urban areas (IBGE, 2017a). "The Amazon cities have peculiar attributes, characterized by the existence of small and medium urban centers, along the main highways and rivers of the region." (SATHLER et al., 2009¹ apud FERREIRA; VIEIRA, 2018, p. 764, our translation). In these small and medium urban centers, changes made in the natural landscape, in the social, economic and environmental dynamics of the region are common, in an accelerated way, year after year. This transformative dynamic, encouraged from the 1970s onwards, with the National Integration Program (GOMES et al., 2017). Thereby, it is understood the need for more effective actions by the federal government with public policies for the protection of natural resources.

Thus, the creation of integral protection areas, extractive reserves or conservation areas in the Amazon are thought out and encompasses a series of events that involve respect for forest peoples, their culture and ancestry; protection of wild animals and all forms of life present in Amazonian *ecosystems*. It is also possible to think about the representation of an economic solution,

which is ecologically adequate. In this aim, it was created through the Law 9.985 of July 18, 2000, the National System of Nature Conservation Units - SNUC, the Conservation Units are divided into two groups: those of Integral Protection and those of Sustainable Use (ICMBio, 2006), whose text deals with the Sustainable Development Reserve (RDS) "according to the National System of Conservation Units (SNUC, Lei 9.985/2000) these units are created with the basic objective of making nature conservation compatible with the sustainable use of part of their natural resources by the extractive populations that traditionally inhabit these areas" (Idem). They are traditional peoples and communities, in accordance with item I, article. 3º Decree 6.040 / 2007,

culturally differentiated groups and that recognize themselves as such, that have their own forms of social organization, that occupy and use territories and natural resources as a condition for their cultural, social, religious, ancestral and economic reproduction, using knowledge, innovations and practices generated and transmitted by tradition (ICMBio, 2006).

The creation of these areas of reserves begin to give new meaning to the political propositions for the preservation and conservation of biodiversity in the country, which opposes the advances of capital. However, it verifies that real estate capital has promoted changes in the landscape in urban areas of cities, as a result of investments in expanding peripheral areas, transforming rural into urban dynamics. Ferreira e Vieira (2018, p. 764) corroborate, evidencing that "land control, state-induced migration policy and incentives for large enterprises ensured the "development of the urban frontier". According to Porto-Gonçalves (2017, p.31, our translation) "until the 1960s, all modern-colonial capitalist incursions into the Amazon were discontinuous in space and time, configuring localized expansion/invasion fronts".

Therefore, it is possible to understand that the transformations that have taken place in the territory are encouraged by public policies at the service of big capital, such as the construction of roads, Manaus Free Trade Zone, hydroelectric plants and mining companies in the different corners and inhospitable places that make up the dynamics of the Amazon of yesteryear. Despite this, the power of capital mobilizes other economic and ideological apparatuses that advance devastating the forest, polluting

¹SATHLER, Douglas, Roberto L. Monte-Mor and José Alberto Magno de Carvalho (2009), "The networks beyond the rivers: urbanization and imbalances in the Brazilian Amazon", *New Economy*, 19 (1), Faculty of Economic Sciences-University of Minas Gerais, Belo Horizonte, Brazil, p. 11-39. In: FERREIRA, Amanda Estefânia de Melo; VIEIRA, Ima Célia Guimarães. Urban sustainability in the metropolitan region of Santarém, Pará, Brazil in the 2000s and 2010s. *Economía, Sociedad y Territorio*, vol. XVIII, no. 58, 2018, 763-795. DOI: <http://dx.doi.org/10.22136/est20181238>. Available at: <http://www.scielo.org.mx/pdf/est/v18n58/2448-6183-est-18-58-763.pdf>. Accessed on: December 26, 2021.

lakes, rivers and streams (PORTO-GONÇALVES, 2017). The field data, provided by the municipal governments, through the Guardianship Councils, show the degrading situation that the populations of towns and cities live along the roads, which impact the social, health, education and public security; in addition, the increase in inequality promotes the prostitution, mainly, of young people and adolescents.

In this sense, the data collected makes it possible, clearly, visualize the problematic. For example, data provided by the Novo Progresso City Hall (PMN, 2018), Trairão City Hall (PMN, 2018) and Itaituba City Hall (PMI, 2018), reveal substantial problems in several directions, such as: social situations of a family nature that involves appearances, intra and extra family custody, physical and psychological aggression, sexual exploitation, pornography, intra and extra family sexual abuse, family neglect, drug use and trade, early pregnancy, high rate of school dropout and problems that require institutional care, in addition other no less important records are announced! Because, the lack of basic sanitation and quality water are part of the problems of most cities in Pará. "The North Region, cradle of the Amazon, is the region of the country that has the least basic sanitation" (INSTITUTO TRATA BRASIL, 2021).

In the West region, it is evident that only Novo Progresso and Santarém have a drinking water service system above 90%, however, in Santarém several neighborhoods live with constant problems in residential supply, which sometimes takes up to days to have water on taps in certain neighborhoods. Itaituba, only 15% of its urban population is served with quality water from the Sanitation Company of Pará (COSANPA) and most households are served by water from private, individual and collective artesian wells. (SOUZA, 2017).

The planned residential units are serviced by the Itaituba Water and Sanitation Company (CASITA)² which still does not offer a quality service. In the municipalities of Trairão and Rurópolis, most of the service is provided by the municipality through artesian wells. We did not obtain data on the quality of this water that reaches the population. Only Novo Progresso has a private service. We only had access to the facilities and the system, but not to the analysis of the distribution water. Therefore, it is thought that the majority of households in western Pará receive water of dubious quality. For example, in Itaituba we obtained some data from the Municipal Health

Department, which allows us to analyze the quality and its impacts on the health of the population (PMI, 2018). Which allowed us to draw some conclusions. Tables 1, 2 and 3 show the evidence of this problem.

In Brazil from the 1988 Constitution and the approval of Law 11.445/2007³, marks a turning point in the history of sanitation in the country, as they add possibilities for a more effective policy, capable of minimizing urban impacts and enhancing citizenship, with a view to access to quality water and a sewage treatment system. However, what is found, mainly, in the North region of the country, are low levels of basic sanitation in the cities, which promotes the appearance of diseases such as Dengue, in addition to other important diseases such as yellow fever, leptospirosis, typhoid fever and hepatitis, as shown in table 2, in addition to diseases caused by the consumption of water of dubious quality, such as acute diarrhea in people of different age groups, as shown in table 3, as well as the high rates of cholera, seen in table 4. These are negative aspects that afflict the majority of Brazilians.

According to Souza (2017), the water supplied to the population in other times was not subjected to any type of treatment, something that still occurs in several cities in the region. This aspect can become even more serious due to mercury pollution and fish consumption. Information collected from annual printed reports and interviews with members of the Guardianship Councils for the Rights of Children and Adolescents of Novo Progresso (PMN, 2018) and Trairão (PMT, 2018), established by Federal Law nº 8069/90 (BRASIL, 1990), it was possible to perceive that there are several social problems in the region that can be highlighted, including the most serious aspects are related to physical and psychological aggression, intra and extra-family sexual abuse, early pregnancy, family neglect, intra and extra-family custody, drug use and trafficking, institutional care, indiscipline, school dropout and disappearance of people. Something very serious! Table 4 brings this data.

²CASITA is an autarchy created by the municipality of Itaituba, through Law 3.141/2018, which has a Decree of norms that regulates the water and sewage system of the municipality of Itaituba (PMI, 2020). Available at: <https://www.itaituba.pa.gov.br/noticia/408/casita-companhia-de-agua-e-saneamento-de-itaituba/>. Accessed on: December 26, 2021.

³It establishes national guidelines for basic sanitation; amends Laws 6.766, of December 19, 1979, 8.036, of May 11, 1990, 8.666, of June 21, 1993, 8.987, of February 13, 1995; repeals Law No. 6.528, of May 11, 1978; and takes other measures.

Table 1: Main Diseases present in the municipality of Itaituba due to lack of Basic Sanitation. From 2007 to June 2018.

DISEASES/ YEAR	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
HEPATITIS "A"	8	9	13	0	6	2	18	11	16	4	2	0	89
HEPATITIS "B/C"	9	23	20	15	12	15	82	81	56	20	24	13	370
Leptospirosis	0	1	0	0	1	2	1	0	0	0	2	0	7
Typhoid Fever	0	0	0	0	0	0	0	0	0	1	0	0	1
Yellow fever	0	0	0	0	0	0	0	0	0	0	1	0	0
Dengue	195	352	16	479	359	42	243	29	61	336	9	0	2.118
Acute Diarrhea	0	1.492	1.855	2.105	2.020	1.777	2.649	2.964	3.847	3.709	1.874	992	22.635

Reference: PMI-SIVEP/MDDA – Municipal Health Department, Itaituba-PA/2018.

Table 2: Cases of Acute Diarrheal Disease by Epidemiological Year According to Age Group, Municipality of Itaituba.

YEAR	< 1	1 a 4	5 a 9	10 +	IGN	Total
2008	374	504	274	311	29	1.492
2009	415	644	345	432	28	1.855
2010	395	768	371	524	47	2.105
2011	382	787	256	549	46	2.020
2012	303	618	228	626	2	1.777
2013	268	677	329	1.375	0	2.649
2014	303	820	422	1.413	6	2.964
2015	405	1.079	461	1.902	0	3.847
2016	313	1.008	544	1.823	21	3.709
2017	275	510	390	688	11	1.874
2018	115	246	131	491	9	992

Reference: PMI-SIVEP/MDDA – Municipal Health Department, Itaituba-PA/2018.

Table 3: Dengue Notification/Investigation.

YEAR OF NOTIFICATION	DENGUE CLASSIC	DENGUE/COMPLICATIONS	DISCARDED	TOTAL
2007	195	0	164	359
2008	352	1	355	708
2009	16	0	73	89
2010	479	5	165	649
2011	359	0	141	500
2012	42	0	38	80

2013	243	0	124	367
2014	29	0	28	57
2015	61	0	68	129
2016	336	0	575	911
TOTAL	2.112	6	1.731	3.849

Reference: PMI-SIVEP/MDDA – Municipal Health Department, Itaituba-PA/2018.

Table 4: Data for the municipality of Novo Progresso

City/Municipality – base year	2017	2018
Novo Progresso		
Physical and psychological aggression	63	26
Intra and extra-familial sexual abuse	43	15
Earlypregnancy	13	6
Family neglect	66	17
Intra and extra-family guard	30	39
Drug use and trafficking	29	13
Institutionalreception	10	6
Indiscipline	93	23
Schooldropout	84	16
Disappearance	15	11
Other cases	198	60

Reference: Guardianship Council/Novo Progresso – Pará (2018).

It verifies that the data presented in the table reaffirm the possibility of this general analysis since there was a considerable reduction of these problems from one year to the next, only intra and extra-family custody, in the year of 2018, increased compared to the previous year. However, there is a concern regarding the subsequent years, as it was not the object of this study. But it is important to realize that the problems were already dangerously manifest, and may or may not have worsened with the Pandemic, the economic crisis, lack of employment and other aggravations that are manifested daily. Another major problem is the lack of basic sanitation in the cities and the lack of service with drinking water for the population as seen above.

It is evident that along the highways and areas under their influence, the problems get worse and in this direction we also draw attention to the municipality of Santarém, specifically, the district area of Alter do Chão,

which historically brings in its territorial and cultural matrix a strong ancestral legacy of traditional populations. However, over the years, tourism emerges as a strong economic link that transforms the dynamics of the village into an urban model. Santarém, located in the western portion of the State of Pará, belonging to the Lower Amazon mesoregion, has a strategic position at the confluence of the Tapajós and the Amazon rivers. The city has been operating since colonial times, as an important trading post for Tapajós, Amazonas (Manaus) and Pará (Belém) (PARÁ, 2018).

The natural beauties and all forms of life in the Amazon space are sublime and deserve to be preserved for use and contemplation by future generations, and Alter do Chão, in the Amazon, nicknamed the “Brazilian Caribbean” and its surroundings such as Pindobal, Cajutura, Aramanaí, etc. are natural spaces to contemplate! According as Souza; Marques (2015), to reach these places

the routes can be by land, through the PA-457, in a route of approximately 30 minutes, or by river, taking approximately 3 hours of navigation, both departing from the city of Santarém.

For example, Alter do Chão was elected by the British newspaper *The Guardian* (2009) as the best beach in Brazil, and Santos et al (1999) Santos (2018) indicate that the location is a paradise setting and perfectly suited to enjoying pleasure of leisure and recreation. The landscape is composed of the junction of the river with the natural forest, in which an unparalleled and constantly changing view is drawn. That is the question! The presence of real estate capital comes every year modifying the natural landscape of several places that should be untouchable. The subdivisions designed by the private sector with financial incentives from the various lines of credit give rise to new businesses overnight that transform the rural space into agglomerations with the *status* of urban life. This is very worrying!

According as Sousa and Marques (2015), the village of Alter do Chão is bathed by the Tapajós River and can be visited in two different periods throughout the year, from December to June, during the Amazon rains, and from July to November, when there is ebb of the river. Besides that, with the reappearance of the beaches, there is a greater frequency of tourists, also taking place the biggest cultural event of the place, which is the Sairé party, which attracts many visitors during the period of a week, coming from different regions of the country. and from abroad, prevailing, however, those coming from the Amazon region itself. Sairé is a folk and religious event

that takes place in September, starting with the religious ritual and continuing through the festivities, highlighting the importance of preserving the region's intangible heritage.

In this perspective, in 2016, Santarém was chosen by the Ministry of Tourism as a reference destination in Ecotourism and won a project to adapt to the standards of inducing destinations. It is possible to see here another element of the State contributing to the advances of the economic, migratory and social process to promote means that strengthen cultural valorization, and, on the other hand, promote the incentive to the presence of capital, which presupposes more capitalist expansion and impact. in the ecosystem of the Tapajós and adjacencies.

The tourist activity is an alternative for the economy of localities that offer tourist services, affirms that both international and domestic tourism are excellent producers of the economy, both in countries and in regions receiving visitors within the same country, through the introduction of the capital that is spent, thus circulating in the places of destination. (THEOBALD, 2002).

During the Amazon summer, sun and beach tourism causes the arrival of thousands of tourists in the village of Alter do Chão, having received more than 139 thousand visitors in the month of September 2015 alone. This is the period when the Sairé festival takes place, which coincides with the peak of the formation of the local beaches. This number of visitors corresponds to 12,9 times the number of the population of the village (Table 5) (SEMTUR SANTARÉM, 2019).

Table 5: Alter do Chão: evolution of population and tourists in the month of September 2007-2015.

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Population	4.441	4.746	4.856	8.078	9.730	10.023	10.389	10.631	10.849
Increment(%)	10,53	6,87	2,32	66,35	20,45	3,01	3,65	2,33	2,04
Tourists	97.845	104.584	105.045	109.857	108.128	115.879	127.250	134.257	139.874
Increment(%)	5,89	6,89	0,44	4,58	-1,57	7,17	9,81	5,51	4,18

Reference: SEMTUR SANTARÉM (2019).

In order to demonstrate how tourism produces an economic impact in Alter do Chão, the Municipal Tourism Department (SEMTUR) estimated the values introduced in the local economy, added to the prevailing prices of 18 items of commerce and services, which include: hospitality, food, beverages, handicrafts, fuel,

communication, purchase of sweets, ice creams and jams; entertainments, pyrotechnic shows, vehicle rental, transport and other services. The analysis was carried out during the month of September of the years 2013 to 2015 (Table 6).

Table 6: Amounts injected by the tourism economy in Alter do Chão, in the month of September of the years 2013-2015

N	Consume	2013	2014	%	2015	%
1	Outsourced accommodation	598.700,00	733.158,44	22,46	817.169,53	11,46
2	Food at home	1.310.400,00	1.510.215,03	15,25	1.805.141,61	19,53
3	Food in cafeterias	489.584,25	561.008,47	14,59	637.018,95	13,55
4	Food in restaurants	1.843.424,85	2.338.701,15	26,87	2.787.610,34	19,19
5	Drinks and similar	1.687.500,00	1.911.176,27	13,25	2.189.976,75	14,59
6	Fuels (land fleet)	4.261.414,35	5.377.959,01	26,20	6.858.723,10	27,53
7	Handicraft purchase	362.273,75	397.989,23	9,86	441.206,48	10,86
8	Communication	1.024.053,45	1.122.205,90	9,58	1.240.696,26	10,56
9	Candy, ice creams, jams etc.	368.849,00	415.134,75	12,55	460.342,47	10,89
10	Entertainment	1.004.321,24	1.097.309,31	9,26	1.059.887,78	-3,41
11	Pyrotechnic shows	85.968,67	93.670,41	8,96	96.091,79	2,58
12	Hospitality with food	3.378.840,75	4.148.891,66	22,79	4.852.229,95	16,95
13	Miscellaneous equipment rental	423.045,56	464.752,35	9,86	486.082,16	4,59
14	Vehicle rental	234.584,00	268.830,21	14,60	302.564,64	12,55
15	Various services	306.785,00	303.342,87	-1,12	326.050,82	7,49
16	Public transport	412.600,00	412.017,00	-0,14	485.602,41	17,86
17	Tourist transport	194.596,00	205.977,34	5,85	219.549,18	6,59
18	Others	338.475,33	354.989,20	4,88	379.092,26	6,79
CONSUMO TOTAL		18.325.416,20	21.719.342,63	18,52	25.447.051,48	17,16

Reference: SEMTUR SANTARÉM (2019).

During the period of the Sairé party in September 2016 was verified a tourist revenue of approximately R\$ 5,395,000.00 (five million, three hundred and ninety-five thousand reais) and in the year of 2017 was R\$ 7,500,000.00 (seven million, five hundred thousand reais).

In 2018, according to SEMTUR Santarém (2019), the

average individual spending during the Çairé party period in 2018 was almost R\$800.00, distributed in transport (bus, boat, own car, rented car or taxi); accommodation (hammocks, inn, hostel, hotel, rented property or camping), food, crafts and tours (TABLE 7).

Table 7: Average individual expenditure, carried out during 05 days of the Çairé party in 2018.

Average individual expenditure, carried out during 05 days of the Sairé party in 2018	
Food	R\$ 147,74
Transport	R\$ 106,43
Accommodation	R\$ 371,49
Crafts/Souvenirs	R\$ 57,06
Attractions and Tours	R\$ 115,61
Total	R\$ 798,33

Reference: SEMTUR SANTARÉM (2019).

New businesses were also created with the increase in the flow of visitors in Alter do Chão, expanding the tourist offer of the village (TABLE 8).

Table 8: Evolution of tourist facilities in Alter do Chão from of 2006 to 2018.

EQUIPMENT IN ALTER DO FLOOR	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Hotels	2	3	3	3	3	3	3	4	4	4	4	4	4
Beds/Hotels	72	142	152	152	178	203	206	419	419	419	419	419	419
Inns	15	19	19	19	21	23	24	26	32	35	36	38	38
Beds / Inns	152	220	220	233	296	364	425	517	611	1007	1065	1340	1340
Gastronomy	85	79	80	82	84	86	93	108	113	120	130	136	136

Reference: SEMTUR SANTARÉM (2019).

In the year of 2018, despite the reduction in tourist flow in Santarém in 2016 and 2017, the municipality received more than 237 thousand tourists, generating revenue of more than 176 million reais, a reflection of the investment and public policies implemented by the government in municipal and state spheres (SEMTUR SANTARÉM, 2019) and the positive exposure given by tourism critics, such as in the article published by the newspaper “O Estado de São Paulo”, in 2018, which elected Alter do Chão as one of the ten best tourist destinations, among international ones, to be visited.

In 2019, SEMTUR projected more than 292 thousand tourists visiting Santarém, with the majority expected for the second half of the year. This would represent a 23% growth compared to 2018. As for revenue was predicted that tourism would introduce more than BRL 216 million (BRL 216,852,317.25) into the local economy. (PORTAL G1, 2019).

Given the above, it is observed that tourism was responsible through its multiplier effect, for injecting large revenues and boosting the creation of new investments in tourist facilities, which positively affected the economy of the municipality as a whole and the spatial dynamics of Alter do Chão. Public policies and private investments have produced and produce in the region a panorama that helps to visualize the principles of recreation, leisure and the culture of nature in the Amazon. All this demonstrates that the village is very important for the regional economy, but we cannot lose the sight of the impacts of this progress on vegetation, soil, rivers, creeks and streams, flora, fauna and many other natural resources of the Amazon, patrimony of humanity. For, the financial resources generated by tourism contribute to regional development in a macro context, in the face of the challenges of the socio-political and economic scenario. However, we must think about the consequences of these incentives for the environment.

IV. DEBATE

The Brazilian Forest Code and its reflexes in the Amazon

Conceiving a critical and reflective analysis of the Brazilian Forest Code poses a very big challenge, because it deals with a theme that is very present in the political and environmental history of the country. The Amazon seen as a heritage of humanity for its importance to the planet emerges as a territorial space that needs special attention. Therefore, for this debate, it is necessary to resume a qualitative and concise approach to Brazilian environmental policy, which initially permeates by Decree 23,793, of January 23, 1934, which legislated on “forests like other forms of vegetation, the lands they cover being recognized as useful” (BRASIL, 1934).

Medeiros (2006) considers that the interest of the Brazilian government in promoting legal means of protecting nature was a reflection of the developmental policy still thought of in the Government of Getúlio Vargas. It also adds that it was during this scenario that the main legislation was created with the aim of protecting the first areas of forests, highlighting the following legal instruments, namely: Decree 23793/1934 (Forest Code); Decree No. 24643/1934 (Water Code); Decree 23672/1934 (Hunting and Fishing Code); Decree No. 24645/1934 (Animal Protection Decree). According to the author: “Decree nº 23793/1934 (Forest Code) had a greater relevance, as it objectively established the legal parameters for the territorial preservation of Brazilian *ecosystems*”, thus legitimizing the implementation of forest services in the country (emphasis ours).

In this direction, it is imperative to highlight the Brazilian Forest Code started in 1934, because this law is specific, and its purpose was to bring together legislation that provided for the environmental issue. [...] It established, through an essentially preservationist vision, the use of the property from of the category of existing forest. And it classified them, according to its (Article 3), into four typologies, namely: “a) protective; b) remainders;

c) model; d) income” (BRASIL, 1934a). In view of this classification framework and the conditions and specificities set out in the Code, on the groups of typologies, it was verified that the income typology was the most impacted. In this regard, Carvalho (2016) states that the vast majority of Brazilian forests were classified as income, which reveals the predatory use of natural resources at the time.

Even if details of some articles referring to the 1934 Code are not exposed, it is pertinent to highlight some aspects that refer to reflections and analyzes for other moments in our political, economic and environmental history, such as: (Art 4) that define the which are protective areas for water, soil, dunes, border areas, public health, sites and rare species of indigenous fauna; o (Article 5) that define the remaining forests and (Article 6) which defines the concept of model forests as artificial areas. However, it is worth highlighting the relevance of Art. 8, which establishes that the conservation of protective and remaining forests is considered as perennial and inalienable. The legislator considered as the only safeguard the situation of the acquirer to oblige itself “by itself, its heirs and successors, to keep them under the current legal regime” (BRASIL, 1934). According to Carvalho (2016), even though the Brazilian Forest Code of 1934 had a preservationist vision, it reproduced a productivist model of exploitation of natural resources. This aspect allows for a reflective analysis of the problems that will justify subsequent changes in the law.

The Brazilian Forest Code of 1965

Studies indicate that the Brazilian Forest Code of 1965 was born from the need to reformulate the 1934 Code. The main reasons listed are the impacts of the "green revolution" in the country, arising from the process of modernization of work in the field, especially those related to agricultural mechanization for the implementation of monoculture and extensive livestock activity, which could pose serious problems to the environment and promote irreparable damage, if not regulated (SILVA JUNIOR et al., 2017). In this context, an analytical study is carried out in order that there is an appropriation of data that provide the necessary mechanisms for a concise reading, which makes it possible to reflect on the current Brazilian Forest Code, approved by Law 12.651 of May 25, 2012, and to trace its critical judgment about the changes, perceiving advances or setbacks in the environmental protection of the Brazilian territory, with special attention to the Legal Amazon region.

According to Silva Junior; Santos (2017), claim that the reformulation of the 1965 Forest Code took three years

of debate among dozens of specialists [...]. Only on September 15, 1965, the then President Humberto de Alencar Castelo Branco, sanctioned Federal Law 4.771/1965. The new, modernizing Forest Code, although it improved some of the instruments of the old law, maintained its assumptions and objectives: to avoid occupation in fragile areas, to force the conservation of a portion of the native flora to guarantee a minimum of ecosystem balance and to stimulate the planting and the rational use of the forests (Idem).

Studies by Valle (2011) point out that the Brazilian forest code presented some advances, such as the prohibition of the occupation of steep slopes and the determination for rural owners to maintain a part of the native vegetation of their farm (legal forest reserve), so that everywhere, part of the existing vegetation was preserved.

Established in 1965, the Brazilian Forest Code was and continues to be an instrument of unique importance for Brazilian society. However, it is perceived that this illustrious document, as well as hundreds and perhaps thousands of other laws are not accessed and/or known by the population. This issue weakens its analysis and interpretation, as well as the guarantee of rights to a healthier and more sustainable environment, because without information, the citizen will hardly understand the nature/man relationship in a balanced way (VALLE, 2011).

In this aspect, the Code shows a clear objective, that of preserving the different Biomes, which was called the “fourth part of rural properties, destined to the creation of Legal Reserves”. From then on, “the 1965 forest code and other legal instruments established the amount of exploitation of land use as much as vegetation” (BRASIL, 2012). For example, in 1986, Law 7.511/86, effected a very significant alteration, where the forest reserve regime was modified, which until then allowed the deforestation of 100% of the native forest, being necessary to plant native species in the place, including exotic. About three years after the old code, a new law was created, 7.803/89, which, unlike the previous one, determined that legal reserves should be made primarily with native species, emphasizing reforestation in areas where it was necessary (VALLE, 2011).

Also, according to the author, from 1996 onwards, the forest code began to be modified by several Provisional Measures, the last one in 2001, MP 2166-67 in the year of 2001. It is verified clearly from the studies carried out on the question, that since the 1990s there has been a strong discussion on the part of rural representatives, analyzing the forest code as a threat to

the development of their activities in the countryside.

What supports more and more grievances, which is very negative, mainly because of the political representation that is established in the National Congress, through the ruralist bench. This fact has become the great socio-environmental and political challenge since its implementation, as well as its development, thus making its true role impossible (IBID).

According as Pasqualetto (2011) both the 1965 Code, as well as the 1934 Code, did not bring measures that would actually make it get off the ground. It adds that it was only with the creation of the Brazilian Institute for Forestry Development (IBDF) that it was seen as the only really effective one, despite criticism of the fact that the institution soon became more concerned with the incumbency of reforestation of exotic species than with conservation policies. However, it is important to highlight that it was from the creation of Law n.º 9.605/98, called Environmental Crimes Law, which provides for criminal types related to the violation of the Forest Code precepts, that rural landowners took the first measures to respect for restrictions on the exercise of property rights. Notwithstanding, instead of trying to adapt and conserve environmental resources, they chose to insist on the model based on immediacy without a long-term sustainability vision, since doing the right way would be too costly for them. Despite the existence of the law and reforestation, there are evidence of the high rates of deforestation in the period in Brazilian biomes. Something that seems interminable, even with the emergence of new legal instruments with a view to preserving forest resources.

The Amazon Biome and the New Brazilian Forest Code

It focuses on the Legal Amazon, nine different units of the federation, which corresponds to all seven states of the northern region (Acre, Amapá, Amazonas, Pará, Rondônia, Roraima and Tocantins), plus the western portion of the State of Maranhão and the State of Mato Grosso, representing approximately 61% of the Brazilian territory in the Legal Amazon, [...] but Brazil is not just the Legal Amazon, we have other valuable and important ecosystems such as the Pantanal, the Caatinga, the Cerrado, the Atlantic Forest and of the Pampa” (NASCIMENTO et al., 2018, p. 26, our translation).

In its history, Brazil carries the *status* of a grandiose country with an exuberant nature, because “since the arrival of the colonizers, it was seen as a source of resources where forests were nothing more than “obstacles” that impeded the advancement of development” (BRASIL, 2017, p. 4, our translation). In this perspective, between advances and/or setbacks, evidenced daily by the assent and/or social, economic and

environmental fragility, aspects emanating from the policy imposed on the country and the decisions taken, which were sometimes unable to give serenity to the directions of Brazilian society. In order to support this logic, some inherent counterpoints to the current Forest Code are evidenced, where some categories such as CPT (Pastoral Land Commission), CUT (Unified Workers' Center), FETRAF (National Federation of Workers in Family Agriculture), MAB (Affected Movement by dams), MST (Landless Workers' movement) and Peasant Way, states that “the text of the (new) project of law is unsatisfactory”, support the idea that it is impracticable, harming, above all, small producers and family farming (Idem). Currently, there is the experience turbulent moments and instability in the various directions in the country, whether social, economic and political and above all environmental, promoted by the dismantling observed in function of the measures and decisions taken by the National Congress and of the Plateau on the rules that legislate environmental policy in the country. Furthermore, the lack of inspection of the Amazon biome has led, in the last five years, to a considerable increase in deforestation in the Amazon (INPE, 2021). TABLE 1.

In this perspective, it is observed that the natural landscape changes every year with the advances of predatory actions in the areas of primary forests with livestock and grain monoculture, as well as water through the indiscriminate exploitation of mineral resources and mercury pollution of the waters in the Amazon basin [...]. In an article from Brasil de Fato, dated March 30, 2021, published by Raquel (2021), reveals that “mercury poisoning, a metal used to extract gold, can cause malformation of fetuses, blindness and even death”. And this condition is related to the consumption of water, food, the soil and the air that we breathe. And it closes by showing that this is the reality of all the indigenous people of the Munduruku ethnic group in the middle Tapajós region, in Pará.

The diversity of landscapes on Brazilian soil makes it impossible to create a single rule that is applicable to the country as a whole. About the subject, Nascimento et al. (2017, p. 26-27, our translation) state that “the Amazon biome is understood as a set of 17 different ecosystems, housing the largest number of species of flowering plants, amphibians and birds in the world”, and question whether it would be fair to apply the same law, or even if it would be a special case, since this part of the country is now receiving worldwide attention and focuses on the balance of the planet [...]. Thereby, it must be considered that “Brazil is not just the Legal Amazon, we have other valuable and important ecosystems such as the Pantanal, Caatinga, Cerrado,

Atlantic Forest and Pampa biomes” (IBGE, 2004). MAP 1.

Table 1: PRODES Amazon Rate - 2015 to 2021 (km2)

Years/ states	AC	AM	AP	MA	MT	PA	RO	RR	TO	AMZ LEGA L
2015	264	712	25	209	1601	2153	1030	156	57	6207
2016	372	1129	17	258	1489	2992	1376	202	58	7893
2017	257	1001	24	265	1561	2433	1243	132	31	6947
2018	444	1045	24	253	1490	2744	1316	195	25	7536
2019	682	1434	32	237	1702	4172	1257	590	23	10129
2020	706	1512	24	336	1779	4899	1273	297	25	10851
2021*	871	2347	39	363	2263	5257	1681	386	28	13235
Var. 2021- 2020*	23%	55%	63%	8%	27%	7%	32%	30%	12%	22%

Reference: INPE (2021). Adapted. Reference date 11/19/21.

Map 1: Map of Brazilian Biomes



Reference: IBGE (2004).

Therefore, the first Brazilian forest code, established in 1934, determined the preservation of 3/4 of the native forest of a rural property. Thirty years later, the 1965 forest code was created, which was in force until 2012 and defined the protection of the Permanent Preservation Area (APP) and the creation of a legal reserve of 50% in the Amazon and 20% in the rest of the country, having as a possible concern the policy of the National Integration Program from the 1960s. Thereby, it is verified that:

The Amazon, from 1960 onwards, is perhaps the regional cut that best reflects the needs for conquests projected by the elites of this country linked to agricultural activities. This region is, in the view of these agents of capital, a space to be conquered, much more than a regional space whose society is part of the nation (NASCIMENTO et al., 2018, p. 30, our translation).

The changes promoted by the New Brazilian Forest Code, approved as from Law 12,651, of May 25,

2012 and sanctioned by the then President Dilma Rousseff, led to changes in 32 articles in addition to nine other vetoes. [...] considering that one of these vetoes allows for an amnesty for those who deforested illegally until 2008. Notwithstanding this, an approved article that said that states should establish restoration strips for landowners who have degraded Permanent Preservation Areas (APPs) was vetoed. In this way, with the veto, it provides rural landowners with advantages, once the areas of deforested APPs were recovered, they would be exempt from paying fines due. It is also important to highlight the change made to the Environmental Credit, as the proposal presented by the Chamber granted credit to those who had deforested before July 22, 2008. From that date, the owner would have five years to recover the APP, from so that if it didn't, it wouldn't be able to receive the credit (EMBRAPA, s/d). Figure 1 illustrates minimum areas to be recomposed.

APPs with anthropic occupation pre-exists on July 22, 2008, with buildings, improvements or agro-pastoral activities, admitted, in the latter case, the adoption of the Pousio regime.

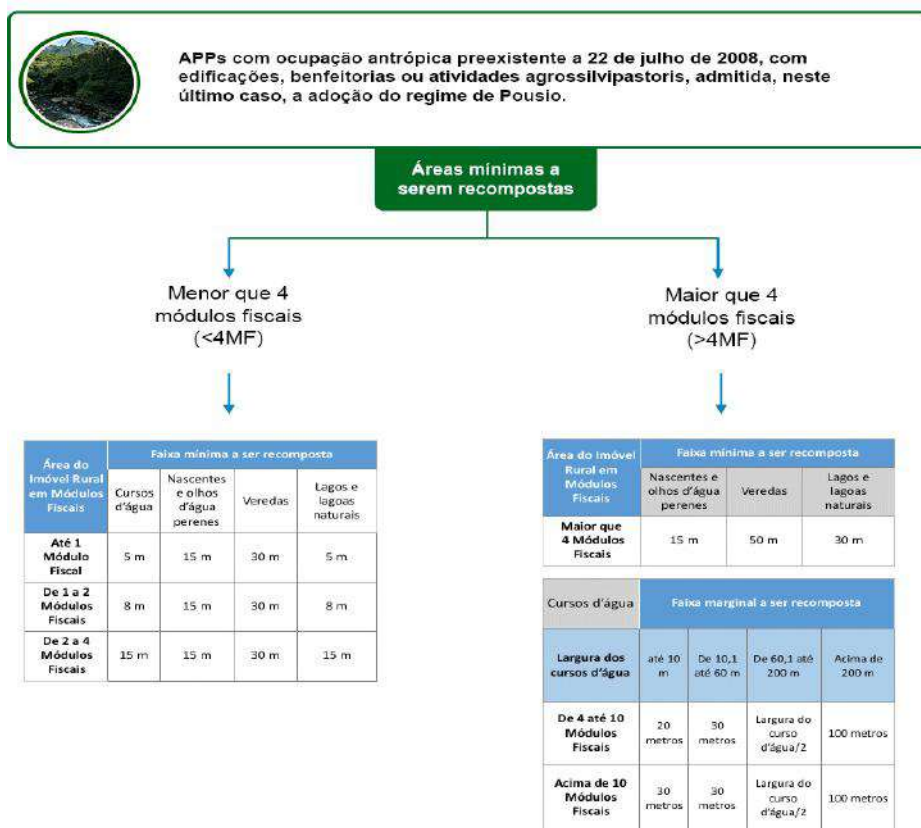


Fig.1: Minimum areas to be recomposed (APPs)

Reference: EMBRAPA⁴ (s/d).

⁴ “For watercourses, regardless of the size of the property, the width of the marginal strip is counted from the edge of the channel of the regular bed of the watercourse. For properties smaller than 4 MFs, the width of the strip to be recomposed does not depend on the width of the watercourse”. (EMBRAPA, s/d).

In relation to urban areas, there were also changes in the article. The text of the Chamber allowed the urbanization of the restinga and mangrove areas as long as the ecological function of the natural areas was protected. However,

in the judgment of repetitive special appeals (Theme 1.010), the First Section of the Superior Court of Justice (STJ), unanimously, established the understanding that the Forest Code (Law 12.651/2012) must be applied for the delimitation of the extension of the non-buildable strip from the banks of watercourses in consolidated urban areas (STJ, 2021, p. 1, our translation).

For the rapporteur, Minister Benedito Gonçalves, this manifest decision, takes into consideration the best and most effective protection to the environment.

It is also observed that the veto of certain proposed changes, such as the areas of apicuns, salt marshes and wetlands remain as APPs, and mangroves, also, must be preserved (BRASIL, 2012). The restoration of riparian forests for small properties will not vary according to the width of the river, but rather according to the size of the property. The range to be recomposed varies from 5 to 15 m. Areas with more than four modules, bordered by rivers wider than 10m, may have a strip of up to 100m of riparian vegetation. Previously, the article predicted that properties in APPs should have vegetation on the banks of rivers recomposed by 15 meters (BRASIL, 2012). The Brazilian Forest Code itself covers and protects all Brazilian Biomes and their diversities, involving the fauna and flora, protects a percentage of the area for the creation of legal reserves, with different percentage criteria for the different biomes: that a portion of 80% of the property must be preserved with primary forests intended for the creation of a legal reserve; in the Cerrado Biome 35% of the property and 20% in the area of general fields, including its characteristics mainly for having a vast forest with a tropical climate. Although, in the Cerrado Biome, this percentage is different, being 20%, from the low trees to the twisted trunks, etc. (BRASIL, 2012).

For the Caatinga Biome also gets 20% and it should be more, because it is a biome exclusively from Brazil, not being found anywhere else in the world, the Atlantic Forest Biome gets 20%, despite having a great diversity, such as mangroves, restinga vegetation, between

others. 20% for the Pantanal Biome, which is composed of Pantanal vegetation, grasses, medium-sized trees, shrubs, etc. 20% was allocated to the Pampa Biome, taking into consideration its formation, which is basically made by grasses and small plant species (BRASIL, 2012). The data presented by the National Institute for Space Research (INPE) from 2015 to 2021, deforestation in the Amazon Biome is asserted and with the prolonged droughts each year, the outbreaks of fires are constant and harmful, which has affected the fauna and flora of the different ecosystems of the Amazon. For example, INPE data reveal that deforestation and fires have only increased. For example, the data referring to 2019, “from January 1st to August 25th, show that in the Amazon there were 75,000 outbreaks of fires and in 2021, in the same Biome, there were 74,908 fires, representing 40.8% of the outbreaks of fires in the country (INPE, 2021). The forest is being devastated by people who see the destruction of the environment as an economic means, taking away from the animals their habitat along with their food, resulting in problems inherent to the climate (temperature, air and water) manifested each year, serving as an example heavy rains, which cause silting of rivers, lakes and streams (INPE, 2019). In the study on deforestation in the Amazon carried out by Pontes (2021), it is shown that the policy of advancing about forests does not bring social progress, since their results show that cities that deforest the most in the Legal Amazon have the worst rates. It summarizes, evidencing that:

In the Legal Amazon, the social and environmental conditions of the people living in its 772 municipalities are deteriorating. The scenario is captured by the Social Progress Index (IPS) made for the region, which reached a score of 54.59 for all nine states – below the 54.64 verified in the last survey, in 2018 (PONTES, 2021, p. 1, our translation).

According as the author “Altamira and São Félix do Xingu, are champions of forest destruction, received scores below the Amazon average: 52.95 and 52.94, respectively. In the ranking of the 772 municipalities listed, they appear in positions 509 and 513”. Notwithstanding this, it corroborates, evidencing that “among the cities in the last positions, many are marked by forest degradation and social conflicts, such as Pacajá (771°) and Pau D’Arco (763°); and illegal mining, such as Jacareacanga (762°). All are located in Pará” (IBID). They

are clear evidence of the political instability and fragility that the country is going through. According to Santos et al. (2021), the Amazon lost 803 km² of forest in October alone, an area almost four times the size of Recife. As a result, the accumulated deforestation from January to October reached 9,742 km², the worst rate in 10 years. Only in comparison with the same period last year, when the devastation had already reached the highest mark since 2012, the accumulated deforestation this year grew 33% (SANTOS et al., 2021).

INPE data reveal that “until 2020, there was deforestation in the Amazon biome of 729.781.76 km², and in the Brazilian Legal Amazon (ALB) it reached 813.063.44 km²” (INPE, s/d). The data also show that from August 1, 2020 to July 31, 2021, deforestation in the ALB grew 21.97% in relation to the rate of the previous period, configuring itself as a reflection of illegal and disorderly occupation by the absence of effective government action (INPE, 2021).

In this context and with this large number of problems, it is understood that the debates and protests against the new Forest Code are many. However, researchers do not believe in a setback, but in a new path. The Amazon biome, like others, has been suffering every year with increasing deforestation and is on the edge. Because, deforestation is corrosive, destroys ecosystems and puts millions of lives on alert.

V. CONCLUSION

As seen, the Legal Amazon has municipalities covered by different forms of vegetation which cannot be treated in the same way. For example, areas of cerrado and savannahs, which have different social and economic dynamics, cannot be treated in the same way as forest areas. “The cerrado biome occupies an expressive part of Mato Grosso, Maranhão and Tocantins. The pace of development of municipalities in this biome cannot be extrapolated to those located in the Amazon biome” (VERISSIMO et al., 2021, p. 10, our translation).

Furthermore, deforestation and expansionist occupation, according to this author, do not promote improvements in the social progress index (IPS) in the Brazilian Amazon. It is important to highlight that this perspective was only possible, in view of, that the study used an innovative method with an approach to demonstrate the results in a quantitative way (IBID). In this sense, we can see that the region has presented successive problems of land order, social and rural violence in recent years. Corroborated in the following way:

Deforestation, in addition to causing serious problems to the environment and climate, does not promote social assent. For example, the municipality of Pacajá (PA) and six other municipalities on the list of the 20 largest deforesters in the territory failed to reach 50 points in the IPS, ranking in the 70 worst positions among all 772 municipalities in the Legal Amazon. They are: Portel (PA), Apuí (AM), Senador José Porfírio (PA), Novo Repartimento (PA), Uruará (PA) and Anapu (PA). These are rates below the average for the Legal Amazon and Brazil. These results only support the thesis that deforestation and the use of fire in agricultural activity is harmful to the environment and society in general. (VERISSIMO et al. 2021, p. 9, our translation).

Therefore, the forest has increasing value and strategic importance. Our understanding of the intrinsic economic value of the forest is expanding, and the Amazon also plays a key role in regulating the region's and the world's climate. Thereby, it is understood that the Legal Framework on Brazilian forests needs to be rethought in order to promote more significant advances and/or changes that are capable of reversing serious socio-environmental problems. And, for that, the collective effort of political leaders, civil society and the legal environment becomes indispensable, in search of a governance system capable of providing actions that enhance the positive premises, in the sense of reversing social and environmental degradation in the country.

Thus, it is still perceived, that the changes promoted by the Brazilian Forest Code and the lack of supervision by the public power, the deforestation of rural and urban areas has grown month after month in the Amazon, promoting not pleasant mishaps. The official data made available by the Space Research Institute about the region are frightening and mark turbulent times, agrarian conflicts and marginalization. Illegal mining grows in territories of traditional (indigenous) populations; [...] large enterprises erode ecosystems and policies do not advance in a climate-friendly direction in the required dimension. These are dark times where wild capital prints different

rhythms that often lead us to conditions of impotence. But, not everything is lost! It's urgent needed joint efforts towards a new path that raises our consciousness and promotes a dignified life, that we are capable of reversing the deleterious effects of our actions.

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High-Protein bar Supplemented with Chia Seed Improves Lipidemic Parameters in Wistar Rats

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Abstract — Chia (*Salvia hispanical.*) seeds are known to have high content of polyunsaturated fatty acids (PUFA) and fiber. This study aimed to evaluate the effect of a High-Protein Bar (PB) supplemented with chia seed added to the feed on the organs, tissues, and biochemical parameters of male Wistar adult rats ($n=32$) divided into four groups ($n=8$), namely group I (ration + 20% chia seeds); group II (ration + PB without chia seeds); group III (ration + 20% PB containing 15% chia seed); group IV (ration + 20% PB containing 20% chia seeds). The shelf-life of PBs was assessed during 45 days in terms of texture, color, and antioxidant activity using the β -carotene/linoleic acid assay. The centesimal composition of the formulations showed a significantly higher value of fiber offered to group I. Animals of groups III and IV showed a lower consumption of the ration ($p<0.05$), while those of group I lower weight of the heart as well as of retroperitoneal, epididymal and perirenal tissues ($p<0.05$). The biochemical parameters showed a significant improvement ($p<0.05$) in testosterone levels in groups that received the rations partially replaced by chia seed-containing PB. In addition, group II, which received the ration enriched with PB without chia seed, showed the highest serum triacylglycerol value, highlighting the important role of chia seeds on lipidemic parameters. It is worth mentioning that more in-depth studies must be carried out to validate the results obtained in the current study.

I. INTRODUCTION

Food intake is closely related to health, not only in terms of quantity but also of composition and quality of the diet (Quirk et al., 2013). With the high number of people with obesity and non-communicable chronic diseases (NCDs), researchers and public agencies from various countries have adopted strategies to raise

awareness in the attempt to reduce these indexes. In the 1980s, Japan began the first strategy, through the use of functional foods, intending to prevent NCDs and improve their quality of life. Functional foods are foods that can reduce health risks and, therefore, should be consumed daily (Siró et al., 2008).

Research has considered chia (*Salvia hispanica* L.) as a functional food thanks to its high nutritional value, which depends on the planting, harvesting, storage conditions, and seed processing after harvest. Its chemical composition includes proteins of high biological value, a high content of polyunsaturated fatty acids such as omega 3 and 6 (Julio et al., 2015) and a high content of dietary fibers which stimulate satiety and improve digestive system function, culminating in the reduction of body weight (Clark and Duncan, 2017). Studies have shown the role of chia seed in improving dyslipidemia, insulin resistance, and intramuscular lipid metabolism, as well as in inhibiting the lipogenic pathway (Ferreira et al., 2020).

High-protein bars (PBs) were initially designed with the main purpose of supplying nutritional deficiencies to military and physical exercise practitioners. The aim of food industry research and development (R&D) is to create new products and launch them on the market, and due to the demand for healthy and nutritive foods, PBs are nowadays a good option for supplying fiber, proteins, vitamin, and mineral needs of consumers (Bosquesi et al., 2016).

Although there are several PBs on the market, sugar-free formulations are still little commercialized in Brazil. In this context, Veggi et al. (2018) studied sugar-free PB formulations containing different chia seed proportions as a source of fibers, among which that containing 20% chia seed was the most accepted by the panelists. Therefore, the present study aimed to investigate the effects of a) storage on physicochemical quality of two different PB formulations and b) intake of a diet based on PBs enriched with chia seed on tissue and biochemical parameters of healthy, sedentary eutrophic rats.

II. MATERIALS AND METHODS

Stability Study

In a previous study, Veggi et al. (2018) developed PB formulations supplemented with chia seeds in different proportions, namely 10, 15, and 20% (PB2), and one without chia seeds to serve as a control (PB1). The centesimal composition of formulations developed by Veggi et al (2018) showed around 20% of moisture, 2.4% of ashes, 20% -23% of proteins, 20% of lipids, 12 - 22% of fibers, and 14% - 26% of carbohydrates. In the present study, the stability of both PB1 and PB2, which was the most accepted in the previous study, was assessed, after different storage times, i.e., 0 (T0), 7 (T1), 15 (T2), 30 (T3) and 45 days (T4), in terms of physicochemical parameters such as color, texture, pH, water activity and antioxidant activity by the β -carotene/linolenic acid assay. For this purpose, the PBs were stored at 25 °C in an

incubator for biochemical oxygen demand (BOD) testing, model TE-371 (Tecnal, Piracicaba, SP, Brazil).

Antioxidant activity by the β -carotene/linolenic acid assay

The antioxidant activity of PB formulations was assessed by the β -carotene/linoleic acid assay previously described by Rufino et al. (2006). The absorbance of samples was measured at 470 nm with a UV-Vis spectrophotometer, model UV-1800 (Shimadzu, Kyoto, Japan). All analyses were done in triplicate. The results were expressed as β -carotene oxidation inhibition percentage (% I), which was calculated, according to the following equations, as the decrease in sample absorbance (As) in relation to that (Ac) of a 6-hydroxy-2,5,7,8-tetramethylchroman-2-carboxylic acid (Trolox) solution used as a control:

$$Ac = Abs_{initial} - Abs_{final} \quad (1)$$

$$As = Abs_{initial} - Abs_{final} \quad (2)$$

$$\% I = \frac{Ac - As}{Ac} \times 100 \quad (3)$$

Objective color analysis

The objective color analysis of samples was performed with a portable spectrophotometer, model CM-700d (Konica Minolta, Tokyo, Japan), calibrated to a white standard, on the coordinates L* (lightness), a* (red-green component), and b* (yellow-blue component) according to the CIE Lab system methods. After exposition for 1h at room temperature (24 ± 1 °C), six measurements were taken at three different points of each sample, and the average values were used for statistical analysis. In particular, the value of L* indicates the position of the point on the vertical axis of luminosity, the value of a* the intensity of the green (-) to red (+) component, and the value of b* that of blue (-) to yellow (+) component of light. The saturation index (C*) and hue angle (h*) were calculated by the equations:

$$C^* = (a^{*2} + b^{*2})^{1/2} \quad (4)$$

$$h^* = \tan^{-1} (a^*/b^*) \quad (5)$$

Texture

Compression analysis after the samples had been left for 1 h at room temperature. It was performed with the TA.XT.PLU texture analyzer (Texture Analyzer Stable Micro System Inc., Surrey, England), with a 5kg load cell, probe P/20P, and speed of 1 mm s⁻¹. For each treatment, 6 readings were performed, and the results were expressed as strength (N).

pH measurement

The pH of samples was measured by direct potentiometry using a digital potentiometer, model HI

2221 (HANNA Instruments, Woonsocket, RI, USA), according to the method 943.71 of the Association of Official Analytical Chemists (AOAC, 2012).

Water activity

Water activity (A_w) was determined using a water activity meter, model AquaLab 4TE 02 (Decagon Devices, Pullman, WA, USA), according to the method 978.18 of AOAC (2012).

Proximate feed composition

Centesimal analysis was carried out according to the methods described by the AOAC (2012). Moisture was determined gravimetrically at 105 °C using an oven, model 400/2ND-300 (Nova Ética, Vargem Grande Paulista, SP, Brazil), according to the 925.09 method, ashes by incineration at 550 °C of the residue in a furnace, model D21 (Quimis, Diadema, SP, Brazil), according to the 923.03 method, lipids by a Soxhlet apparatus, model TE 044 (Tecnal, Piracicaba, SP, Brazil), according to the method 920.39, proteins by a modified Kjeldahl 991.20 method (model TE 0363, Tecnal) using the 6.25 conversion factor, and crude fibers according to 044/IV (Instituto Adolfo Lutz, 2008).

Animal study

Healthy, sedentary, eutrophic, male Wistar rats (*Rattus norvegicus*), aged 3 months and with weight between 250 and 300g (n=32), were used in this study. Initially, all animals underwent a five-day adaptation to the experimental environment (animal room) and received water and a standard semi-purified commercial diet (Presence Purina, São Paulo, SP, Brazil) *ad libitum*. The animals were housed individually in cages and kept under room temperature and 12-h light-dark cycle. The study was approved by the Animal Use Ethics Committee (CEUA) of the Federal University of Mato Grosso, Campus of Cuiabá (CEUA Process n. 23108.209001 / 2017-71).

Experimental Design

The animals were subdivided into four groups (n=8) to assess the effect of four different diets formulated using standard rat feed (Presence Purina), partially replaced by chia seed or PB supplemented with chia seed (Table 1), on tissue, biochemical, and clinical parameters of male adult rats.

Over the 32-day experiments, the average water intake (mL/24h) and food intake (g/24h), calculated by the weight of leftovers the following day, were recorded, as well as the animal body mass three times a week.

Table 1. The different treatment diets offered to the different animal groups

Group	Diet
I	Ration replaced by 20% chia seeds
II	Ration replaced by 20% of *PB without chia seeds
III	Ration replaced by 20% of PB containing 15% chia seeds
IV	Ration replaced by 20% of PB containing 20% chia seeds

*Formulations of the protein bars (PBs) can be accessed in Materials and Method and also in Veggi et al. (2018).

Sample collection and analysis

After the animals had fasted for 12 h, they were euthanized by inhalation of an excess of ethyl ether followed by decapitation, and blood sample was collected in tubes with clot activator/EDTA/EDTA K3. The determinations of glucose, lipid profile (TG, HDL, LDL, and total cholesterol), insulin, glycated hemoglobin, total blood proteins, albumin, and anabolic hormones GH and testosterone were carried out with an automatic biochemical analyzer, model Labmax Pleno (Labtest, Belo Horizonte, MG, Brazil). Hormonal cortisol as a stress biomarker was evaluated by chemiluminescence using an immunoassay system, model Immulite® 1000 (Siemens Healthineers, São Paulo, SP, Brazil). Heart, liver, stomach, kidneys, adipose tissues (retroperitoneal, omental, epididymal, inguinal, and perirenal subcutaneous), and muscle tissues (soleus, extensors, and gastrocnemius) were properly excised and weighed (wet weight).

Statistical Analysis

For each formulation, 5 repetitions were performed, and the physicochemical data were analyzed in triplicate. Data were submitted to the Shapiro-Wilk normality test. For statistical comparisons among treatments, analysis of variance (ANOVA) was applied for parametric data, followed by the T-student test, while the Wilcoxon test was used for non-parametric data. For statistical comparisons between the times of each treatment, ANOVA was used for parametric data, followed by Tukey's *post-hoc* test ($p < 0.05$), while the Kruskal-Wallis test followed by *post-hoc* Nemenyi test was applied to non-parametric data.

For the animal testing data were evaluated for normality test using the Kolmogorov-Smirnov method. Parametric data were subjected to analysis of variance (ANOVA), followed by Tukey's *post-hoc* test, while non-parametric data were analyzed using the Scott-Knott test.

For calculating differences between means, the R version 3.4.1 program was used. The effect size test was based on *a priori* testing (F-value ≤ 0.10: small; F-value 0.10 < F-value ≤ 0.25: medium; F-value 0.26 < F-value ≤ 0.40: large), performed by the G-power program, version 3.1.9.2.

III. RESULTS

Protein Bar Stability Study

Table 2 shows the stability profile of the two protein bar formulations (PB1 e PB2) developed by Veggi et al. (2018). A decrease in antioxidant protection during the shelf-life assay was observed, so that, notably, after 30 days of storage the antioxidant activity was no longer detected.

Table 2. Physicochemical parameters of Protein Bars assessed over 45 days of storage in the BOD chamber at 25 °C. Storage time (days): 0 (T0), 7 (T1), 15 (T2), 30 (T3), 45 (T4)

Parameter	Storage time (days)	Formulation		p-value
		PB1	PB2	
%I**	T0	37.14±5.75 ^a	44.09±8.58 ^a	>0.05
	T1	47.96±5.94 ^a	45.70±7.92 ^a	<0.05
	T2	60.35±3.02 ^b	59.01±1.08 ^b	<0.05
	T3	12.53±1.62 ^c	15.73±1.40 ^c	<0.05
	T4	nd ^d	nd ^d	<0.05
L**	T0	66.62±1.63 ^b	61.66± 1.59 ^{ab}	<0.05
	T1	68.88±0.85 ^a	63.01± 0.85 ^a	<0.05
	T2	69.28±0.73 ^a	61.60± 0.73 ^{ab}	<0.05
	T3	67.80±0.85 ^{ab}	60.38±0.85 ^{bc}	<0.05
	T4	65.65±1.25 ^{bc}	59.99± 1.25 ^{bc}	<0.05
a*	T0	7.22±0.43 ^{bc}	6.59±0.58 ^b	<0.05
	T1	6.92±0.23 ^{cd}	5.54±0.29 ^c	<0.05
	T2	6.65±0.20 ^d	5.39±0.50 ^c	<0.05
	T3	7.49±0.29 ^b	7.94±0.70 ^a	>0.05
	T4	7.88±0.29 ^a	7.04±0.55 ^b	<0.05
b**	T0	35.35±1.42 ^a	35.18±1.91 ^b	<0.05
	T1	35.62±0.41 ^a	31.03±1.58 ^{ab}	<0.05
	T2	34.91±0.82 ^{ab}	38.13±1.53 ^a	<0.05
	T3	34.21±0.60 ^b	31.00±0.94 ^{ab}	<0.05
	T4	34.20±0.77 ^b	30.35±1.24 ^a	<0.05
C**	T0	36.08±1.40 ^{ab}	33.53±1.90 ^a	<0.05
	T1	36.29±0.40 ^a	31.52±1.63 ^{ab}	<0.05
	T2	35.54±0.86 ^{ac}	31.11±1.55 ^b	<0.05
	T3	35.02±0.58 ^c	32.01±1.56 ^{ab}	<0.05
	T4	35.09±0.79 ^{bc}	31.15±1.27 ^b	<0.05
h*(°)*	T0	78.44±0.76 ^{ab}	78.65±0.10 ^{ab}	0.54
	T1	78.10±0.38 ^a	79.86±0.57 ^a	<0.05
	T2	79.21±0.19 ^a	80.02±0.78 ^a	<0.05
	T3	77.64±0.51 ^{bc}	75.63±1.08 ^b	<0.05

	T4	77.06±0.34 ^c	76.94±0.86 ^b	0.85
Strength (N)*	T0	10.66±1.84 ^c	9.68±1.62 ^b	0.64
	T1	12.94±3.82 ^{bc}	15.41±2.50 ^a	0.20
	T2	13.93±1.33 ^{ab}	15.54±2.29 ^a	0.02
	T3	15.77±1.92 ^a	9.91±1.74 ^b	0.01
	T4	15.09±2.15 ^{ab}	8.58±1.19 ^b	<0.05
pH*	T0	5.90±0.07 ^a	5.91±0.07 ^a	0.11
	T1	5.72±0.06 ^b	5.71±0.05 ^{ac}	0.55
	T2	5.67±0.07 ^b	5.65±0.05 ^c	0.15
	T3	5.85±0.04 ^a	5.85±0.04 ^{ab}	0.04
	T4	5.90±0.28 ^a	5.89±0.27 ^{ab}	0.77
A_w**	T0	0.85±0.02 ^b	0.84±0.02 ^b	0.19
	T1	0.87±0.01 ^a	0.87±0.01 ^a	0.81
	T2	0.86±0.01 ^b	0.85±0.02 ^b	0.16
	T3	0.85±0.02 ^b	0.84±0.02 ^b	0.72
	T4	0.85±0.01 ^b	0.85±0.01 ^b	0.43

Values expressed as means ± standard deviations. Means followed by the same letter in same column do not differ statistically. *The Wilcoxon test, and **Student's t-test were used to compare the difference among the means. PB1 = Protein bar without chia seeds; PB2 = Protein bar with 20% chia seeds; %I = β-carotene oxidation inhibition percentage; C* = saturation index; L* = lightness; a* = intensity of the green (-) to red (+) component of light; b* = intensity of the blue (-) to yellow (+) component of light; h* = hue angle; A_w = water activity; nd = not detected.

The reactant used in the total antioxidant capacity assays linoleic acid, in which one of the hydrogen atoms of one of the methylene groups is removed leaving the acid free radical ready to attack β-carotene molecules; consequently, its double bond is destroyed resulting in the formation of orange products and a decrease in absorbance at 470nm. Table 2 shows the protective activity of inhibiting the autoxidation of PB formulations over 30 days of storage; for this reason, a comparison test of means among the different storage times was not applied.

No differences between the PB samples were observed when considering pH and A_w over the shelf-life study (p>0.05) compared to the initial (T0) and final (T4) times of storage, while a statistically significant reduction of PB2 compression (p<0.05) was detected only at T4.

As for the color parameters, the intensity of the green-red component of light (a*) showed a statistically significant increase (p<0.05) during storage of PB1, which acquired a reddish color at the end of treatment. On the other hand, the intensity of the blue-yellow component

(b*) for PB1 and PB2 showed significant decreases (p<0.05) either between them at the same storage time or among the different storage times in the same treatment, showing a general reduction in yellow color. Color saturation (C*) was significantly different (p<0.05) between PB1 and PB2, with PB1 showing a higher color purity compared to PB2. Regarding the tone, which is represented by the hue angle (h*) being a near brown color, samples did not differ from the initial to the final time of storage (p>0.05).

Proximate feed composition

The diet fed to animals in group I, with 20% chia seeds added to the ration, showed the highest amount of fiber (p <0.05), while that for group II, with 20% PB, showed the lowest one due to the absence of chia grains (Table 3). As expected, intermediate values of this content were detected in the diets for groups III and IV, which were prepared by adding 20% PB containing 15 and 20% chia seeds to the ration (Veggi et al., 2018), respectively.

Table 3. Proximate analysis of diets prepared for the different groups of test animals (male Wistar rats) by partially replacing the ration by chia seeds or protein bar

Group	Moisture	Ashes	Proteins	Lipids	Fibers	Carbohydrates
I	16.58±0.71 ^a	6.54±0.28 ^a	26.62±0.72 ^a	4.33±1.23 ^a	15.97±1.33 ^a	29.94±1.50 ^a
II	14.29±2.62 ^a	5.72±0.17 ^c	27.43±1.80 ^a	6.47±1.20 ^a	8.70±0.30 ^c	37.47±0.45 ^a
III	17.57±0.34 ^a	5.94±0.12 ^{bc}	28.18±1.64 ^a	5.82±0.21 ^a	10.59±0.71 ^{bc}	31.89±2.10 ^a
IV	16.83±0.60 ^a	6.30±0.12 ^{ab}	28.24±0.83 ^a	5.35±0.23 ^a	12.89±1.03 ^b	30.39±2.01 ^a
p-value	0.07	<0.05	0.44	0.09	<0.05	0.53

Values expressed as means ± standard deviations. Means followed by the same letter do not differ statistically. The Tukey test was applied at the 1% probability level to compare the difference among the means. Group I = 80% ration + 20% chia seed; group II = 80% ration + 20% protein bar without chia seeds; group III = 80% ration + 20% PB containing 15% chia seed; group IV = 80% ration + 20% PB containing 20% chia seeds.

Whereas all diets exhibited similar contents of lipids and proteins, the ash content was lower in the diet containing PB without chia seeds, suggesting a positive role of seeds in the mineral content of diets.

General parameters

Figure 1 shows the values of daily intakes of diet and water as well as that of the animal body weight along

the 32-day experiment. Groups I and III showed similar values of water intake ($p > 0.05$) over the 32 days of the experiment. There was a progressive increase in the body weight of all the animals along the time up to 27 days, after which the growth ceased. Similarly, there was a generalized increase ($p < 0.05$) in the feed intake of all groups, but no significant differences were detected among groups ($p > 0.05$) from the 27th day onwards.

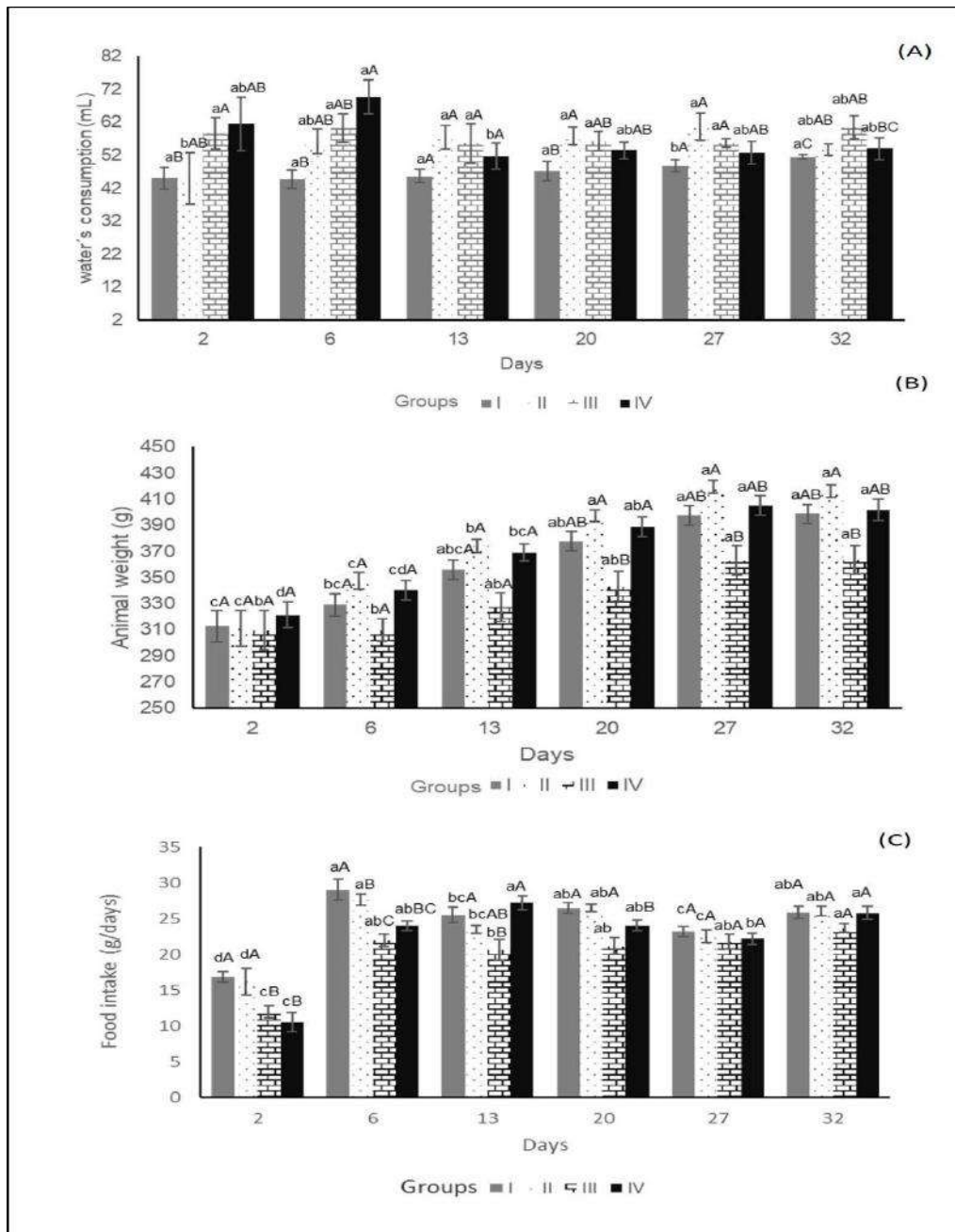


Fig.1.(A) Food intake, (B)body weight, and (C) water intake in the different groups of test animals (male Wistar rats) from the 2nd to the 32nd day of the experiment. *Identical lowercase and capital letters indicate no statistically significant difference in each parameter along the time in the same group and among the groups on the same day, respectively. Group I = 80% ration + 20% chia seed; group II = 80% ration + 20% protein bar without chia seeds; group III = 80% ration + 20% PB containing 15% chia seed; group IV = 80% ration + 20% PB containing 20% chia seeds.

Fat and muscle organs and tissues

Group III presented lower weights of heart as well as retroperitoneal, epididymal and perirenal adipose tissues

compared to group II, but with no statistically significant difference from groups I and IV, while the stomach weight in group III was lower than in group I only (Table 4).

Table 4. Weight of organs and tissues in the different groups of test animals (male Wistar rats).

Organweight(g)	Group				p-value	F-value
	I (n=8)	II (n=8)	III (n=8)	IV (n=7)		
Heart	1.37±0.60 ^{ab}	1.41±0.04 ^a	1.23±0.05 ^b	1.40±0.03 ^{ab}	0.04	0.25
Liver	13.45±0.62	13.64±0.49	11.91±0.59	13.07±0.61	0.16	0.45
Kidneys	3.26±0.16	3.13±0.08	2.86±0.14	3.06±0.13	0.17	0.45
Stomach	1.82±0.05 ^a	1.77±0.05 ^{ab}	1.55±0.08 ^b	1.58±0.08 ^{ab}	0.01	0.72
RAT	4.96±0.43 ^{ab}	5.75±0.58 ^a	3.40±0.42 ^b	4.19±0.47 ^{ab}	0.01	0.70
OAT*	0.44±0.09	0.61±0.07	0.40±0.09	0.52±0.10	0.3	0.38
EAT*	5.79±0.51 ^{ab}	6.98±0.43 ^a	4.63±0.62 ^b	6.09±0.58 ^{ab}	0.03	0.61
ISAT*	1.41±0.41	2.08±0.25	1.91±0.22	1.81±0.25	0.43	0.35
PAT	1.29±0.02 ^{ab}	1.59±0.16 ^a	0.92±0.10 ^b	1.28±0.16 ^{ab}	0.03	0.63
Soleus	0.37±0.02	0.38±0.01	0.35±0.03	0.39±0.02	0.61	0.37
EMT	0.27±0.03	0.18±0.02	0.22±0.02	0.23±0.02	0.08	0.65
GMT	4.63±0.25	4.87±0.06	4.43±0.26	4.79±0.18	0.46	0.34

Values expressed as means ± standard errors. Means followed by the same letter do not differ statistically. The Scott-Knott test was applied at the 1% probability level *The Tukey test was applied at the level of 1% probability. RAT = retroperitoneal adipose tissue, OAT = omental adipose tissue, EAT = epididymal adipose tissue, ISAT = inguinal subcutaneous adipose tissue, PAT = perirenal adipose tissue; EMT = Extensor muscle tissues, GMT = Gastrocnemius muscle tissue. Group I = 80% ration + 20% chia seed; group II = 80% ration + 20% protein bar without chia seeds; group III = 80% ration + 20% PB containing 15% chia seed; group IV = 80% ration + 20% PB containing 20% chia seeds.

Biochemical parameters

In the blood, group I showed the lowest glucose level, while group III the lowest high-density lipoprotein (HDL) level and group II the highest triglycerides (TAG)

level. Moreover, groups III and IV whose feed contained chia grain and protein bar in the diet showed the highest testosterone concentrations (Table 5).

Table 5. Effect of diets on blood biochemical parameters in the different groups of test animals (male Wistar rats)

Parameter	Group				p-value	F-value
	I (n=8)	II (n=8)	III (n=8)	IV (n=7)		
GLU (mg. dL ⁻¹)	111.89±3.78 ^b	125.24±1.67 ^a	137.37±3.70 ^a	133.44± 3.16 ^a	<0.05	0.85
TC (mg. dL ⁻¹)	99.35±4.74	92.56±3.78	90.32±4.30	94.54±3.44	0.47	0.27
HDL (mg. dL ⁻¹)	49.87±3.02 ^a	41.63±0.99 ^{ab}	40.12±0.10 ^b	41.71±2.04 ^{ab}	0.01	0.66
LDL (mg. dL ⁻¹)	31.62±2.69	22.46±2.88	29.90±3.22	33.18±2.28	0.06	0.53
TAG (mg. dL ⁻¹)	76.87±6.20 ^b	128.00±10.40 ^a	91.12±4.50 ^b	92.14±6.90 ^b	<0.05	1.13
TP (g.dL ⁻¹)	6.87±0.11	7.17±0.15	6.86±0.13	7.07±0.21	0.38	0.38
ALB (g.dL ⁻¹)	2.87±0.05	2.90±0.09	2.75±0.07	2.87±0.11	0.55	0.28
GLOB (g.dL ⁻¹)	4.00±0.08	4.27±0.08	4.11±0.14	4.20±0.14	0.34	0.45
HbA1c (%)	4.65±0.38	4.03±0.12	3.74±0.21	4.71±0.53	0.13	0.52
INS (μUI.dL ⁻¹)	1.55±0.07	1.42±0.05	1.81±0.20	1.58±0.07	0.13	0.52
IGF-I (ng. mL ⁻¹)	10.62±0.46	10.50±0.42	10.38±0.42	10.14±0.26	0.86	0.20
GH (ng. mL ⁻¹)	0.02±0.00	0.01±0.00	0.02±0.00	0.02±0.00	0.46	0

TES (ng. dL⁻¹)	52.61±6.68 ^{bc}	49.54±8.47 ^c	92.95±5.68 ^a	82.81±11.25 ^{ab}	<0.05	0.25
COR (µg.dL⁻¹) *	0.89±0.04	0.96±0.12	0.90±0.03	0.90±0.03	0.86	0.17

Values expressed as means ± standard errors. Means followed by the same letter do not differ statistically. The Tukey test was applied at the 5% probability level. GLU = glucose; TC = total cholesterol; HDL = high density lipoprotein; LDL = low density lipoprotein; TAG = triglycerides; TP = total proteins; ALB = Albumin; GLOB = globulin; HbA1C = glycated hemoglobin; INS = insulin; IGF-I = insulin-1 growth factor; GH = growth hormone; TES = testosterone; COR = cortisol. Group I = 80% ration + 20% chia seed; group II = 80% ration + 20% protein bar without chia seeds; group III = 80% ration + 20% PB containing 15% chia seed; group IV = 80% ration + 20% PB containing 20% chia seeds.

IV. DISCUSSION

The aim of the present study was to determine the effects of a diet enriched with PB containing chia seeds on tissue and biochemical parameters in rats, and, to assess the effect of storage on physicochemical quality of two different PB formulations. Regarding the physical and physicochemical parameters analyzed during the shelf-life test, the addition of 20% of chia seeds affected the texture of PB2 during storage. PB1 strength remained the same throughout the storage period, while that of PB2 significantly decreased, which made it different from the other formulations after storage. On the contrary, (Zhu and Chan, 2018), when investigating the partial wheat replacement by chia seeds by up to 30% in bread baked with steam, observed an increase in sample hardness, which was attributed to the change in gluten formation due to wheat flour dilution by chia seeds.

In the present study, the decrease in the hardness of the PB containing chia seeds can be ascribed to the mucilage covering the seeds, which is mainly composed of acid and/or neutral heteropolysaccharides and proteins with the property of forming colloidal solutions that, in contact with water, become viscous. During the shelf-life study, there was no increase in water activity in both formulations likely due, at least in part, to the ability of chia seed mucilage to bind outer water and to form constitutional, vicinal, and multilayered water in the samples. This may have reduced the molecular interaction among the ingredients, especially that between isolated soy protein and concentrated whey protein.

The method of assessing the antioxidant activity through the β-carotene/linoleic acid system evaluates the inhibition activity of free radicals generated by linolenic acid peroxidation, i.e., the ability to protect the sample in the oxidizing medium. Natural compounds with antioxidant activity have been used in several studies to develop new functional products (Jaster et al., 2018). In this study, the antioxidant activity of samples assessed by this method decreased during the 45-day storage. Both PB1 and PB2 formulations contained vitamin E, a lipophilic antioxidant agent, and citric acid, an antioxidant

and hydrophilic/lipophilic chelating agent. Even with the presence of these antioxidants, the formulations did not prevent the oxidation of the β-carotene/linoleic acid system. For the formulation containing chia seeds, this fact can be explained by the high content of polyunsaturated fatty acids present in chia, which may have favored the formation of free radicals whose stabilization would have required greater antioxidant activity. Also, the PBs remained stored under the protection of light and refrigerated, which may have reduced oxidation. Morales et al. (2016) observed that lipid oxidation was accelerated in wheat-based biscuit formulations supplemented with different concentrations of chia seeds, which led to a reduction of the biscuit shelf-life. In this respect, it should be remembered that chia itself has a high antioxidant power due to the presence of polyphenols, flavonoids, and mainly vitamin E (Ding et al., 2018), which allowed reaching a protective activity of up to 79.3 % (Reyes-Caudillo et al., 2008).

In general, all the color parameters (L*, a*, b*, C* and h*) of PB were reduced by the addition of chia seeds, which means that PB2 was less reddish and yellowish than PB1 likely because the seeds had the characteristic brown “dots” of chia as well as an internal mass with uniform color. Other researchers who analyzed food products, such as bread and hams, made with chia seeds and flour, observed the same color behavior concerning parameters a* and b* compared to controls without chia (Ding et al., 2018). The hue angle (h*) was in the range of 70 and 100°, which corresponds to a position in the first quadrant, i.e., to a predominantly yellow color. The h* value of PB1 slightly decreased during the 45-day storage at 25 °C from 78.44° at the start to 77.06° at the end (p < 0.05), while no statistically significant difference was observed for PB2. Such a scarce or negligible influence of protein replacement by chia seeds on the tonality parameter, as well as on the pH, agrees with previous results of color attributes sensorially evaluated by the affective test using a structured 9-point hedonic scale (Veggi et al., 2018). These authors did in fact report acceptance rates of 86.44 and 88.66% for PB1 and PB2, respectively, by untrained individuals, even though the purchase intent and

global preference for the latter formulation were greater than for other samples without chia seeds or with lesser amounts of seeds.

Marineli et al. (2015a) reported that rats fed with chia seed and oil showed no reduction in body weight, nor an increase in abdominal fat, but a food intake decrease, while obese rats fed with chia seeds for 8 weeks had lower body weight associated with reduced retroperitoneal and omental adipose tissues (Poudyal et al., 2012). The non-statistically significant variations in food intake observed in the present study are consistent with the hypothesis of the latter authors that chia has properties that allow the redistribution of lipids in the body, resulting in a reduction in the accumulation of fat in tissues and, as a consequence, promoting a protective effect on several organs, including the liver.

Considering that chia is composed of approximately 30% of fiber, the lower blood glucose levels observed in group I (Table 5) may have been due to the greater content of chia seeds in their diet. In fact, fiber intake increases the viscosity of the intestinal mucosa, thus reducing the contact surface of glucose with the enterocyte, the postprandial glycemia and the insulin resistance (Pereira and Ludwig, 2001), in addition to promoting both fermentation and formation of short-chain fatty acids (Anderson et al., 2009). Similar results were obtained by da Silva et al. (2016), who fed rats with a diet containing chia seeds and flour for a shorter time (28 days) than in the present study, and investigation showed longer time (6 and 12 weeks) of chia seeds supplementation in obese rats (Marineli et al., 2015b). The aforementioned phenomena also promote increases in satiety and lipid oxidation (i.e., reduction of adipose tissues), which can explain the reduced adipose tissue weight observed in group III. Several studies highlight the role played by chia, since it is known that it is rich in monounsaturated fatty acids, which are oxidized more quickly compared to saturated fatty acids; therefore, it is likely that the chia-based diet induced a high rate of basal energy expenditure as well as an increase in thermogenesis.

Consumption of a diet rich in sucrose for a long period of time (3 months) promotes dyslipidemia and insulin resistance (Oliva et al., 2013). Moreover, it is known that the increased availability of serum triglycerides and free fatty acids promotes lipid accumulation in non-adipose tissues, such as cardiac, hepatic, and skeletal muscle tissues, and lip toxicity, thus leading to cell dysfunction and death in non-adipose tissues (Schaffer, 2003). Chicco et al. (2009) did not observe any differences in blood glucose level after 3 weeks of administration of a diet rich in sucrose as well as a diet rich in both sucrose

and chia seeds, while, after 2 months of ingestion, chia supplementation reduced visceral adipose tissue, dyslipidemia, and insulin resistance. In the present study, PBs containing 15 and 20% chia seeds led to satisfactory results concerning dyslipidemia after 4 weeks.

In a study performed by Ferreira et al. (2020), a diet rich in sucrose, with the replacement of corn oil by chia seeds as a lipid source, reduced the content of lipids in the skeletal muscle likely due to an increase in their oxidation. In fact, the groups that consumed chia seeds showed increased gene expression of carnitine palmitoyl transferase 1, increased levels of the receptors activated by the peroxisome proliferator ($PPAR\alpha$, $PPAR\gamma$) and protein kinase activated by phosphorylated AMP, which is also a regulator of fatty acid metabolism. Additionally, the chia diet reduced isoforms of precursor proteins and mature forms of SREBP-1, a protein recognized for its lipogenic effect on skeletal and hepatic muscle tissue. Although analyses of molecular mechanisms were not performed in the present study, the findings of these authors may explain, at least in part, the positive effect of adding chia seeds to different diets, including sucrose rich diets.

The levels of total cholesterol and low-density lipids are related to the consumption of fibers, whose soluble fraction is associated with bile acids or cholesterol during the synthesis of intraluminal micelles, resulting in a decrease in liver cholesterol as well as standardization of LDL receptors, dispensing the LDL. The total cholesterol levels in all groups were higher than those observed by Molena-Fernandes et al. (2010) in rats supplemented for 35 days with brown and golden flaxseed flour, likely due to the presence of chocolate in all the PB formulations investigated in the present study. On the other hand, the group supplemented with chia had higher HDL levels perhaps owing to the influence of polyunsaturated fatty acids (PUFA) present in the chia seed; however, no decrease was observed in the LDL level. In the present study, there was a reduction in triglycerides level in the groups that consumed chia supplemented feed, which was proportional to the increase in the content of chia seeds from 10 to 15% in PBs. Thus, the intake of diets containing chia seeds and PBs supplemented with chia seed, for a short period, improved lipid homeostasis in healthy and eutrophic animals, probably due to the different feeding structures, given the complexity of the food synergy and the interaction among stable compounds, which can greatly influence the bioavailability of nutrients.

It noteworthy that the groups supplemented with chia had higher testosterone levels (Table 5). It has been reported that anabolic androgenic steroids promote a decrease in serum HDL levels and an increase in the LDL

one (Alquraini and Auchus, 2018). On the other hand, in the present study, there was an increase in HDL level like that observed in other studies carried out with male rats fed with diets supplemented with avocado oil and flaxseed flour (Abboud et al., 2015). These diverging results suggest that these effects greatly depend on the type of both steroid and supplemented matrix. Even though flaxseed grain resembles chia seeds because of its high contents of PUFA and fibers, male rats fed with a diet containing flaxseed had increased serum estradiol levels and no changes in that of testosterone compared to the control group (Corrêa et al., 2017). Studies carried out with men point out a link among low testosterone concentrations and insulin resistance, increased risk of diabetes mellitus, obesity, adverse lipid profile, metabolic syndrome, and cardiovascular risk (Dimopoulou et al., 2018). Hypogonadism, in addition to infertility, may be related to symptoms such as fatigue, weakness, decreased libido and energy, erectile dysfunction, reduced muscle, and bone mass and increased fat (Abboud et al., 2015). Therefore, the consumption of chia seeds appears to be more promising than that of flaxseed, as it promoted loss of adipose tissue, maintained muscle mass, and decreased TAG levels in the present study.

In the present study, all biochemical parameters were obtained at values considered within the normal range for adult male rats (Melo et al., 2012). It is important to note that the findings of the present study contribute to the development of new food products, especially dietary foods that are free of sugar, a source of protein, and rich in fiber. The proposed formulations may have a significant role in the prevention of chronic non-communicable diseases since they allowed reductions in glycemia, triglyceridemia, and adipose tissues as well as an increase in serum HDL in sedentary eutrophic rats.

V. CONCLUSION

The results of this study showed that protein bars (PBs) supplemented with chia seeds were stable for 45 days of storage at room temperature, as confirmed by the maintenance of texture, pH, and water activity, which are important physicochemical parameters in monitoring the quality of foods during shelf life. These results are the premise for future investigations of product stability with a high-protein content supplemented with high fiber grains and monounsaturated fatty acids.

The consumption of feed partially replaced by chia seeds and PBs by rats, for a short period, proved to be an excellent alternative for reducing the weight of adipose tissues associated with the decrease in body weight, as well as for controlling serum levels of triglycerides and

HDL. It is worth noting that the biochemical and molecular mechanisms involved in improving the lipid profile and reducing adipose tissue must be examined in future studies.

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Quilombola Communities in Brazil, aspects of Food and Nutrition Security – Literature review

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Keywords—*food security, eating habits, food insecurity, quilombola.*

Abstract—*Introduce: The law nº 11.346, of 15 september of 2016, lays down that the power public should respect, protect, promote, inform and to evaluate the realization of the Human Right to Adequate Food. However, the quilombolas are vulnerable and suffer from discrimination by the institution. Objective: Survey articles from the last five years on food and nutrition security in quilombola communities in Brazil. Methodos: This is a systematic review of the literature with qualitative analysis, in which full articles published in the years 2016 to 2021. The collect of information was to realize during October and November of 2021. Resultuts: In relation to food agriculture quilombola, observed little people to local produce, because there is rural exodus, which promotes flaws in local supply of food. Reduced consumption of food in nature and minimally processed and increased the consumption of the food processed and ultra processed. Observed that the quilombola population consumes less fish than beef, due to pollution of rivers and hunting practice, it is common in the quilombola population. The majority quilombola population live in insecurity feed, due to aspects of socioeconomics and environments, it is observed in all age groups. Studies show that it is four times bigger than comun population. Conclusion: A high prevalence of food insecurity was observed in this population, as well as a lack of intake of certain foods, such as fruits and vegetables. Furthermore, the absence of running water, distinct from sewage, per capita income and access to health services aggravate the situation.*

I. INTRODUCTION

Food and Nutrition Security (FNS) is a concept that is being discussed worldwide, defined by a multiplicity of

indicators of human well-being and quality of life[1]. Law N° 11,346, of 15 September 2006 (Organic Law on Food and Nutrition Security), by establishing that it is the duty of the public authorities to respect, protect, promote,

provide, inform, monitor, supervise and evaluate the realization of the Human Right to Adequate Food, as well as guaranteeing the mechanisms for its enforceability”, assures all citizens their rights in this scenario[2].

Quilombolas are ethnic/racial groups according to self-attribution criteria, which have their own historical trajectory, with specific territorial ties and pride of black ancestry strongly linked to the historical oppression supported³. Currently, the quilombola people are in great social vulnerability and suffer from neglect and institutional discrimination[3].

Current research carried out in quilombola communities already demonstrate a high prevalence of food (in)security among the evaluated households. In a study carried out using the Brazilian Food Insecurity Scale (EBIA) the prevalence of food insecurity was 86.1% [4].

Thus, this work aims to carry out a survey of articles from the last five years on food and nutrition security in quilombola communities in Brazil.

II. METHODOLOGY

This is a systematic review of the literature with qualitative analysis, in which full articles published in the years 2016 to 2021, in Portuguese - Brazilian, were selected. Data collection was carried out in October and November 2021.

The research was carried out in BIREME and CAPES PERIODIC academic databases, using the descriptors: Food and nutrition security, Food habits, Food insecurity, Quilombolas. The connective AND was applied between the descriptors, food and nutritional security AND quilombolas; Eating habits AND Quilombolas; Food insecurity AND Quilombolas.

After the selection, there was an analysis through the reading of articles related to the research topic and they were judged according to the research objectives, with the goal of carrying out an analysis on Food and Nutrition Security (FNS) in quilombola inhabitants in the Brazil.

The inclusion criteria were: Complete articles that investigated the quilombola population and food security in Brazil. Regarding the exclusion criteria, duplicate articles, dissertations, non-indexed publications, theses and monographs were rejected.

Were identified 71 scientific articles in the databases, of which 30 were selected for a primary analysis, of these 19 met the inclusion criteria, 5 were excluded for not being adequately structured in topics, finally, after an interpretative reading to obtain the results, the sample consisted of 14 articles.

III. RESULTS AND DISCUSSION

3.1 Food in agriculture

Food and nutrition are basic requirements to guarantee the protection and promotion of health, as they ensure the quality of life for individuals. Silva et al. [5], in studies with members of quilombola communities, carried out an analysis of their agricultural production, and determined that there is a pattern of adoption of technologies aimed at capitalist development, with a disruption in the export of production, to the detriment of self-consumption. Allied to this factor, the rural exodus has been occurring concomitantly, characterized in this context by the figure of young people, who in search of better conditions leave their rural homes, thus contributing to the shortage of labor for local production.

Studies carried out in the last decade show the importance of agricultural production for the supply of families. The current scenario has demonstrated the failures in the supply system, highlighting that it is not possible to meet the needs of 72% of families Grisa et al. [6] in their findings, highlighted that among quilombola rural workers, the system of planting, cultivating and harvesting for their subsistence is common, while others, essentially the elderly receive financial assistance from the government, and with the use of large amounts of money. most buy food in markets. Figueiredo et al. [7] observed that there is a major problem regarding fruit intake in quilombola communities in Brazil, which can develop nutritional deficits and micronutrient deficiencies. Navas et al. [8], in a study in Vale do Ribeira, observed a scenario similar to the previous one, with reports of low consumption of fruits and vegetables, and insufficient production to supply the families residing there, with greater importance in the purchase of basic food products.

3.2 The use of a tool to assess the frequency of food intake in quilombola populations

Rivas et al. [9], carried out a study on the use of the food frequency questionnaire and its effectiveness as a tool to assess the population's food situation, articulating that it is an instrument that must contain 50 items, since identifying lower values would not be performed correctly, thus as values greater than 100. In the findings of the Brazilian Institute of Geography and Statistics, IBGE showed low consumption of fruits and vegetables, due to being populations with low income and living in a cold region [10].

In Porto Alegre, it was highlighted that the FFQ that was applied in the sample was the closest to the reality of the population analyzed in the study, with a list of more extensive foods that are part of the eating habits of the

black population and are part of the consumption of food. urban people of Porto Alegre Henn et al. [11].

3.3 From avortado to bought, food practices and food security in communities

Nascimento et al. [12] identified that the intake of açaí by the local population has changed over the years, the growing commercialization of the fruit has interfered with the population's own consumption, which may have influenced in cases of food insecurity. Santos et al. [13], found changes in the eating habits of individuals over time, reflecting in eating behaviors associated with negative impacts on food security.

Murrieta [14] states that changes in food production practices are linked to young people leaving the quilombo in search of employment in the urban area. Nascimento [12] observed significant changes in the dietary patterns of the families studied, where reports already highlight that in previous decades the food was diversified and came from the production unit, in the current one we can analyze a greater dependence on the trades of Abaetetuba.

So there was a greater consumption of processed foods, canned foods, instant noodles and bologna, where it is easy to prepare, natural juices are being replaced by soda.

3.4 Eating habits of quilombola adolescents

Sousa et al. [15] found a significant difference in terms of healthy eating among these young quilombolas, in which adolescents have a lower consumption of healthy foods. However, the opposite of what was expected was observed, with low consumption of fresh and minimally processed foods, and a considerable increase in the intake of ultra-processed foods in both groups evaluated.

Rodrigues et al. [16] found in their research that there were decreases in fruit consumption among young people. When investigating the consumption of ultra-processed foods in adolescents Silva et al. [17], found that both macro-regions of the country have high consumption of ultra-processed foods, with the percentage found above 70%.

Lamarão et al. [18] analyzed the eating habits of adolescents studied in schools in Macapá, the vast majority reported consuming fried foods, sugary drinks and sweets daily. The general prevalence of overweight, which is the sum of overweight and obese adolescents, was considered a high rate for the population studied. Low food and nutritional quality may be influencing weight gain.

Studies by Antonogeorgos et al. [19] found an inverse association between excess weight and regular practice of physical activity, where the findings of these studies may be associated with differences in the methods of evaluation and classification of research variables. Making these

contradictions and the fact that low levels of physical activity stand out at the top of the risk factors associated with numerous causes of death in the country, making it necessary to carry out more studies [20].

3.5 Food insecurity in quilombola communities

Silva et al. [5] sought to identify the prevalence of food insecurity in a rural area of Northeast Brazil and to investigate the factors associated with this outcome, according to residence in quilombola and non-quilombola communities in the same catchment area. The variables evaluated that were somehow related to food insecurity were obtained by the EBIA, which brings together groups of concepts, making it possible to estimate the prevalence of food insecurity, and classify it according to the levels of severity (mild, moderate and severe). From the analysis of the results, it can be seen that quilombola families would be the group with the highest risk of IAN when compared to other families living in rural areas.

Over the years, several studies have shown similar results, and affirmed that families living in rural communities have a higher prevalence of food insecurity when compared to those living in urban areas. In the study by Maas et al. [21], it can be observed that food and nutritional insecurity reached more than a quarter of households in the rural area, in which it was possible to identify that households with a higher risk to this outcome were related to low socioeconomic and income levels. education, low participation in income transfer programs and among other factors.

Ribeiro et al. [22] when carrying out an analysis in a quilombola community in Sergipe, on food and nutrition security, observed findings on the prevalence of food insecurity in traditional peoples, in 83.3% of respondents. Furthermore, Monego et al. [23] approached 14 black communities, and highlighted that in Tocantins there was a higher prevalence in the total of families that presented food insecurity, totaling 85.1%.

Silva et al. [24], when wanting to identify the situation of food insecurity in Maranhense families in Brazil, carried out an analysis of studies carried out in families from other countries, and noticed a high prevalence of food insecurity, when applying this research in Brazil, it detected that the state of the Maranhão was the state that presented the highest level of prevalence in all federated units, through the EBIA. Similarly, Silva et al. [5] in their study have shown that families living in rural areas have a higher prevalence of food insecurity, highlighting that those who are quilombola have a lower economic level when compared to other non-quilombola families.

Despite significant progress in reducing global hunger in recent times, it continues to be a problem in many countries, affecting mostly the group of women with less education [25]. However, there needs to be improvement in strengthening and performance in rural markets for family farming and it is a key parameter in strategies for the population to have improvements in food security and quality of life and diet of small farms.

3.6 Socio-economic conditions related to socio-environmental conditions, and food and nutritional insecurity

The research carried out by Cruz et al. [2], aimed to evaluate the socio-environmental aspects related to food and nutritional insecurity of quilombolas from a Marine Extractive Reserve. For this, a semi-structured interview was carried out in order to collect information about the socioeconomic and infrastructural conditions of the community. Thus, the results showed that 56.5% of respondents had incomplete elementary education, similar results were found by Passos et al [26], in which low education, no study or incomplete elementary school, was represented by 72.8% of the quilombola population in the study.

Regarding family income, the study by Cruz et al. [2] observed that in 47.9% of households it is less than the minimum wage, in addition, the income composition is composed of social benefits, such as Bolsa Família and Bolsa Verde. According to Gomes et al. [27], the Bolsa Família Program promotes income transfer according to the different characteristics of each family, seeking to improve the living conditions of family groups. For Burlandy [28] the interrelationship between income deficit and food insecurity is undeniable, as there is no way to deny the monetary issue during access to food goods, thus, income transfer programs seek to facilitate this access.

Still in the study Cruz et al. [2], it was reported that the residences were entirely made of rammed earth. In this way, Junior [29] reported that mud houses are associated with the low purchasing power of their residents, issues such as thermal and acoustic comfort, good ventilation are disregarded. In addition, according to the interviewees, when asked about the destination of the garbage, 100% of them said that it was burned or buried on the property itself, however, during the research, household garbage was exposed in the open near residential properties. Study carried out by Monego et al. [23], in quilombola communities in Tocantins, reported similar results, in which 52% of the community was destined for garbage to be buried or burned.

Families headed by women had a higher prevalence of Food and Nutritional Insecurity, even though women were

more independent and employed in the job market, these aspects did not help to reduce IAN in their homes. Sousa et al. [30] when analyzing variables that contribute to the emergence of IAN in quilombola families, showed that in houses managed by women, Food and Nutritional Insecurity is greater. Cherol et al. [4] found results above 80% for Food Insecurity, which confirms the findings of Maciel et al. [31] and Cherol et al [4] by reaffirming the need for public policies, actions and government programs that help to combat this problem and help the population to have access to healthy foods.

In addition, the IBGE [10] analyzed the survey of the demographic and socioeconomic basis and verification of the government across the country, in 2013 it pointed out a considerable and significant decrease in AI in Brazil. In quilombola households in 2011, it was found that the AI of the population group is four times higher than the level stipulated for the Brazilian population, being 86.1% and 22.6%, they highlighted the classification of race and color among the inhabitants, there was the proportion of moderate and severe AI among browns and blacks 11.1% and 55.9%.

3.7 The dilemma of quilombola diet

Correa et al. [32] carried out a study in the quilombola communities of Santo Antônio and São João in which they are characterized by the high content of tubers and cereals as opposed to fruits and vegetables, the findings are nutritional elements observed in the two communities of the present analysis, protein meats were around red meat, where the meat comes from wild animals. Begossi et al. [33] associated the decline of fishing resources, irregularity, as a consequence of river pollution, habitat destruction and dams built on the rivers for a hydroelectric project, these facts jeopardize the food security of the traditional peoples of the Amazon, and food has been affected by the impact of the dam.

However, according to Trivellato et al. [34], foods included in the consumption habits of quilombolas are threatened, due to the fragmentation of the Amazon and the decrease in forest cover, which negatively influence the availability of game species, as well as the low consumption of fruits and vegetables. Vegetables 5,8% and 4,4%, with a higher intake of processed products with 20%.

3.8 Social Inequality and Food Insecurity in a quilombola community

The IBGE [10], when carrying out a survey, observed that the data presented in quilombola households in 2011 showed that the AI of the quilombola peoples was four times higher than the estimated level of the Brazilian

population in 2013 86,1% and 22,6%, and when taking into account the classification of race and color, in 2013 the proportion of AI was moderate among browns and blacks, lower than that observed in quilombos, 11.1% to 55.9%.

3.9 Malnutrition and factors associated with food insecurity in children

The work proposed by Silveira et al. [35], who investigated the prevalence of malnutrition in children under 60 months of age in remaining quilombo communities in two municipalities in Maranhão, showed a mild severity for the height-for-age (H/A) deficit and moderate for the deficit of weight-for-height (W/H), in addition to mentioning that children of mothers with short stature tend to be more likely to have a height-for-age deficit. Thus, it was observed that this context is the result of environmental factors of families, which were mostly inserted in lower economic classes.

This study was similar to the work by Pereira et al. [36] that evaluated the nutritional status of children under 5 years of age in Brazil, in which it was identified that weight deficit, verified by the W/A ratio and thinness defined from the W/E ratio, were more prevalent among children under 1 year old; 3,6% and 8,9%, respectively, and stunting was higher in children aged 3 years (12,00%); especially in indigenous families. Furthermore, it was noted that mothers with shorter heights also tend to have babies with an equally short length in contrast to those with normal height.

Furthermore, Araújo et al. [37] presented a similar reality, in which the prevalence and factors associated with malnutrition in children under five years of age in the interior of the Amazon were directly investigated. The prevalence of H/A deficit was higher in families in rural areas, especially among children of indigenous descent, evidencing vulnerability to malnutrition. In this context, it was therefore correlated with situations of social inequalities and consequent food insecurity, which had an impact on children's nutritional status.

Neves et al. [38] in their research showed the presence of a high prevalence of weight and height deficit in the Northeast of Brazil. Thus, when analyzing the facts that led to this problem in children entitled quilombola communities, an association was noted with food and nutritional insecurity variables, which were found to be lack of basic sanitation, low sociodemographic level and low education and income. less than minimum wage.

IV. FINAL CONSIDERATIONS

This work sought to evaluate the publications made in the last five years on food and nutrition security in quilombola communities, in order to identify the current approach to this topic, as well as the situation of these individuals.

From the analysis of the selected articles, a high prevalence of studies can be observed regarding the situation of insecurity experienced by this population, as well as eating habits and the lack of intake of certain foods such as fruits and vegetables. Food and nutrition insecurity among quilombola communities in Brazil and indicators of socioeconomic conditions reinforce the importance of effective implementation of public policies aimed at eradicating poverty and food insecurity in the population. In addition, the absence of running water, distinct from sewage, per capita income and access to health services had direct access with food insecurity.

In this context, food security constitutes a universal right, which includes the poorest and blackest segments, which unfortunately in Brazil are still poorly recognized and left at the mercy of malnutrition and the lack of access to quality food in sufficient quantity to supply the biological social needs. The act of eating becomes more than a simple daily act, becoming an expression, characteristic of the black population, which must have a cultivated and preserved food culture.

In short, the quilombola food culture is more than characteristic of a people that never ceases to fight for their rights and patrimony of the Brazilian nation. Its origin was built with rude marks, but they reveal the strength of a people that managed to overcome the scourge of slavery and continue to show their importance and strength in the face of inequality prevailing in society.

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Inclusive Special Education: An approach in the context of Youth and Adult Education in the City of Manaus - AM

Educação Especial Inclusiva: Uma Abordagem No Contexto Da Educação De jovens E Adultos Na Cidade De Manaus – AM

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Keywords — *Inclusion, special education,
teacher, student.*

Palavra Chave— *Inclusão, educação
especial, professor, aluno.*

Abstract — *The proposal for school inclusion emphasizes, among other aspects, that education systems must respect and meet the educational needs of people with disabilities in the regular class. To this end, schools have several services, resources and strategies, such as: multifunctional resource rooms or pedagogical support rooms. From the above, as the EJA school located in the city of Manaus - Am, are you looking for improvements in the teaching of student learning with special needs? This research is justified by its interest in identifying, mapping and monitoring people with disabilities enrolled in an EJA school that constitutes district coordinator 3 of the State Department of Education – SEDUC. Therefore, to elucidate the research problem, the following general and specific objectives were elaborated: General: made to analyze the training path of People with Disabilities in the Education of Youth and Adults enrolled in High School and Specific: two closed questionnaires were applied to improve know the current situation of the school and students, outlining the profile of each student and teachers and, finally, the disclosure was made through reports and histories of the achievements and difficulties of the students.*

Resumo— *A proposta da inclusão escolar enfatiza, dentre outros aspectos, que os sistemas de ensino devem respeitar e atender às necessidades educacionais das pessoas com deficiência na classe regular. Para tanto, as escolas dispõem de vários serviços, recursos e estratégias, como: salas de recursos multifuncionais ou de apoio pedagógico. A partir do exposta, como a escola da EJA situada na cidade de Manaus - Am, estão buscando melhorias no ensino da aprendizagem de aluno como necessidades especiais? Presente pesquisa justifica-se por apresentar interesse em identificar, mapear e acompanhar as pessoas com deficiência matriculadas em uma escola da EJA que constitui a coordenadoria distrital 3 da Secretaria de Estado de Educação – SEDUC. Portanto, para elucidar o problema de pesquisa elaborou-se os seguintes objetivos geral e*

específicos: Geral: feito a analisar o percurso formativo das Pessoas com Deficiência na Educação de Jovens e Adultos matriculados no Ensino Médio e Específicos: foi aplicado dois questionários fechados para melhor conhecer a atual situação da escola e alunos, traçando perfil de cada aluno e professores e por último foi realizado a evidenciação por meios de relatórios e históricos das conquistas e dificuldades por partes dos alunos.

I. INTRODUÇÃO

Diante dos grandes desafios encontrados pela Educação atualmente, um deles é como podemos incluir alunos como Portadores de Necessidades Especiais – PCD no contexto escolar, sem excluí-lo de atividade que são distribuídas igual para todos. Esse grande desafio se torna muito mais difícil quando é voltado para o âmbito da Educação de Jovens e Adultos – EJA. Muitas das escolas da EJA na cidade de Manaus estão de acordo integral para receber esses alunos com algum tipo de necessidade educacional, porém, os líderes governamentais estão cada vez mais deixando de lado o apoio a docentes e apoio na busca de ajuda para especialização ou buscas pelo aperfeiçoamento acadêmico.

A proposta da inclusão escolar enfatiza, dentre outros aspectos, que os sistemas de ensino devem respeitar e atender às necessidades educacionais das pessoas com deficiência na classe regular. Para tanto, as escolas dispõem de vários serviços, recursos e estratégias, como: salas de recursos multifuncionais ou de apoio pedagógico, atendimento educacional especializado, acesso ao currículo, porém, o acesso a esses ambientes é praticamente restrito, pois a deficiência de profissionais para atender essa demanda é grande e por fim tornam-se um problema pela grande desistência de alunos PCD do contexto escolar.

A partir do exposta, como a escola da EJA situada na cidade de Manaus - Am, estão buscando melhorias no ensino da aprendizagem de aluno como necessidades especiais?

Segundo Haddad e Di Pierro (2000), o desafio da expansão do atendimento na educação de jovens e adultos já não reside apenas na população que jamais foi à escola, mas se estende àquela que frequentou os bancos escolares e, no entanto, não obteve aprendizagens suficientes para participar plenamente da vida econômica, política e cultural do país e seguir aprendendo ao longo da vida.

Desta forma a presente pesquisa justifica-se por apresentar interesse em identificar, mapear e acompanhar as pessoas com deficiência matriculadas em uma escola da EJA que constitui a coordenadoria distrital 3 da Secretaria de Estado de Educação – SEDUC.

Portanto, para elucidar o problema de pesquisa elaborou-se os seguintes objetivos geral e específicos: **Geral:** feito a analisar o percurso formativo

das Pessoas com Deficiência na Educação de Jovens e Adultos matriculados no Ensino Médio e **Específicos:** foi aplicado dois questionários fechados para melhor conhecer a atual situação da escola e alunos, traçando perfil de cada aluno e professores e por último foi realizado a evidenciação por meios de relatórios e históricos das conquistas e dificuldades por partes dos alunos.

II. REFERENCIAL TEÓRICO

2.1 História da Educação Especial

É importante contextualizar a Educação Especial desde os seus primórdios até a atualidade, para que se perceba que as escolas especiais são as principais responsáveis pelos avanços da inclusão, longe de serem responsáveis pela negação do direito das pessoas com necessidades educacionais especiais, de terem acesso à educação. Evidencia-se que a inclusão ou a exclusão das pessoas com deficiência estão intimamente ligadas às questões culturais.

No Brasil, até a década de 50, praticamente não se falava em Educação Especial. Foi a partir de 1970, que a educação especial passou a ser discutida, tornando-se preocupação dos governos com a criação de instituições públicas e privadas, órgãos normativos federais e estaduais e de classes especiais.

Tem-se a Declaração de Salamanca (1994) como marco e início da caminhada para a Educação Inclusiva. A inclusão é um processo educacional através do qual todos os alunos, incluído, com deficiência, devem ser educados juntos, com o apoio necessário, na idade adequada e em escola de ensino regular.

A prática da educação inclusiva merece cuidado especial, pois estamos falando do futuro de pessoas com necessidades educacionais especiais. Antes mesmo de incluir, é importante certificar-se dos objetivos dessa inclusão, para o aluno, quais os benefícios/avanços, ele poderá ter, estando junto aos alunos da rede regular e produzir transformações.

A educação especial surgiu com muitas lutas, organizações e leis favoráveis aos deficientes e a educação inclusiva começou a ganhar força a partir da Declaração de Salamanca (1994), a partir da aprovação da constituição de 1988 e da LDB 1996.

A educação dessas pessoas é denominada de educação especial em função da “clientela” a que se destina e para a qual o sistema deve oferecer “tratamento especial” tal como contido nos textos da lei 4024/61 e da 5692/71, hoje substituída pela nova lei de Diretrizes e Bases da Educação Nacional, lei 9394/96. A educação é responsável pela socialização, que é a possibilidade de uma pessoa conviver com qualidade na sociedade, tendo, portanto, um caráter cultural acentuado, viabilizando a integração do indivíduo com o meio.

2.2 Educação Especial e o novo EJA

A partir de uma busca no site oficial da Secretaria de Educação de Estado não foi possível obter informações acerca da relação entre Educação Inclusiva com a modalidade de ensino Educação para Jovens e Adultos (EJA). O que se vê são informações acerca da reformulação da EJA que apresenta como objetivos: 1) aperfeiçoar as práticas educativas da modalidade; 2) minimizar a evasão escolar; 3) otimizar o tempo de escolarização; 4) colocar à disposição do estudante da EJA uma modalidade atrativa, onde este sinta-se capaz de vencer os obstáculos do percurso escolar.

Dos objetivos supracitados chama à atenção, principalmente o 1 e o 4, pois constituem - se como pano de fundo para o interesse desta proposta de pesquisa. Quanto ao funcionamento, de acordo com a SEDUC a EJA se faz com jovens e adultos e não para eles, reforçando a ideia de que sua organização e funcionamento sejam incentivadores do atendimento aos estudantes e motivação para permanência e avanço nos estudos. Sendo assim, a reformulação da estrutura e da proposta pedagógica EJA não se refere apenas a característica etária, mas a articulação desta modalidade com a diversidade sociocultural e econômica de seu público.

Portanto, conforme a SEDUC, o “Novo EJA” deve oportunizar um currículo que tenha como principal objetivo a formação de um indivíduo dentro de sua integralidade, possibilitando conhecimentos diversos, habilidades, atitudes sociais, críticas e coerentes, contribuindo para o exercício da cidadania plena. A SEDUC informa ainda que coloca à disposição dos educadores da EJA um importante instrumento de apoio com a qualidade de referencial que lhe é conferido.

2.3 Quando o estudante ou a estudante da EJA é Pessoa com Deficiência?

Geralmente o questionamento que paira sob a cabeça das pessoas responsáveis na escola pela acolhida da PCD tem sido “o que fazer com essa pessoa?”. Pensando em uma resposta simplista, logo se responderia “oportunizar ensinamento assim como é feito aos demais estudantes”, contudo Nascimento e Carvalho apontam:

Garantir o acesso aos espaços escolares e aos conteúdos curriculares pertinentes a cada etapa de ensino dos estudantes com deficiência não tem sido tarefa fácil e o mesmo pode-se dizer em relação à permanência. Esses estudantes, conforme regulamenta a Política Nacional de Educação Especial na Perspectiva da Educação Inclusiva (2008), Público-Alvo da Educação Especial, serão mencionados doravante como estudantes/educandos P.A.E.E. A política educacional inclusiva percorreu um longo trajeto de idas e vindas, até chegar na atual Política Nacional de Educação Especial na Perspectiva da Educação Inclusiva de 2008 [...]. (NASCIMENTO e CARVALHO, 2020, página 136).

Embora o debate acerca dessa temática não seja recente ainda assim os motivos para continuar a luta por intermédio de debates, discussões, confronto do que está exposto nos dispositivos legais e de como isto se materializa na realidade da escola, não se esgotaram. Ao contrário do que algumas pessoas pensam não basta que exista uma lei para salvaguardar os direitos adquiridos por essas pessoas, todavia é preciso sim que toda a sociedade se mantenha atenta e pronta para contribuir para a legitimação e consolidação desses direitos.

O vivenciado no campo de estágio enquanto licenciando em ciências biológicas, bem como as conversas com colegas, professores da escola e de instituições de ensino leva-nos a supor que algumas escolas ainda não estão preparadas para trabalhar com as diferenças e o resultado disso são as diversas incongruências que até hoje ocorrem no âmbito do ambiente escola. Bins (2013) deixa claro os meandros que constituem esse processo, embora o foco do trabalho desta pesquisadora tenha sido especificamente o adulto com deficiência intelectual, estudante da EJA é válido trazê-lo para este diálogo:

Ao abordar o sujeito adulto com deficiência intelectual, tenho a intenção de pontuar as barreiras e as concepções históricas que as pessoas com deficiências intelectuais têm enfrentado e que produzem definições preconceituosas sobre seu desenvolvimento. Busco também compreender quem é o adulto com deficiência intelectual, que muitas vezes chega à escola com pouca vivência social, escolar e afetiva. Ao conviver e trabalhar com pessoas adultas com deficiência intelectual, bem como ao realizar a coleta de dados e buscar literatura sobre o tema, percebi que pouco são os teóricos que se ocupam da questão, e isto, acredito, reflete um pouco o “lugar” que estas pessoas ocupam na sociedade. A cultura na qual está imerso interfere no olhar do professor sobre o aluno com deficiência intelectual, que muitas vezes chega à escola com um comportamento bem diferenciado daquele que se espera de um adulto. (BINS, 2013, página 37).

No Brasil, o cenário educacional de constantes modificações na estrutura do Ministério da Educação e Cultura (MEC), decorrente das trocas governamentais, cria uma situação de profunda instabilidade. Não temos políticas educacionais de Estado, mas de governos. Nesse contexto, ameaça ao caráter democrático, laico e gratuito da escola pública, disseminada por grupos que defendem interesses econômicos de viés neoliberal, é uma marca presente na educação brasileira há décadas. Recentemente, a onda conservadora que, a cada dia, demarca territórios e lugares nas discussões pedagógicas atuou de forma incisiva na recente reforma curricular, propondo questões e temas que visam o que ensinar, desde a primeira infância até o ensino médio (NASCIMENTO e CARVALHO, 2020, página, 136).

Em razão do cenário acima exposto, a questão que tem orientado nossa investigação visa a saber como tem

ocorrido a garantia do acesso e da permanência aos educandos P.A.E.E. no contexto da BNCC. Tal questão tem como fundamento o fato de que, desde a educação infantil até a educação de jovens e adultos (EJA), a Base Nacional Comum Curricular excluiu em sua versão final, materiais específicos e subsídios para estudantes deficientes e professores, de modo a atender as especificidades e singularidades inerentes a este público-alvo.

2.4 Educação inclusiva: professor, escola e família

A educação dá-se em qualquer lugar, na família, nas indústrias, escolas, instituições esportivas, hospitais, em todos os cantos do mundo. Nesta perspectiva Freire (1999, p. 25) afirma que: “ensinar não é transmitir conhecimento, mas criar as possibilidades para sua produção ou a sua construção”

Nesse sentido deve-se entender a educação como um progresso dinâmico e flexível, que possibilite ao ser humano interagir diretamente com a sociedade, desenvolver suas potencialidades, decidir sobre seus objetos e ações. Neste caso, Carvalho, afirma que a “transformação social é a transformação das condições concretas da vida dos homens” (2000, p. 164). E este é um processo histórico condicionado pelas próprias condições de vida e resultado da ação histórica dos homens.

Prosseguindo, a referida autora ressalta, sem atribuir tamanha responsabilidade aos professores, unicamente, há que reconhecer que eles desempenham significativo papel nessa direção. Para se desincumbirem desse papel, precisam dispor de conhecimentos além daqueles estritamente relacionados aos assuntos que irão lecionar. É necessário que estejam instrumentalizados a promover a educação com o sentido de formação e não como transmissão de conhecimentos, apenas.

Prosseguindo, a referida autora ressalta, sem atribuir tamanha responsabilidade aos professores, unicamente, há que reconhecer que eles desempenham significativo papel nessa direção. Para se desincumbirem desse papel, precisam dispor de conhecimentos além daqueles estritamente relacionados aos assuntos que irão lecionar. É necessário que estejam instrumentalizados a promover a educação com o sentido de formação e não como transmissão de conhecimentos, apenas.

III. METODOLOGIA

A pesquisa acadêmica deve perseguir o rigor científico em todas as suas instâncias, iniciando pela escolha das estratégias de abordagem e das metodologias a serem empregadas na coleta de informações e entrevistas, de modo que aquilo que se tomou como base para todo o

processo de pesquisa e posterior sistematização dos dados e descrição do que se fez, possibilite traduzir as aprendizagens e os caminhos construídos na teoria e prática da vivência profissional e pessoal de cada investigador (BINS, 2013).

A presente pesquisa orienta-se pela abordagem qualitativa por acreditar que esta modalidade de pesquisa possibilita ao pesquisador um olhar mais humanista, holístico e aproximado da realidade dos sujeitos.

Desta forma, a pesquisa qualitativa permite a interação do pesquisador com os sujeitos participantes do estudo facultando-lhes o direito de relatar de forma fidedigna, o que deu certo e o que deu errado, as fragilidades e fortalezas observadas no decorrer da pesquisa. Fazendo desta forma uma interlocução entre a teoria e os dados empíricos (TRIVIÑOS, 2009).

Os sujeitos da pesquisa foram constituídos por estudantes portadores de deficiência e seus professores encarregados de seu processo de aprendizagem. Este estudo foi desenvolvido em uma escola que constitui a coordenadoria distrital 3 da Secretaria de Educação de Estado, da cidade de Manaus – AM. Como base pesquisa para se obter os resultados esperados, foram aplicados questionários fechados em duas etapas: no primeiro momento o objeto de investigação foram os professores e a gestão escolar como os demais colaboradores, afim de conhecer e entender como está se dando a formação de alunos com necessidades educacionais. No segundo momento um questionário foi aplicado para os alunos com intuito de conhecer o perfil socioeconômico, trajetórias, desafios e conquistas que os mesmos tenham vivenciado realizando a comparação de sua formação por meio de relatórios, históricos disponibilizados pela escola.

IV. RESULTADO E DISCUSSÃO

Antes de qualquer intervenção a ser aplicada a esta pesquisa, foram necessário a realização de observações nas dependências da escola, reuniões com a gestão e apoio pedagógico, afim de entender a real situação do ensino aprendizagem que são oferecidos para estudantes PCD.

Na vivência da graduação onde foi realizado uma pesquisa voltada para os projetos políticos pedagógicos, o retorno a mesma instituição se dá desta vez para realização de uma pesquisa voltada para Educação Especial, com ênfase na inclusão de alunos com necessidades educacionais.

A pesquisa começou com um questionário fechado com professores, cerca de 12 professores

participaram da pesquisa foram extraídos apenas perguntas com mais relevância para pesquisa.

Ao serem questionados com a seguinte pergunta: O acesso as dependências da escola, estão de acordo previstos nos dispositivos legais para atender alunos PCD?

Cerca de 80% dos professores informaram que, sim e 20% deles informaram que parcialmente. Em uma reunião questionados em relação a essas não conformidades em relação aos 20%, os professores relataram a seguinte situação:

“geralmente a escola passa por manutenção demoradas, como por exemplo elevador e banheiros adaptados, que resulta na desistência de muitos alunos.”

Neste sentido é verdadeiro o que já citamos nesta pesquisa em relação a grande desistência de alunos por dificuldade de acesso algumas dependências escolares, este tipo de situação é real em diversas escolas do Brasil.

Ao questionamento: Que apoio os professores e instituições tem dos líderes governamentais para solucionar tal problema?

Um quantitativo de 90% dos professores respondeu que *“verbas são repassadas para o governo, porem existe uma demora para realização das devidas amamentações nas demências da escola.”* Os outros 10% não opinaram em relação a este questionamento.

O seguinte questionamento está relacionado com a formação dos professores para atender a demanda de alunos com necessidade educacional em uma visão geral. Sendo questionados: Quantos professores a escola tem a disposição desses alunos? Dos 12 professores efetivos para demanda do ensino na EJA, um (1) professor é para interprete de libras, 1 (um) para salas adaptadas e 1 (um) para atender alunos com deficiência visual ou motora. Em relação a este diagnóstico é constatado a grande deficiência de profissionais voltados para a Educação Especial o que se faz necessário e urgente de novos professores para atender esses alunos.

Diante deste questionamento, tive o relato de uma professora de uma das turmas do Ensino Médio que possuem alunos PCD:

“Em relação a falta de professores, nós da escola estamos trabalhando duro e se dedicando ao máximo para possamos ter êxito nas conquistas de nossos alunos de modo geral, sem a exclusão, e sempre com apoio dos pais e da gestão da instituições, esperar pelos governantes se torna algo cansativo, e o educador não pode ficar de braços cruzados.”

Assim, partindo do pressuposto de que a Educação de Jovens e Adultos seria um espaço de

emancipação e formação para a cidadania e vida adulta, neste caso, dos alunos com deficiência intelectual; cabe questionar até que ponto estes “novos” espaços não se configuram nos moldes das escolas e/ou classes especiais, onde muitos desses alunos conviveram por longos anos.

Neste segundo momento, os questionados das pesquisas foram os estudantes, como muitos desses estudantes precisam ser acompanhados de seus professores, as perguntas foram lidas de forma individual e particular, com intuito de estabelecer uma linha exata de cada perfil que esses alunos apresentavam. Ao todo participaram do questionaram 22 alunos, 8 alunos com necessidades educacionais e os demais alunos são colegas de classe que fazem parte do convívio escolar.

Quando questionado: Quais dificuldades são encontrados diante da sua formação escola e a instituição?

1ª aluno: “as dificuldades encontradas são relacionadas ao difícil acesso que temos em relação algumas dependências da escola, como: banheiro ou acesso a outro andar por elevadores.”

Em questão dos matérias não adaptados o aluno em questão relaciona o uso do recurso do professor, em ser adaptado com sua condição motora. Neste sentindo alguns professores ou colegas de classe ajudam na locomoção, o que tira a alta dependência dos alunos.

2ª aluno: “outras dificuldades que encontramos são ao acesso alguns materiais didáticos não adaptados para acompanhar os colegas de classe.”

Em questão dos matérias não adaptados o aluno em questão relaciona o uso do recurso do professor, em ser adaptado com sua condição visual.

Quando questionado: Quais conquistas foram conquistadas por eles durante sua formação do ensino fundamental para o médio?

1ª aluno: “minha maior conquista foi conseguir chegar até o ensino médio e conseguir compreender que posso evoluir e entrar na faculdade.”

2ª aluno: “a maior conquista é que eu posso contar com meus colegas de classe e interagir com eles sem se sentir excluído.”

E para os demais colegas, fazer parte da formação desses alunos é importante, pois torna-os capazes de serem eles mesmo e aceita-los no seu meio é fundamental para sociedade. A realidade que escola vive é totalmente comum em qualquer lugar do Brasil. Por tanto, oferecer empatia ajuda muito na evolução do ser humano.

Em análise com os relatórios e históricos obtidos pela própria instituição é possível observar que durante 4 anos, a escola recebeu inúmeros alunos PCD, como

também já obteve um número grande de desistência dos mesmos. Ainda em relação aos descritos evidenciados nesses relatórios, muitos alunos com necessidades educacionais conseguiram resultados satisfatórios e conseguiram concluir com êxito o ensino médio.

V. CONSIDERAÇÕES FINAIS

Somos diferentes, temos os mesmos direitos e a escola é para todos. Sabemos e concordamos com esses princípios. Entretanto, quando estamos envolvidos nas tarefas cotidianas na escola, às vezes nos sentimos impelidos a repetir repertórios e ferramentas com os quais nos sentimos mais seguros, pois fomos forjados a partir deles.

Através da pesquisa foi possível reconhecer que mesmo dentro de toda complexidade das relações humanas, o papel da educação é inigualável e insubstituível. Para que este papel tão importante da educação aconteça na prática é preciso qualidade, eficiência, competência, diálogo e afetividade para transformar sonhos em alegrias concretas. O processo de ensino/aprendizagem requer o entendimento de que ensinar e aprender não significa acumular informações memorizadas, mas sim fazer o aluno buscar novas alternativas, fazer escolhas frente a novas situações apresentadas.

Este estudo aponta para a necessidade de repensar e ressignificar a prática pedagógica docente, efetivando a construção de uma metodologia de ensino em que a prioridade seja levar o aluno a “aprender a aprender”, a incorporação de uma proposta pedagógica humana centrada no aluno, que desenvolva atitudes e valores humanos.

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Patch Antenna with Slots and Sar reduced through AMC

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antennas with AMC, SAR reduction.

Abstract— This study proposes a system consisting of a “patch” [1] dual-band antenna [2] with slots, dimensioned for 5G applications. In this device an AMC (“Artificial Magnetic Conductor”) structure was inserted in order to improve the operating characteristics. The AMC plane [3] is formed using a 2 x 2 matrix of unit cells, each with a U-shape and a reconfigurable element. The results compared with an antenna without AMC indicate that the system provides SAR reduction, directivity improvement and gain increase to be discussed in the text.

I. INTRODUCTION

5G is the latest mobile network technology and has the potential to make our lives smarter, safer and more efficient. As the next generation of network technology for mobile applications, 5G offers exciting opportunities in healthcare, education and agriculture. In this way 5G systems promise to drastically change our lives after their implementation, bringing features such as increased speed compared to 4G, increased bandwidth, reduced latency and the explosion in the consumption of interconnected equipment with previously unimaginable amounts of users and new applications. However, the operating range and the expansion of the number of antennas involved, combined to the large-scale use of equipment, increase the risks related to human exposure to non-ionizing radiation. When placed close to the body, an antenna with high radiation or omnidirectional pattern such as a dipole antenna tends to produce increased electromagnetic absorption in the human body due to its proximity during operation. This results in a high Specific Absorption Rate (SAR) [4] value, which potentially affects

the tissues of the human body. The American National Standards Institute (ANSI) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP) have regulated that exposure to human tissue is limited to 1.6 W / kg on average per 1g of tissue and 2 W / kg per 10 g of tissue, respectively. In view of this demand, this work describes a dual-band planar antenna within the frequency range intended for the installation of 5G in Brazil, (as approved by the ANATEL Regulatory Agency) together with an AMC type metamaterial (“Artificial Magnetic Conductor”) [3] designed to reduce the SAR Specific Absorption Rate and further improve the antenna directivity.

II. MICROSTRIP ANTENNA

With the evolution of printed circuit production technology and the ease of construction, microstrip antennas have been used in various equipments. Their relevance is determined by being adaptable to the environment, moldable to curved surfaces, inexpensive and mechanically robust, particularly when mounted on rigid surfaces. Such antennas can be installed in different types of equipments or means of transport such as: aircraft,

satellites, missiles, radar, automobiles, cell phones, demonstrating their enormous versatility [1]. This type of antenna adds competitive advantage in certain applications. The possibility of multiple band and the convenient radiation diagram can be elective differential at the time of manufacture. This also happens with the other characteristics of the microstrip antenna, such as: smaller dimensions, reduced weight, ease of fabrication, low cost, easy adaptation to the surfaces of the devices, good integration with other types of circuits, etc. The modeling of the antenna is directly related to what is intended to be achieved in the final result, such as an antenna with a good bandwidth to be applied to a wireless communication device or with a narrow frequency band to be applied to a frequency filter. Since the beginning of wireless communications, which date from the end of the 19th century, to the present, the increase in research was remarkable and an unexpected evolution in these systems was observed in that period. The advent of wireless telegraph and the use of electromagnetic transmission as a means of information transmission resulted in a significant improvement in the research of components for the infrastructure of communication systems. Among the researched components, one of the main elements that gained prominence, due to its importance, were the radiating elements, popularly known as antennas.

The Institute of Electrical and Electronic Engineers (IEEE) defines the term “antenna” as “that part of a transmitting or receiving system that is designed to radiate or receive electromagnetic waves”. In other words, an antenna is an intermediary structure between free space and the transmitting or receiving electronic device. The connection between the electronic device and the antenna is made through a guiding device, which can take the form of a coaxial cable, a waveguide or a flat transmission line (microstrip type, for example). When electromagnetic energy is transported from the transmission source to the antenna, the antenna is called transmitter, when energy is transported from the antenna to the receiver, then it is a receiving antenna [1].

Since many years, several models have been developed which have emerged for diverse applications. Reflector antennas, loop antennas, short dipoles and horns are among the most common models.

However, in 1953 Deschamps and Sichak proposed a new model in the development of resonator elements. In their work, the construction of low-cost planar antennas in microstrip technology was proposed. The works by Munson (1974) and Kerr (1978) consolidated Deschamps' idea and added new techniques for the construction of microstrip antennas [5].

In cases where space or weight is limited, the use of planar structures as a radiating element for electromagnetic waves becomes attractive. Such conditions are very convenient in, for example: airplanes, satellites, Vant's and mobile devices.

In addition to these characteristics, microstrip type antennas have greater flexibility for adjustments in electromagnetic parameters such as resonance frequency, polarization, radiation pattern, impedance matching and bandwidth [1].

A microstrip antenna consists of two minimally thick metallic layers separated by a dielectric layer, the substrate. These layers are arranged in a planar structure.

The radiating element above the substrate is called "Patch", and it is through this element that the waves are transferred from the antenna medium and radiate to the free space. The patch structure has a direct relationship with the distribution of current and electromagnetic fields in the substrate.

A metal ground plane is placed below the substrate and it works as a ground for the antenna, in addition to acting as a reflector, thus reducing the side and secondary lobes [1]. The structure of a microstrip patch antenna is represented in Fig. 1.

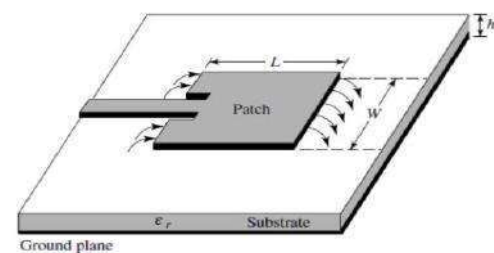


Fig.1 - Representation of a Microstrip Antenna
Source: Adapted from Balanis (2016)

Where, h is the height of the substrate, ϵ_r is the relative permittivity of the dielectric and W and L correspond, respectively, to the width and the length of the rectangular patch.

The layout of the antenna can have different forms. Each of them corresponds to a different mathematical model for the analysis the electromagnetic behavior of the antenna.

The most common shapes, such as the rectangular and circular patch are used more frequently in research and development where the shape is not a fundamental element in the variation of the antenna performance parameters [1].

In general, the possible antenna shapes play important roles in more specific applications, in the case of the rectangular patch will have more general applications. For example, the controlled insertion of slits in its radiating

element can change the component into an antenna dedicated to specific applications. This situation is one of the objects of study in this work.

The intermediate layer of the patch antenna, the substrate, is a fundamental element for antenna design. The physical characteristics of the substrate directly influence some antenna parameters, such as its radiation efficiency, size, bandwidth, etc... Among the materials desired for improved performance, those with greater thickness and lower dielectric constant are preferred, at the cost of one larger device dimensions [1].

However, if the element size is a key condition for the system, thinner substrates with a higher dielectric constant are indicated, with considerably device dimension reduction.

2.1 Antenna Performance Parameters.

When the electromagnetic behavior of the antennas is considered, it is possible to verify that there is a significant dependence between the performance and its main parameters. [6]

As far as microstrip antennas are concerned, the main limitation is the bandwidth. The main reason for the small thickness used is the attempt to minimize the effect of electromagnetic waves that propagate inside the dielectric.

As an opposite result, if we increase the thickness (height) of the antenna's dielectric substrate, the bandwidth increases. However an adverse effect is produced, since the increase in the thickness of the dielectric produces surface waves, which distorts the radiation pattern and usually reduces the radiation efficiency when reaching the edge of the substrate.

Also, the antenna feeding techniques when increasing the substrate thickness are also impaired [6].

Among others, two parameters are of great relevance during the design of an antenna : One of them is the antenna input impedance, associated with the return loss of the power incident on its input. This parameter facilitates the understanding of how the antenna is linked to the supply structure in a given frequency range. The second parameter is the radiation pattern, which represents how the electromagnetic energy is distributed by the antenna in the space.

Regarding radiation there are other dependent parameters, for example, it can be mentioned: the front-to-back, ratio, the side lobes, the level of cross polarization for antennas with linear polarization, the gain, the directivity, the efficiency and the axis ratio for circular polarization antennas.

In order to establish the application of the antenna and determine its performance, this section will analyze characteristics such as: gain, return loss, radiation pattern, polarization and bandwidth.

2.1.1 Radiation Pattern

The radiation pattern of an antenna is defined by Balanis (2011) as a mathematical function or graphical representation of the radiation properties of an antenna as a function of spatial coordinates θ (elevation angle) and ϕ (azimuth angle). The determination of the radiation pattern of an antenna is obtained from the intensity in the far field of the antenna [7].

Figure 2 represents the coordinate system for the radiation pattern of an antenna.

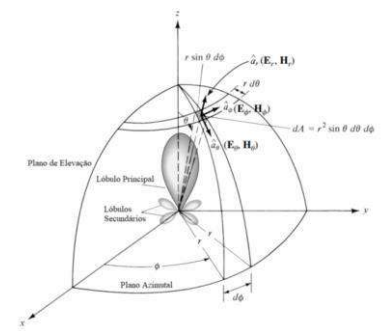


Fig.2 - Microstrip Antenna Radiation Pattern

Source: Adapted from Balanis (2016)

The representation of the radiation pattern of an antenna can be done in either two or three dimensions, the first being a representation of the cut planes performed in the 3D diagram.

The vertical or elevation plane is represented by θ and normally corresponds to 0° or 90° , while the horizontal or azimuthal plane is represented by ϕ and for better visualization is defined as 90° [1].

The radiation pattern and allow to characterize the performance of an antenna. Then, it is possible to estimate e.g., the directivity, analyzing the main lobe as well as the side and rear lobes.

There is no ideal relationship between these lobes for all antennas, allowing the division into two main classes, : omnidirectional antennas and directives, where each one has different applications, depending on the desired coverage, [1].

2.1.2 Directivity, Gain and Efficiency

According to Balanis [1] directivity is given as the ratio between the radiation intensity in one direction and the average of the radiation intensities in all directions, where the radiation intensity of an isotropic source is given by:

$$U_0 = P_{rad} / 4 \pi$$

Relating the radiation intensities according to the definition of directivity, we have:

$$D = U / U_0$$

Soon,

$$D = 4\pi U / P_{rad}$$

It is observed from the previous equation that for an isotropic antenna the directivity has an unitary value, η_s the radiated intensity in any direction is constant.

The calculation of the directivity must be associated with the efficiency of the antenna in question, as the previous equations disregard the resistive and the dielectric losses [56].

According to Balanis [1], the efficiency of an antenna is given by:

$$\eta_0 = \eta_{ed}(1 - \eta_r)^2 \quad [1]$$

Equation 1 presented relates the total efficiency η_0 with the radiation (η_{ed}) and reflection (η_r) efficiencies. The association of the directivity with the efficiency of an antenna provides a third parameter, the gain, which is also a of fundamental importance for application in wireless communication links. Balanis [1] states that the gain of an antenna is the relationship between the intensity radiated in one direction and the intensity obtained if all the input power (P_{in}) were radiated by an isotropic source.

$$U_0 = P_{in} / 4 \pi$$

Therefore, the gain is given by

$$G = 4 \pi U / P_{in}$$

It is observed by the similarity between the equations, the relationship between the gain and the directivity.

These two parameters differ because the antenna efficiency is not unitary, so that not all the input power (P_{in}) is converted into radiated power (P_{rad}). Thus, the following equation can be written.

$$P_{rad} = \eta_{ed} * P_{in} \quad [2]$$

Substituting [2] in the gain equation, one obtains

$$G = \eta_{ed} 4\pi U / P_{rad}$$

Thus,

$$G = \eta_{ed} D$$

This equation optimizes the gain calculation by eliminating the reflection efficiency variable (η_r), which can be different from 1 (one) when there is no perfect impedance matching. To estimate a value to the gain, then the following equation can be used

$$G = \eta_0 D$$

2.1.3 Return Loss (S_{11})

As already mentioned, the return loss R_L is one of the main design parameters of an antenna, as it is a measure that indicates the possibility of the prototype working correctly when built. This parameter determines the relationship between the incident and reflected wave in the direction of the load [7]. Return loss can be calculated as in Equation 3.11.

$$R_L = -20 \cdot \text{Log} |\rho|$$

Where ρ is the reflection coefficient.

It is also possible to obtain the return loss through the analysis of the scattering matrix. Pozar [7] defines this method as the most suitable to derive the relationships between transmission line and load.

III. METAMATERIALS

The term metamaterial can be considered as an artificial compound which exhibits electromagnetic properties not found in natural materials. Also known as left-handed material (LHM), electromagnetic bandgap material (EBG), artificial magnetic conductor (AMC), high impedance surface (HIS), etc.

Metamaterials can also be conceptualized as periodic structures, dielectric or metallic, which behave like homogeneous materials. This periodicity leads to resonant structures that may seem incompatible with a broadband application.

To design an unidirectional antenna, which is the case on many platforms, the antenna must radiate outward. The antenna is usually supported by a reflector or absorption cavity.

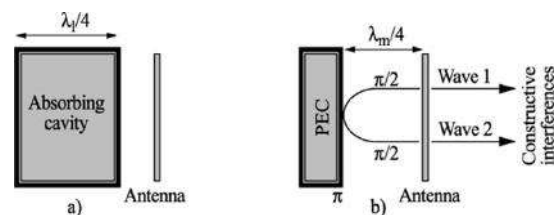


Fig.3 - Unidirectional antenna above the cavity (a); and PEC (perfect electrical conductor) (b)

The solution with the absorption cavity is simple, but half of the radiation is lost (Figure 3a), as all the energy radiated towards it is absorbed. Absorbent materials are heavy and features are difficult to reproduce. Furthermore, the has dimensions close to a quarter wavelength at the lowest operating frequency, which becomes a problem at low frequency applications.

Another efficient technique is to use a reflector composed of a perfect electrical conductor (PEC) to reflect the back radiation (Figure 3b). This technique is ideal in mid-bandwidth, where the constructive interference phenomenon is achieved by placing the reflector at a quarter wavelength (at the center frequency) of the antenna. This solution is inherently bandwidth-limited and can rarely exceed an octave [1].

Among the objectives of this work, it is intended to conceive the combination of directivity improvement, SAR reduction and compactness. Therefore, metamaterials as the artificial magnetic conductors (AMC) have relevant characteristics. While in a conductive metal the reflected wave produce a phase shift of π , the artificial magnetic conductors do not introduce a phase shift (Figure 4).

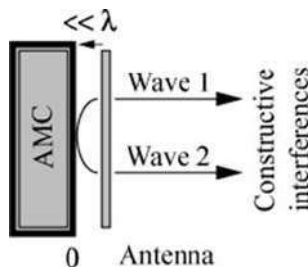


Fig.4 - Unidirectional antenna with AMC

3.1 The design of the AMC unit cell

As a computational validation criterion, initially, a unit cell with square metallic patch is implemented, whose design parameters used are similar to those obtained in the work of Zhang [8].

However, the implementation made here differs basically in terms of the numerical method applied to obtain the phase of the reflection coefficient at the AMC.

In Zhang's work, the study is performed in the time domain using the FDTD (Time Domain Finite Difference Method), while here, the simulations were performed in the frequency domain using the FEM (Finite Element Method), included in a commercial CST software.

In this work, the unit cell implementation consists of a model based on the Bloch-Floquet theory [9]. Essentially, the unit cell of the AMC structure has periodic boundary conditions (PBCs) on its four sides, thus modeling an infinite periodic surface, as it is shown in Figure 5. For simplicity, the metallic patch (in orange on top) and the ground plane (in orange at the bottom) are specified as perfect electrical conductors (PEC).

The space between the metallic radiating element and the earth plane is filled with a dielectric substrate. To excite the structure, a probe is placed, at half-wavelength ($\lambda/2$),

above the metallic track and a plane wave linearly polarized in the z direction is produced.

As in this work the frequency domain is used, different wavelengths are used to excite the AMC surface, representing a frequency window (interval). In the text, λ_i and λ_f will be the initial and final wavelengths, respectively, corresponding to the initial and final excitation frequency, f_i and f_f .

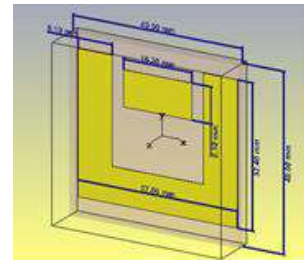


Fig.5 - Unit cell design.

IV. OPTIMIZATION ALGORITHMS FOR THE ANTENNA DESIGN.

From a structural point of view, the frequency response of microstrip antennas depends on the dimensions and geometries involved in the design. Also, the AMC unit cell, including its periodicity, the dielectric substrate used, the type of element used and its geometric shape are important [10]. Several geometric shapes for the those elements have already been described in the literature. Some of these elements are shown in Figure 6.

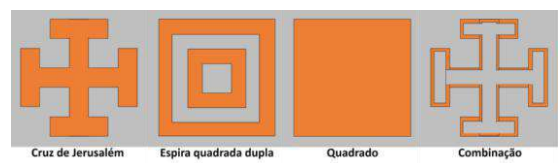


Fig.6: Typical geometries of the elements of a FSS (Frequency Selective Surface). Source: adapted from reference (10).

Although these geometries are simple, more complex shapes include fractal geometries [11; 12; 13]. In the antenna and in the AMC design described in this work, the evolutionary algorithm CMA-ES was used. In order to validate and to improve the optimization algorithms, all new optimization routines, based on evolutionary theories, were checked via test functions. These functions, initially, are single-purpose, in order to facilitate the study.

4.1 ADAPTATION OF THE COVARIANCE MATRIX - Evolution Strategies (CMA-ES)

The CMA-ES algorithm was first proposed by Nikolaus Hansen in 2001 [14]. It is a bio-inspired optimization algorithm. The CMA-ES has a candidate population distribution model (Multivariate Parameterized Normal Distribution) to explore the project space [15]. It is based on the selection and adaptation strategy of the sample population, preserving and modifying the parameters of the strategy, the convergence property of previous generations (Covariance Matrix), using knowledge in the generation of the next generation population. In each generation, the parent for the next generation is calculated as a weighted average of λ candidates selected from μ descendants generated in that generation using a selection (λ, μ).

The next-generation population is generated by sampling a multivariate normal distribution of the Covariance Matrix with the variance in generation g over the generation mean $MN(M(g), (\sigma(g) 2C(g)))$ [16] [3].

The step size $\sigma(g)$ determines the overall variance of the mutation in generation g .

The variable property of step size σ in each generation plays a vital role in controlling premature convergence and convergence close to global optimals.

CMA-ES works through a cycle of steps depicted in Figure 7.

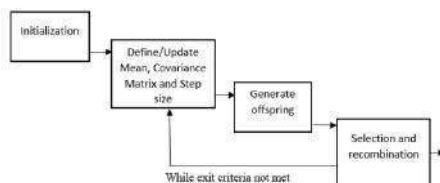


Figure 1. Evolutionary strategies life cycle.

Fig.7- Operation of the CMA-ES through a cycle of steps.

The evolutionary strategy based on the adaptation of the covariance matrix, CMA-ES, proved to be superior to other evolutionary strategies. The fact that it is a model with well-defined mathematical functions makes the algorithm easy to handle when it comes to changing parameters.

V. SAR AND ELECTROMAGNETIC ENERGY ABSORPTION

In the human body, each type of biological tissue has different levels of absorption of electromagnetic energy.

Then, the concept of specific absorption rate (SAR - Specific Absorption Rate) was created in order to quantify the absorbed energy, specifically, in different irradiated tissues [17].

Specific Absorption Rate (SAR) is the rate of energy absorption by the body tissues, in specific watts per kilogram (W/kg).

Therefore, it is the dosimetric parameter used to establish limits to the absorption of radiation due to non-ionizing electromagnetic fields. The concept of dose, energy (or power) absorbed per unit of mass, was developed to set the limits for non ionizing radiation.

When defining the SAR, an attempt was made to establish a measurement unit (dose) correlated with the effects of the body temperature increase.

SAR values depend on incident field parameters, such as: frequency, intensity, polarization and source-object configuration (near or far field); characteristics of the exposed body such as size, internal and external geometry; dielectric properties of different tissues and, also, reflective effects of the soil and other objects close to the exposed body. When the human body axis is parallel to the electric field vector, and under plane wave exposure condition, whole body SAR reaches maximum values. In practice, there is no way to measure SAR values directly on humans. To analyze the effect, computational simulations are used in order to calculate it as in the case of this work. Also, other quantities can be used to assess exposure to electromagnetic energies, such as the electric and the magnetic field intensities, as well as the power density.

Exposure to more intense fields, producing SAR values greater than 4 W/kg, can exceed the body's thermoregulatory capacity and produce tissue-damage.

5.1 EMF Exposure Limits

ICNIRP, the acronym in English of the International Commission on Non-Ionizing Radiation Protection, established recommendations to limit non-ionizing radiation, which are adopted by most countries in the world, including Brazil through Anatel. [18]

Exposure limits are based on the average human body SAR determined under the following conditions:

- Flat wave with the man standing, parallel to the incident electric field, which represents a situation of greater absorption, except in relation to a few special cases.
- SAR should be averaged over a 6-minute time period in order to maintain the relationship between absorbed power and induced heating (increase on the tissue temperature due to the EMF absorption).

As the threshold for irreversible effects is above 4 W/kg, ICNIRP has established exposure levels for professionals (occupational) and the general public with safety factors of 10 and 50 times the threshold, respectively.

SAR factor of safety

Irreversible thermal effects > 4 W/kg

Table 2 - ICNIRP established exposure levels for professionals in the field (occupational) and the general public with safety factors.

Occupational Limit	0,4 W/kg	10
General Public Limit	0,08 W/kg	50

It is important to mention that other EMF exposure effects (such as the "non-thermal effects") are not considered in the ICNIRP recommendations.

VI. PROGRESS OF RESEARCH

In the antenna design, the adequate parameters were obtained through computational analysis, in which the radiating element is divided into sectors of interest based on the analysis of the distribution of surface current densities and, in these sectors, the Balanis equations were applied [1] to determine the resonant bands.

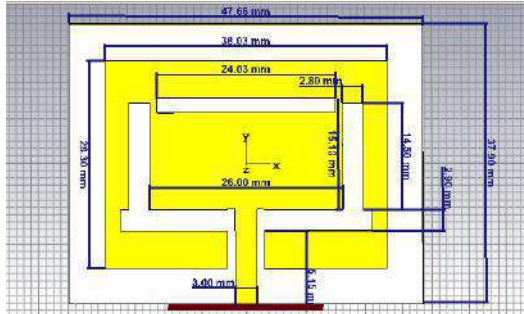


Fig.7 - Dimensions of the produced antenna.

During the implementation of the design, the behavior of different antenna formats was verified and, finally, the need to create an original layout and develop a methodology in order to meet the requirements was defined. Once the "patch" antenna layout was identified, a methodology based on an evolutionary algorithm (CMA-ES) was implemented to determine the most suitable placement of the slots. The CMA-ES algorithm was simulated using a population of variables consisting of the width of the radiating element, length and positioning of the mobile slit, thus obtaining the resonances at the desired frequencies. This implementation was performed using a planar antenna [1] with the insertion of 5 slits (four fixed and one mobile). As shown in Figure 7, the variation of the

movable slit coordinates produced the necessary effect to obtain the double band [2] in the bands assigned for 5G.

The radiating element was developed with the insertion of slits in order to produce double resonance. After creating the layout, the position of the overslot used was inserted and changed (with the implementation of the CMA-ES algorithm) to facilitate the adjustment of the frequency ranges of interest. The structure is based on a Series Band Pass filter:

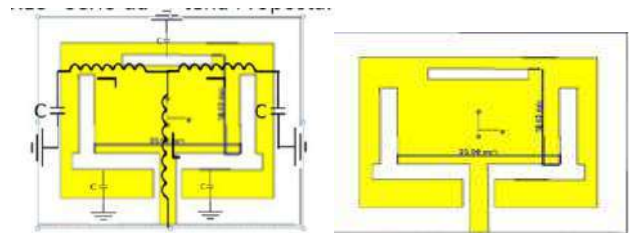


Fig.8 - Antenna geometry and simulation of a Series Bandpass Filter:

Component distribution aspect for modeling in RLC – Proposed Antenna. Based on the analysis of RLC electrical circuits, the angular frequency was calculated.

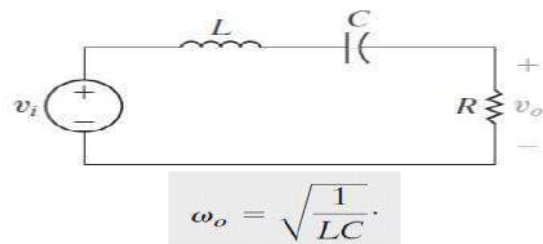


Fig.9 - Antenna equivalent circuit.

Antenna calculation based on Series RLC Band Pass Filter. The initial design specifications considered the target resonance frequencies (f_r), the relative permittivity (ε_r) = 4.7 and the dielectric thickness (h) = 1.6 mm

$$L_p = \frac{c}{2 \cdot f_r \sqrt{\epsilon_r}} - 2\Delta L \quad [1]$$

$$W_p = \frac{c}{2 \cdot f_r} \cdot \sqrt{\frac{2}{\epsilon_r + 1}} \quad [2]$$

From these, the frequencies fr1 and fr2 were calculated [1] based on the parameters L and W and, with the same parameters, two antennas were simulated. The FR4 substrate was used. The CST Studio Suite software was employed, This is a software package for high-performance 3D Electromagnetic analysis allowing the design, the analyses and the optimization of

electromagnetic (EM) components and systems. This simulation package offers analysis of the performance and the efficiency of antennas and filters, the compatibility and the electromagnetic interference (EMC / EMI), as well as the exposure of the human body to EM fields, electromechanical effects in motors and generators, and thermal effects in high power devices. CST Studio Suite is used in engineering to optimize device performance by identifying compliance issues early in the design process and reducing the number of physical prototypes needed and the risk of test failures and recalls.

After the simulation and obtaining the parameters close to the two desired resonances, the CMA-ES algorithm was implemented in the design procedure in order to improve the performance.

7.1 Implementation of metamaterials on the antenna

Metamaterials also known as high impedance surfaces (HIS) have relevant properties in controlling the propagation of electromagnetic waves. Two of these properties are of special interest. First, they can behave like perfect magnetic conductors, so the parallel currents in the image appear in-phase rather than out-of-phase. This feature allows efficient radiation for antennas placed parallel and close to the surface. Second, they limit the propagation of electromagnetic waves in certain frequency bands [19] (“electromagnetic bandgap” or EBG), so that there is no multipath interference and the radiation patterns are smoother.

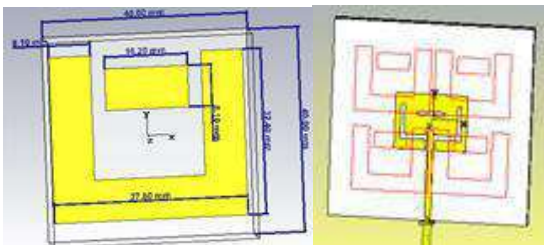


Fig.10 - (a)AMC unit cell appearance. (b) AMC 2X2 matrix.

Fig. 10 (a) illustrates the AMC cell developed in this research and figure (b) shows the cell matrix proposed in order to minimize the effect of SAR. The developed antenna structure consists of five layers distributed as follows: a layer for ground plane (the lowest layer), followed by two substrate layers (FR4) and a layer consisting of the AMC between them. Finally, a layer for the radiant element placed on the top.

To improve the directivity and reduce the SAR, a solution composed of artificial magnetic conductors (AMC)[6] was developed, also known as high impedance surfaces (HIS) or metamaterials. As highlighted in item 6, these

elements have properties in controlling the propagation of electromagnetic waves. Figure 11 shows the Reflection Diagram relating to the AMC unit cell.

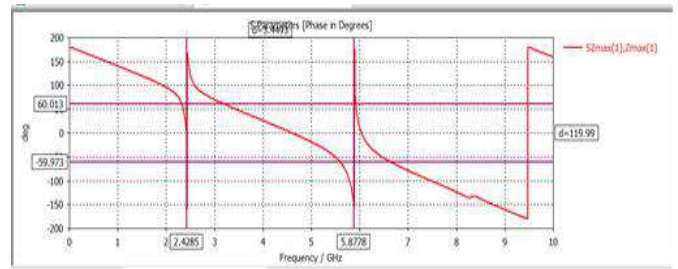


Fig.11 - Unit cell phase diagram

VII. RESULTS

As explained above, in the proposed antenna a metamaterial structure of the AMC type (“Artificial Magnetic Conductor”) was inserted. The AMC plane [3] is formed using a 2 x 2 matrix of unit cells, each U-shaped, and a movable element for adjustment (“overslot”).

The radiant element was developed with the slit insert.

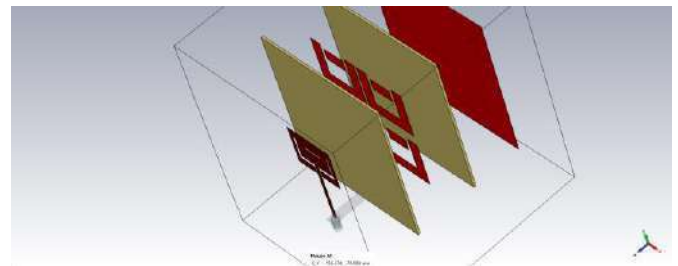


Fig.12 - (a) Overview of the exploded antenna.

In this way, an improvement in the directivity and a reduction in the SAR was obtained. The Microstrip Antenna System with slots[20] + AMC and ground plane (Figure 11). The figures below show results produced in the proposed antenna. For comparison purposes, screens with and without AMC were selected for the following characteristics: Return loss as a function of frequency (S_{11}), gain, radiation diagrams and SAR.

Antenna Patch with slots and AMC.

As described in item 6, the antenna structure developed was presented in the previous item and consists of five layers. In order to analyse the behavior of the antenna and its specific absorption rate (SAR) a phantom [21,22] with electrical characteristics similar to the human body was used. The antenna was positioned 6 mm apart at the center of the phantom.

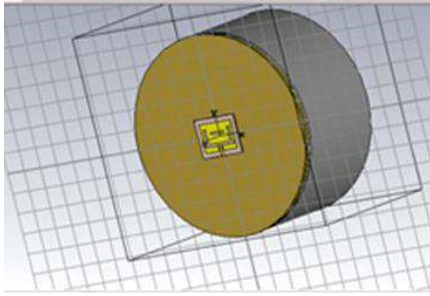


Fig.13 - Antenna was positioned at the center of the phantom.

Initially, simulations of the patch antenna were carried out without the insertion of AMC and the SAR screens obtained with the phantom were collected. The simulated S_{11} , directivity, gain and SAR at 2.4 GHz are shown in Figures from 14 to 22.

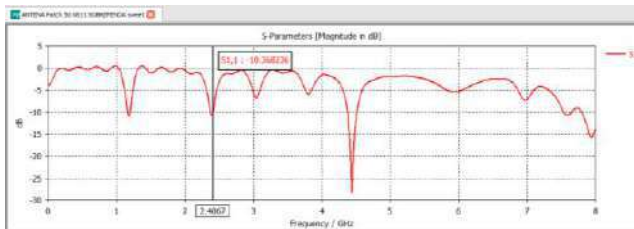


Fig.14 – S11 Antenna Return Loss without the AMC

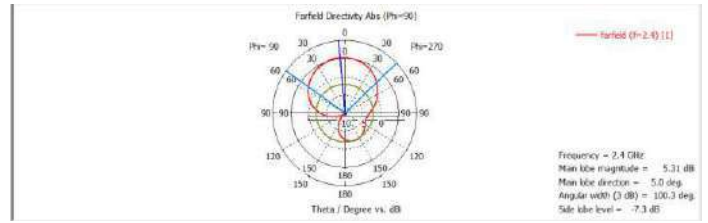


Fig.17 – 2D Radiation pattern at 2.4 GHz without the AMC.

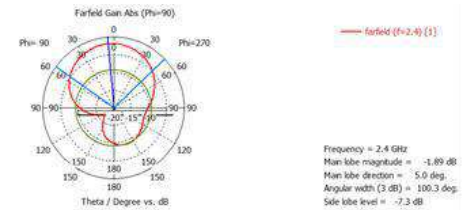


Fig.18 – Radiation pattern at 2.4 GHz without the AMC.

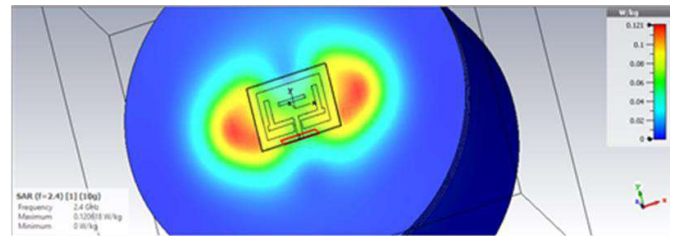


Fig.19 – SAR 10g at 2.4 GHz without the AMC.

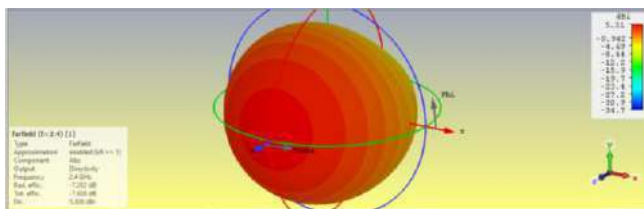


Fig.15 – Radiation pattern at 2.4 GHz without the AMC

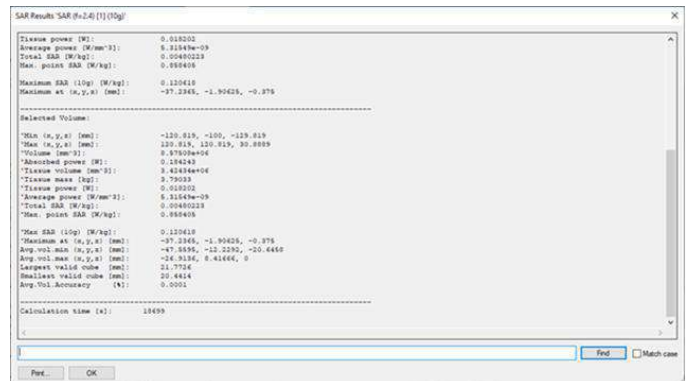


Fig.20 – 10g SAR report at 2.4 GHz

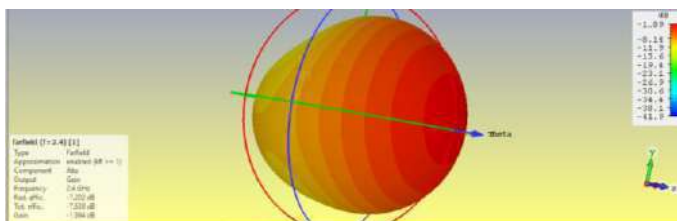


Fig.16 – Radiation pattern at 2.4 GHz without the AMC.

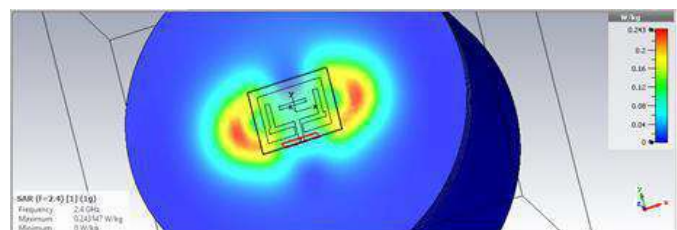


Fig.21 – SAR 1g at 2.4 GHz without the AMC

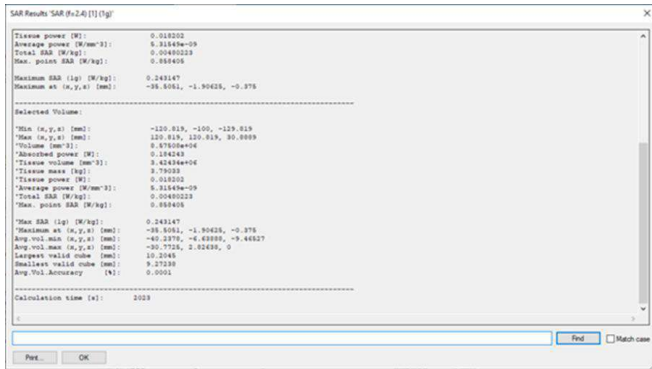


Fig.22 – SAR 1g report at 2.4 GHz frequency

In the second stage of the research the metamaterial structure (AMC) was introduced into the patch antenna and, after the simulation, the return loss S_{11} was obtained.

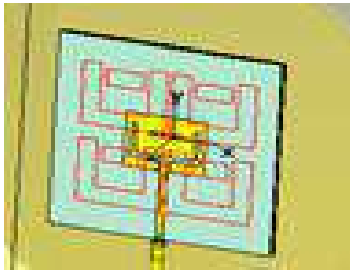


Fig.23 - Antenna and the AMC

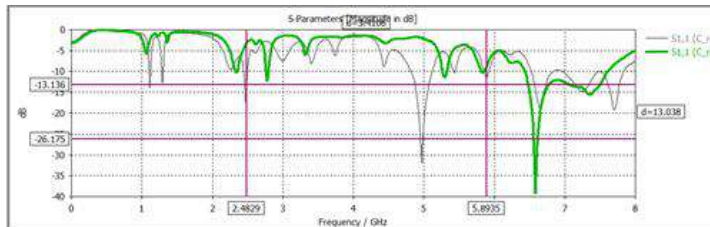


Fig.24 – S11 Antenna and AMC Return Loss

Radiation pattern at 2.4 GHz were obtained from the simulation.

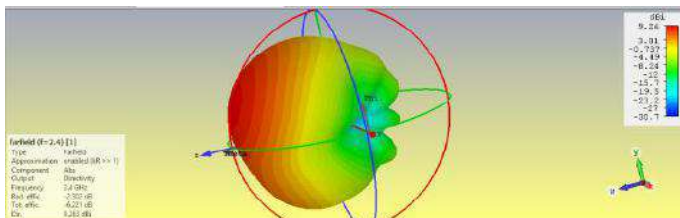


Figure 25 - Radiation pattern at 2.4 GHz with the AMC

Antenna gain with AMC at 2.4 GHz frequency.

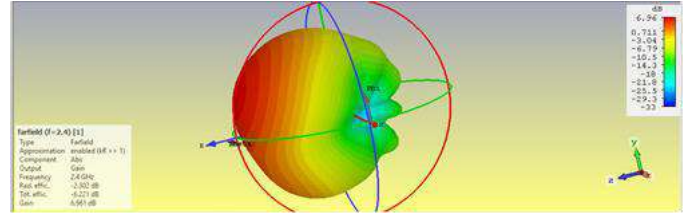


Figure 26 – Radiation pattern at 2.4 GHz with the AMC.

Front to back ratio

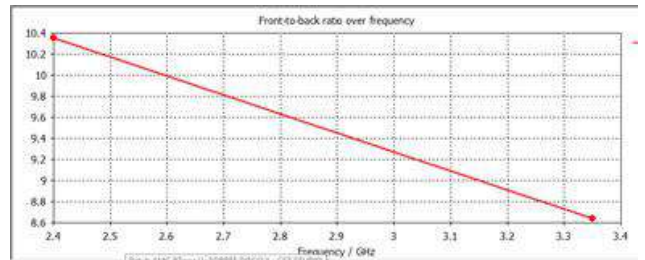


Fig.27 – Front to back ratio at 2.4 GHz

From the simulation, the radiation pattern and DIRECTIVITY directivity at 2.4 GHz were obtained, Also, 1 g SAR was simulated for the antenna with the 2x2 AMC.

SAR 1g

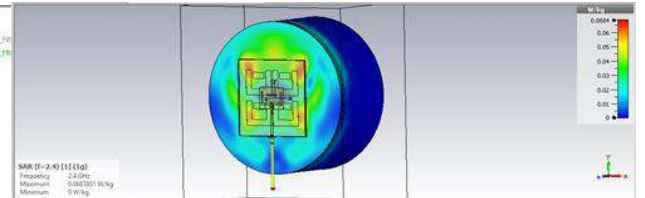


Fig.28 – SAR 1g at 2.4 GHz with the AMC

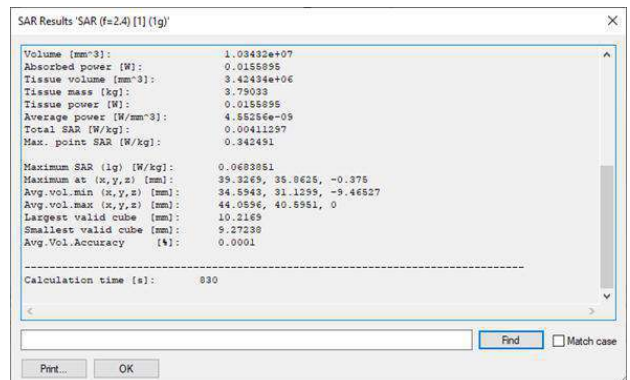


Fig.29 – SAR 10g report at 2.4 GHz

SAR 10g

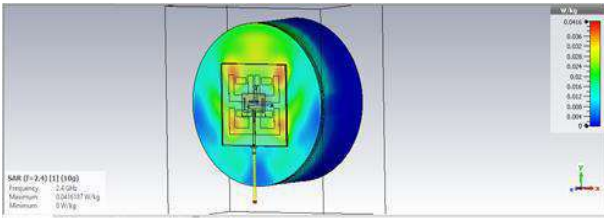


Fig.30 – 10g SAR at 2.4 GHz with the AMC

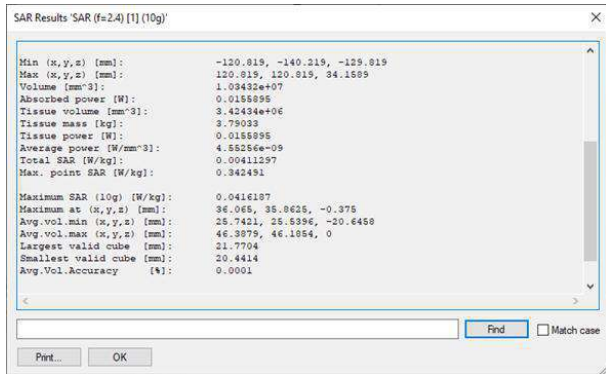


Fig.31 – 10g SAR report at 2.4 GHz

In table 2 a comparison between the antenna with the AMC and without the AMC is presented:

Table 2 – Directivity, Gain and SAR simulated results. (Limits: ICNIRP 2WKg ANSI 1.6W/Kg).

Antenna	without AMC F=2,4GHz	with AMC F=2,4GHz
Directivity	5,31	9,23
Gain	1.89	6,96
SAR ANSI (1g)	0,243	0,0683
SAR ICNIRP(10g)	0,120	0,0416

The results above demonstrate that the proposed antenna system with AMC presented a relevant performance improvement in some characteristics such as: the gain, the directivity and the reduction of SAR when compared to other authors, as shown in Table 3 [2]

Table 3 - Comparison to other authors.

Parameters	[2]	[8]	[9]	[5]	Este trabalho
Size (mm ²)	26 X 16	30 X 25	30 X 30	55 X47	41X28
Substrate thickness (mm)	1.5	1.6	1.6	1.2	1.6
substrate	Rogers RO4003	FR-4	FR-4	Rogers RT5880	FR-4
No. of notches	2	0	3	2	3
Technique applied	Chanfrado	Meia placa	Chanfrado	Chanfrado com DGS	Irradiante com DGS
Gain(dBi)	3.07	not mention	2.65	8.9	
Bandwidth(GHz)	3.1 - 10	1.2 - 12	0.91	67	2.35- 9
Date	2020	2018	2020	2020	2020

VIII. CONCLUSION

In this work, a dual-band patch antenna was proposed to reduce the SAR and to operate in the 5G bandwidth. The slot insertion technique was used to establish the frequencies of operation. The evolutionary algorithm CMA-ES was used as a design tool. The development of an unit cell and the 2X2 matrix for the introduction of the metamaterial of the AMC type, produced important results such as 73% increase in the directivity, 71% reduction in the SAR and 268 % increase in the gain, compared to the patch antenna without AMC.

These results can be improved in future works. The application of the CMA-ES evolutionary algorithm together with the AMC matrix, may result in important results further reducing the SAR, as well as improving the antenna gain and the directivity.

ACKNOWLEDGMENTS

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Potential for implementation of Environmental Sustainability Management (ESM) in a Higher Education Institution in Brazil: A case study

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Keywords— *ecological footprint, indicators,
public institution.*

Abstract— *The positioning of leaders at the Leaders Summit on Climate held this year, makes Brazil rethink series of actions related to the environmental issue. For HEIs, as opinion makers and responsible for the qualification of professionals who work in different areas, it is indispensable this discussion to be made in their environments as well. However, there are few with effective environmental management system or able to present a parameter that clearly shows their concern about the sustainable issue. Some universities have already structured systems involving the dean office. This work aims to identify the main difficulties in the localization of the items that constitute each of these footprints internally in a Higher Education Institution (HEI), by determination of different environmental footprints (ecological, water and carbon) . A preliminary survey shows that in some cases, simple control would assist in the quantitatively follow-up of fuel expenses, among others.*

I. INTRODUCTION

Environmental sustainability in Higher Education Institutions (HEIs)

To what refers to sustainability in HEI, there are numberless works that address the subject (Zaleniene and Pereira, 2021; Carrillo-Sanchez *et al*, 2021; Vaidya *et al*, 2021; Ridhosari and Rahman, 2020; Versteijlen *et al*, 2017; Li *et al*, 2015; Banai and Theis, 2011). Su and collaborators (2018), in their studies on the performance of the universities in the communities, present the calculation of some global indicators, such as the total energy footprint, the carbon footprint and the water footprint, comparing them to other universities. These results can serve as a reference for public policy makers and

environmental managers who seek to implement sustainability in universities and other communities (D'adamo *et al*, 2020; D'adamo, 2019). Gua and collaborators (2019), in a research on the quantification of the environmental footprint in a university campus, identified the environmental footprints (energy, water resources), allowing the creation of policies that encourage the use of alternative energy sources, helping the decision-makers in relation to the sustainability issue.

Marques and co-authors (2018) carried out an important collection of information about indicators in universities, whose results can be checked on website International Sustainable Campus Network (ISCN, 2021). In this work, the authors identify a set of sustainability characteristics from the analysis of the university practices,

enabling the Brazilian Universities to compose their own sustainability indicators, metrics and parameters, in line with the UN Sustainable Development Agenda by 2030.

Abdala and collaborators (2018) defend the idea of creating an Environmental Management Plan for all university Campuses. Nishimura and Malheiros (2018) make a comparative analysis of the integration of sustainability at Universidade Leuphana de Lüneburg with the School of Engineering in São Carlos of EESC/USP, highlighting the fundamental role of sustainability in Higher Education Institutions and how this topic is developed in different contexts (territorial, economic, political, social and environmental). Pantaleão and Cortesse (2018) analyze the global ranking system established by UI GreenMetric World University Ranking (UI GreenMetric), based on 6 categories, namely: Management involvement via HEI policy in relation to the sustainability issue; energy management; waste management; water management; transport management, and involvement of the different courses in the sustainability issue. The advantage of this proposition is to stimulate the academic debate on the subject, in addition to presenting data which may serve as a reference for other HEIs that wish to follow the same path in the design or the adaptation of their campuses, contributing to the transformation of individuals, societies and cities through education.

Yañez and co-authors (2020) present the evolution of the carbon footprint in the different campuses of the Universidade de Talca. For this purpose, they based on the method established by the GHG Protocol, which separates emissions into three scopes: Direct, indirect and other indirect emissions. This indicator also enables comparison between other HEIs, providing metric for monitoring of the efficiency of the actions aimed at the sustainability improvement. Ortegon and Acosta (2019) present the creation and the use of an ecological footprint indicator for the management of actions associated with sustainability in the Colombian universities. In this work, a non-exhaustive list of the different methods for determination of the ecological footprint indicator is presented. In their studies, the authors concluded that ISO 14064 and the Greenhouse Gas (GHG) protocol would be the main methodologies for measurement of the carbon footprint at the universities.

Different authors report use of the carbon footprint as an indicator for monitoring and management of actions associated with environmental sustainability in different HEIs (Karuchit, 2020; Rodrigues, 2019; Mendoza et al, 2019; Filimonau et al, 2020; Li et al , 2020).

Global indicators or programs to help the management of the environmental sustainability actions

The environmental performance management issue is a subject studied before the implementation of the series of standards ISO 14000. In the 1990s, upon the implementation of the quality programs in Brazil and the intensification of the environmental legislation, the different industrial segments started considering the environment issue as important and subject to substantial fines. Upon the inclusion of the ISO 14000 series, different environmental performance indicators were incorporated. Initially, the companies verified the legal parameters monitored by the federal environmental bodies (Brazilian Institute of the Environment and Natural Resources, IBAMA) through the regulations of the National Environment Council (CONAMA) and the parameters set by the bodies of all state of the federation (Instituto Estadual do Ambiente, INEA, for Rio de Janeiro, and Companhia Ambiental do Estado de São Paulo, CETESB, for São Paulo). Upon the realization of the different international conferences, the requirements related to the release standards became more restrictive. Thus, the countries acted for improvements in the environmental performance. The search by different actors for parameters or indicators that would express the efficiency of the environmental management better started (Martini and Gusmão, 2009).

The realization of Rio+10 in 2002 generated a balance of the lessons learned and the practical results obtained from the agreements signed by the countries that participated in Rio-92 (1992). The main discussed points took into account the affirmation of the sustainable development issue, a concept that promotes the interdependence between economy, environment and society, enabling different segments to start the search for parameters that express better how to show the concern, the performance and the improvements obtained in relation to sustainability to the society (Martini and Gusmão, 2009).

Ecological footprint

As presented by Ribeiro and co-authors (2008), this indicator means “the load capacity refers specifically to the maximum load that can be safely and persistently imposed on the environment by the society”. In the methodology proposed by the authors, the indicator incorporates all types of energy and considers only the most important revenues. The model considers five items: Appropriation of renewable resources, extraction of non-renewable resources, absorption of tailings, soil destruction and depletion of water resources. And it operates with average consumption and productivity

values, involving five categories of territory or defined area (biodiversity territory, built territory, energy territory, bio-productive land territory and bio-productive ocean area). As restrictions, the work informs that the system does not act in the social dimension of sustainability and does not consider the interference of social actors. The authors mention that the method is simplistic, because it is not capable of capturing all aspects of reality, as it does not involve all variables of each system. A refinement of the research using the terms 'Ecological footprint in higher Education Institution' reveals only 14 references. Lambrechts, W. and Liedekerke L.V (2014) present the ecological footprint calculation discussing the possibilities to use this tool for operations in campus, educational purposes and development of policies. In this work, the ecological footprint has been determined for all components, namely: Energy, water consumption, generated waste, mobility (employees, teachers and students), the consumables, the main (paper books, computers), the occupation of the infrastructure (buildings and equipment) and food. The results show the contribution of each considered item, enabling more effective management. In the search for environmental management system for HEI, Genta and co-authors (2019) determined the ecological footprint using the same methodology developed by Lambrechts and Liedekerke (2014) for different scenarios, in a campus with more than 30 thousand students. A survey has been carried out with the community on how people imagine the spaces of HEI of the future, how the design of the classrooms and the outdoor areas could meet the new requirements of education and research of the future, in order to favor the interdisciplinary work, the technology transfer and the knowledge sharing, preserving energy, water and all other

natural resources. The research considered energy consumption (electric and fossil), water consumption, mobility, waste and food. Based on the data, a comparison was made among the different ecological footprints, enabling identifying of the sources of highest contribution that should be monitored in order to reduce the environmental impact of the campus.

In their studies about environmental indicators, Nunes and co-authors (2013) assessed the uncertainty in the determination of the ecological footprint. For this purpose, they used the methodology proposed by Wackernagel and Rees (1996), based on HEI in Portugal with 4,950 people. The evaluation concludes that the methodology is useful for evaluation of ecological footprints in several segments, including HEI.

Water footprint

As shown by Hoekstra and co-authors (2011), the concern about water consumption is not related only to what the individuals spend daily, but their habits as well. From the clothes they use to the food they eat. When observing HEI, it can be compared to a small community, where different actors contribute to water consumption. The water footprint is defined as the total volume of water used during the production and the consumption of goods and services, as well as the direct and indirect consumption in the production process (UFCEG, 2021). As presented by Vanham (Year), the water footprint measures both the consumption of fresh water as a resource and its use to assimilate waste.

Hoekstra *et al.* show that the water footprint can be classified according to the categories presented in Figure 1.

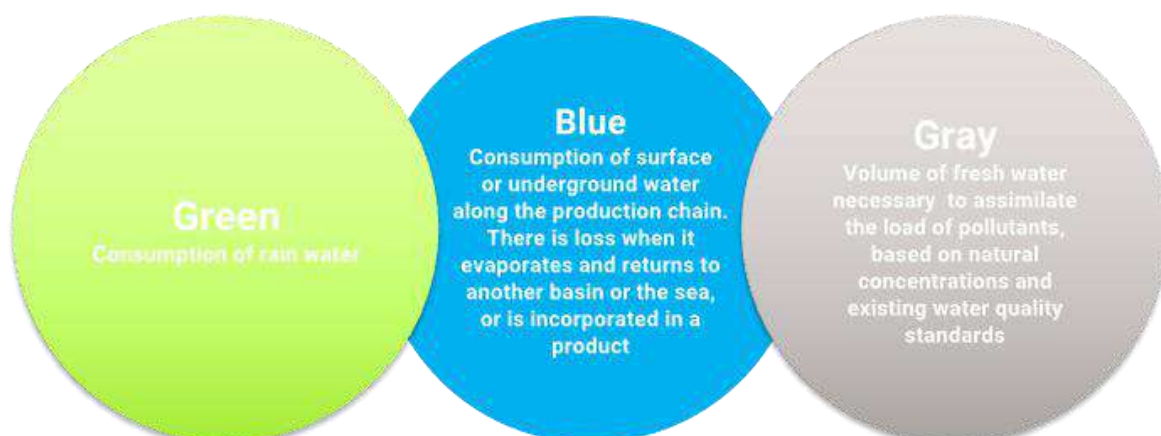


Fig.1. Water footprint classification

The purpose of the knowledge about the water footprint is to explain the scarcity or the pollution of the water and its respective impacts among the developed activities. It enables identification of actions that must be taken to assure the sustainable use of the water resources.

Based on the methodology presented by Hoekstra and co-authors (2011), HEI can be interpreted in different ways, considering the footprint per consumer (student), the footprint by the community (HEI as a whole), or the footprint in a delimited area.

The assessment of the environmental footprint involves:

- Definition of the goal and the scope (whether individual, group, municipality, etc.)
- The determination of the footprint
- The assessment of the water footprint sustainability
- Action plan

Vaidya and co-authors (2021) determined the water footprint considering three parameters: Water, energy and food. The determination considers the direct and the indirect expenses. The work shows water footprint per capita of around 513.19 liters. This value was obtained considering:

a) Energy footprint

$WF_{\text{energy}} = \sum n_i \cdot Ec_i (UCWE_i)$ where Ec_i is the energy consumption and $UCWE_i$, the corresponding factor in terms of water volume

b) Footprint related to food

$WF_{\text{food}} = \sum n_i \cdot FP_i (UCWE_i)$ where FP_i is the type of food consumed and $UCWE_i$ the corresponding factor in terms of water volume

c) The water footprint of the Campus, considering the value obtained from the control of the water, energy and fuel consumption of the university itself (among other controls related to academic activity).

The total water footprint is equal to the sum of the calculated footprints. In the work, it is informed, for example, that the university had 11 buses to transport

students. The correspondence coefficients were taken from works written by Hoekstra and co-authors (2011).

In another work, Gu and co-authors (2019) present the determination of different ecological footprints (energy, water and carbon). As already presented by Vaidya and co-authors (2021), the water footprint is calculated considering three components: The direct water footprint, which corresponds to the water consumed within the campus; the energy water footprint, which is equivalent to the water footprint related to the energy consumption (in this case, for each type of energy – electric and fuel), and the water footprint of the food preparation. The total is equivalent to the sum of the three footprints.

Carbon footprint

Yañez and co-authors (2020) determined the carbon footprint using the Greenhouse Gas (GHG) Protocol, carried out in three scopes: Direct, indirect and other indirect emissions.

By using this method, the consumption of each type of energy (electric and fuel) is transformed using an emission factor associated with the respective category, namely: $kg\ CO_2eq/m^3$, tCO_2/kWh , $kgCO_2/traveled\ km$. The sum of these values defines the carbon footprint, where X_i and F_i are the amount of energy (LPG, diesel and electricity) and the GHG emission factor per type of energy, respectively. This indicator enables identification of the items which effectively impact the CO_2 emissions directly or indirectly.

$$CF (tCO_2e) = \sum_{i=1}^n (X_i \times F_i)$$

II. METHODOLOGY

The present work was based on a preliminary survey about research related to the determination of the ecological footprint in different HEIs, in Brazil or abroad. Therefore, a search was made in the Scopus database for to its relevance in the academic world, disregarding gray literature. With the results from the search, a screening was made aiming to collect only articles related to higher education institutions. By reading more specific publications, procedures and data necessary for consideration in the studied HEI were obtained. This stage was essential, once the analyzed HEI lacks a lot of data.

Thus, the calculations for determination of indicators (ecological, water and carbon footprint) are taken as estimates based on parameters from the literature. The composition of the HEI case study scenario was built based on the collection of data obtained from the Campus administration and official information available on the world wide web.

Case study

Location of HEI, State University of Rio de Janeiro (UERJ)

Situated in the city of Rio de Janeiro, UERJ is located in the Maracanã district, the central district of the city of Rio de Janeiro, served by different modes of public transport (railway system, subway system and different bus lines). Figure 2 shows the localization of the Campus.



Fig.2. Localization of UERJ, Campus Maracanã.

The total area of the campus is 289,629 m², 120 m² of which correspond to the garden area. A total of 18,606 students, 2,251 teachers and 4,080 servants. The campus contemplates 33 academic units, 156 departments and 557 laboratories (UERJ, 2019).

Its organizational structure operates with Superior Council that reports to the Dean and sub-deans (pro-deans), there are the dean advisory bodies, the different administrative bodies, and finally, the academic units. Unlike a company, where the sector responsible for the environmental part is well defined, public HEIs in Brazil have established the sectors responsible for health and safety, with the environmental part integrated into one of these sectors. The responsibility for the monitoring of the facilities (electricity, water, control of garbage collection, gardening, etc.) is under the responsibility of the city hall which administers the Campus. The different academic units are responsible for the specific studies or prompt initiatives associated with the environmental issues (scientific initiation projects, extension projects, course graduation monographs, master's and doctor's degree theses).

The purpose of this study is to see the sustainable profile of the aforementioned HEI, which is public, in relation to the indicators water consumption, land use and greenhouse gas emissions. This study will help to identify the situation of the analyzed HEI regarding the impacts pursuant to its activities, enabling its ranking in relation to other HEIs which might adopt similar monitoring of environmental parameters. The work will also assure the identification of the main problems to be faced for the creation of a management program, contributing to the financial cost reduction.

III. RESULTS AND DISCUSSIONS

In a survey made on the world wide web and on the official site of the Institution, it was found that there was not defined and broadly disclosed environmental management policy. The actions associated with the environmental issues are prompt and not integrated.

Through interviews and information collected from the Administration, it was found that the Campus Administration takes actions to reduce the energy consumption. For example, installation of solar panels in the university canteen to heat washing water in the kitchen and installation of a pilot system for collection of condensed water from the air conditioners to use in gardening.

In preliminary consultations, important initiatives of the Institutes can be seen at HEI, such as collection of rainwater. Although they are pilot projects and restricted to academic and research level, they show potential for future deployment. In addition to these initiatives, certain graduate and postgraduate programs address the environmental issue. This topic is constantly the focus of scientific initiation, master's and doctor's degree projects within HEI.

The assessment of the curriculum of the graduate courses offered at HEI revealed the existence of 7 courses that adhere to the environmental topic (Biological Sciences, Chemical Engineering, Chemistry, Mechanical Engineering, Cartographic Engineering, Geography and Tourism). The level of adherence was based only on the finding of courses offered that commented on "environment", "ecology" or "sustainability". The subject flowcharts were collected from the pages of the respective courses. It shall be pointed out that the number of mentioned subjects may be higher, once the curriculum of 3 courses was not provided. The curriculum is available only for 60% of the analyzed courses. Only 11 mandatory subjects of this contingent explicitly adhere to the environmental topic. There are also 12 elective courses available to be offered. The Biological Sciences course

offers the highest number of them, both mandatory and optional.

Carbon footprint

The determination of the carbon footprint adopted in this work followed the methodology presented by Yañez *et al* (2020). Scope 1 GHG emissions were estimated, i.e.:

Stationary combustion – fuel burned by stationary equipment owned or leased by the small business to operate under their management, for example: boilers, generators, furnaces.

Mobile combustion – fuel burned by mobile equipment, such as car, truck, pickup, forklift. In this case, the studied HEI does not control the volume of fuel consumed, but the movement of financial resources, which is limited by the budget. Initially, an estimated average monthly value of diesel and gasoline will be considered. It is admitted that the gas consumption is restricted to the canteen

Fugitive emissions - initially they will not be accounted for as there is no effective maintenance program with information that enables estimation to be made

Note: Expenses for the student travel: As shown above, the localization of the campus is central and well served by different modes of public transport. Thus, as a preliminary assessment, a survey was made among students from the institution to identify the neighborhood where they live and the means of transportation used. These data will enable estimation of fuel expenses related to the travel of the students to the campus.

For emissions due to the use of energy (scope 2), for the electric energy consumption, the monthly/annual survey made by the Campus Administration was considered.

For other indirect emissions considered in scope 3 (emissions generated by employees and professors traveling to work, travel of employees), the data was collected from the human resources sector of HEI.

The emission factors used in the determination are shown reduced in Table 1.

Table 1. Factors used to determine the equivalent emissions of CO₂ source Pablo Yañez P., Sinha A. and Vásquez Z.(2020).

Unit considered	Source	Emission factor (GHG)
University Canteen	Natural Gas (l)	1642 kg CO ₂ /m ³
IES Vehicles	Diesel / Gasoline (l)	2646 kgCO ₂ / m ³ (diesel) 2241 kgCO ₂ / m ³ (gasoline)
Electric systems *(IES)	(kWh)	0.3972 t CO ₂ / MWh
Paper	Consumption / student.day	0.939 kg CO ₂ /kg
Residue for treatment	(kg)	0.421 CO ₂ /kg
Residue for Recycling	(kg)	0.400 CO ₂ /kg

Calculation of carbon footprint

Scope 1

Type of Fuel (by IES) (*)	Consumption/month	Total m ³ (year)	tCO ₂ equiv	Factor
Gasoline	3000 (liters)	36	80.676	2241 kg CO ₂ /m ³
Diesel	1000 (liters)	12	32.112	2676 kg CO ₂ /m ³
Gas (**)	0.00243 kg/meal*day	691	1135.09	1642 kg CO ₂ /m ³
Total 1			1247.96	

(*) Not considered students and professors traveling to access the campus

(**) Estimated expenses at the university canteen (UC)

Item	Average consumption (per meal)	Reference
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Water	24.8 L (Range from 20 to 30 L)	Silva K.M.B (2019)
Electric energy	1.28 kWh (0.2 – 1.3)	
Gas	0.00243 kg/meal	

The total number of effective days per year was estimated based on the official 2020 calendar (DOU, 2020). According to it, in Brazil, there were 254 business days, with 9 national holidays and 52 weekends.

Regarding the number of meals served, due to lack of information, an estimate of the ratio meal/total number of students was made as shown in Table 2.

Table 2. Study of the average meal supply capacity in university canteens.

Estimation (Meal; day / student)	Work	Source
500 / 8352 = 0.06	University canteen - challenges to serve meals to UFRA community and not the garbage collectors	https://progep.ufra.edu.br/attachments/697_ESTUDO%20DE%20CASO%2003.pdf
7180 / 48045 = 0.15	DAC University Canteen - UC	https://www.ru.unb.br/index.php/186-categoria-ru-em-numeros
704 / 1767=0.9	Proposal of a Policy for the University Canteens at UNESP	https://www2.unesp.br/Home/cope/documentos/propostaru_11_2016.pdf
7000/47254 = 0.15	The “big tray” beyond the canteens: achievements and challenges of one of the largest university canteens in the country	http://www.uff.br/?q=noticias/27-03-2019/o-bandejao-para-alem-dos-refeitorios-conquistas-e-desafios-de-um-dos-maiores
1000/15185 = 0.06	School Canteen	http://www.unirio.br/prae/nutricao-prae-1/setan/restaurante-escola

Using a conservative mean(0.1 meals / student).

Total students in the Maracanã campus - 18,606 (data obtained in the survey made by the Department of Academic Affairs (DAA) 2021 of the studied HEI, with this total, it will be estimated that UC of HEI provides a total of 1860 meals / day

With these considerations, the consumptions for UC are:

Electric energy/year = (1.28 kWh/meal*1860ref/day*254days/year = 604,723 kWh/year)

Natural gas/year = (0.00243 kg/ref*1860 ref/day*254days/year = 1148 kg/year

Considering gas density of 2.5 kg/m³

Gas consumption = 459m³/year

Based on the calculations made, it is estimated that the carbon footprint of the studied HEI related to scope 1 gases is equivalent to 6710.1 tCO₂ eq/student

Scope 2

Item	Estimated annual consumption	tCO ₂ equivalent	Factor
Electric energy canteen (*)	604.723 MWh/year	240.19	0.3972 tCO ₂ /MWh
Electric energy Campus (**)	16313.22 MWh/year	6479.6	

(*) reference Silva K.M.B (2019)

(**) Estimated consumption of the consumption in the campus (actual data was not provided by the Administration of the studied HEI campus)

Average value	Reference
96.17 kwh/m ²	Universidade Federal do Vale do São Francisco https://portais.univasf.edu.br/secad/relatorios-e-indicadores/consumo-de-energia-eletrica-1 , access 05/06/2021

Estimate= 96.17*(169629 m² built area) = 16313.22 MWh/year

Scope 3

Scope 3 expenses involve knowledge about expenses related to employees' trips and travel, student travel, and waste treatment expenses.

As in the studied HEI there are no controls related to waste generation, both in the campus and in the university canteen, a search was made on the internet, as shown in Tables 3 and 4.

Table 3. Bases for estimation of waste generation in an academic canteen.

Work	Mean	Reference
Solid waste generation indexes in large industrial canteens	Composition 72.5% organic matter and 27.4% recyclables. The average waste generation index was 59.3g/meal, highlighting the return with the highest contribution (19.6g/meal) and the clean leftover stage as the smallest waste producer (12.5g/meal)	Ribeiro, M.L <i>et al</i> (2018)
Diagnostic of the solid waste produced at the ufrn university canteen	Average per capita of solid waste 0.2 Kg.	Carneiro <i>et al</i> (2010)
Generation of organic solid waste in a university canteen in São Paulo/SP	Per capita of the leftover-intake in the period was 60.8±9.4g	Domingues <i>et al</i> (2016)
Analysis of the solid waste generated in the university canteen of the institute of nature and culture at ufam	Average 60g per capita/day	Sanches <i>et al</i> (2016)
Waste generated in the university canteen in a public university in Alto Solimões, Amazonas, Brazil	Average 67g per capita	Silva <i>et al</i> (2021)
Solid waste management: a study at the university canteen of UFRPE considering the environmental agenda in the public administration	The total leftover-intake per capita in the first six months 2018 was 17.23g	Gonçalves M.M and Albuquerque L.L (2018)
Generation of organic, recyclable and tailings waste by the university canteen in Area 1 of the USP Campus in São Carlos: diagnostic and proposal for adequate disposal	59.4 g per capita	Miranda, G.S (2018)

Mean of waste generation of 50 grams per capita in a university canteen will be considered

On page <https://super.abril.com.br/mundo-estranho/quanta-comida-uma-pessoa-adulta-come-em-um-ano/> the following annual food consumption information is also stated: Milk – 163 liters / Meat – 47.5 kg / Banana – 33 kg / Raw rice – 30 kg / Coffee – 8 liters / Tomato – 11 kg / Bread – 18 kg / Salt – 3.5 kg / Onion – 15 kg / Lettuce – 11 kg

Table 4. Estimate of common waste generation in HEIs in Brazil.

Reference	Average value	Access
Diagnostic of the urban solid waste at a private university	At the university between 0.12 g/inhabitant day and 65 g/inhabitant day	Lins, E.A.M <i>et al</i> (2018)
Generation and Composition of Solid Waste in University Campus	0.47 kg/day.user	Ishak N.R., Mahayuddin S.A and Mohamed, M.R (2013)
A review of waste generation, characterization and solid waste management practices using bottoms-up approach in educational buildings.	59.20 g/user/day	Talsania P and Modi, N (2019)
An average value of 57gr/day*student will be considered (RSU of residence is higher due to the inclusion of the food waste, among others, and will not be computed)		

Estimate of the waste generation for treatment

Total = 57gr/day*student*254 days*18606 students = 267.37 t

Calculation of the carbon footprint for Scope 3

Item	Estimated consumption	tCO ₂ equivalent	Factor
Residue for treatment	267.37 t/year	113.4	0.421 kg CO ₂ e/kg
Paper (*)	54.32 t/year	51	0.939 kg CO ₂ e/kg
Student travel expenses (**)	NC	NC	-
Residue for Recycling (***)	PET 400 kg/month PP 180 kg/month	2.78	0.400 kg CO ₂ e/kg

(*) Bases for identification of the average paper consumption by students in HEI

Due to the lack of control over the consumption of paper in the Campus, its average value was calculated based on the references shown in Table 5.

Table 5. Bases for estimation of the paper consumption in the studied HEI.

Researched work	Mean	Reference
Diagnostic of A4 paper consumption: the case of the Minas Gerais Federal Institute - campus Governador Valadares-MG	2 to 3 sheets/ day.student	Penna <i>et al</i> (2014)
Analysis of A4 paper consumption in the dean's office of UFMG: proposal for rational use, cost reduction and environmental impacts	2 sheets / student.day	Macedo, D.M.L (2016)
Assessment of the impact of the paper consumption	4 sheets / day.student	Bonifácio, M.A <i>et al</i>

in a higher education institution		(2016)
Double-sided printing: reduction in the paper consumption at UNIMEP	1 sheets / day.student	Carvalho, A.L (2011)
The A4 paper at Universidade Federal de Goiás - Regional Catalão: an approach to the use of this consumable with environmental sustainability bias	1 sheets / day.student	Santos,J.P (2017)

Diagnostic of the impact of the paper consumption: An analysis of the Ecological Footprint in the Campus of Tupã, UNESP	2 to 3 sheets / day.student	Pires L.F <i>et al</i> (2016)
Based on the survey, this work will consider between 2 to 3 sheets / student.day		

(**) (not considered NC)

(***) Survey of the Campus Prefecture

Paper footprint: Base operating with the average value of 2.5 sheets/student.day

Total = $(18606) \cdot (2.5) \cdot (254/500)$ (paper/ream) = 23629 reams/year

PEpaper = $(23629) \cdot (1t/435 \text{ reams}) = 54.32 \text{ t}$

Preliminary carbon footprint = $6886.68 / 18606 = 0.46 \text{ tCO}_2\text{eq} / \text{student.year}$

Carbon Footprint = $0.37 \text{ tCO}_2\text{eq} / \text{student.year}$

Within the range if compared to the reference, not considering the expense for transport (range 0.5 to 0.9 t CO₂eq / student)

Water footprint

The water footprint for HEI was determined according to the methodology presented by Vaidya and co-authors (2021), which has already been commented. Preliminarily, as the analyzed HEI does not have several control mechanisms, the consumption of food and water will be estimated based on data available in Scopus and/or Science direct databases).

The estimated consumption of fuels used internally in the analyzed HEI was determined based on the information provided by the transport sector of the university. The time spent by students in transit to travel to the university was estimated based on geographic and official data provided by HEI.

The university provides data indicating the municipalities and the districts where students live. From this survey, considering that the university is central and served by different modes of public transport, the criteria for determination will be:

- Students who live in distant places with access to the train system: The average traveling distance will be computed and multiplied by the total number of students in the region (neighborhood or municipality). For residents with access close to the metro, the same consideration will be made. For the group that is not served by these two modes, travel by bus will be considered. Traveling by car will not be considered.
- To build this scenario, expenses for teachers and employees travel will not be considered.
- 254 school days per year will be considered

Based on the work of Júnior *et al* (2018), the water consumption was estimated at 33 liters of water per person during the day. The study considers toilets, excluding consumption in canteens for teachers and employees. (read the Water footprint calculation manual, mainly that resulting from indirect consumption, namely consumption for paper production, etc.

Annual consumption/buildings = $33 \text{ (liters/person.day)} \cdot 254 \text{ (days/year)} \cdot 18,606 \text{ students} = 155955.5 \text{ m}^3/\text{year}$

Annual canteen consumption = $19 \text{ (liters/meal,day)} \cdot 1860 \text{ (ref.day)} \cdot 254 \text{ (days/year)} = 9.97 \text{ m}^3/\text{year}$

Item Water	Estimated annual consumption m ³ / year	Total people / day
Average consumption of the buildings	155955.5	18606
Consumption in the canteen	8976	1860

Energy consumption

Type of Fuel (by HEI) (*)	Consumption / month	Total m ³ (year)
Gasoline	3000 (liters)	36
Diesel	1000 (liters)	12

Gas	0.00243 kg/meal*day	691
Electric energy canteen		604.723 MWh/year
Electric energy Campus		27853 MWh/year

(*) used in the calculation of the carbon footprint

Food consumption

Food (*)	Individual consumption/year kg	Total kg
Cereals and vegetables	39	72540
Fruits	28.9	53754
Milk	163	303180
Meat	47.5	88350

(*)(estimation in the calculation of the ecological footprint)

Paper Consumption

Amount per capita (*)	Annual consumption	Total in mass
2.5 sheets / student*day	36290 reams / year	54.32 (t/year)

(*) estimated in the carbon footprint

Calculation of the Water Footprint

Items	Annual consumption	Coefficient of Equivalence	Equivalent in m ³ water
Energy			
Gasoline (*)	36 m ³ (year)	0.105 Gal / mile	13.18
Diesel (*)	12 m ³ (year)	0.08 Gal / mile	5.8
Gas	691 m ³ (year)	2.51 L/kg LPG (**)	4.35
Electric energy canteen	604.723 MWh/year	0.106 m ³ / kwh	64,100.63
Electric energy Campus	16313.22 MWh/year	0.106	1,729,201.32
Food			
Cereals and vegetables	72540 (kg/year)	1644 l/kg	119,255.76
Fruits	53754 (kg/year)	962 l/kg	51,711.34
Milk	303180 (kg/year)	1020 l/kg	309,243.6
Meat	88350 (kg/year)	15415 l/kg	1,361,915.25
Paper	54.32 (t/year)	300 to 2600 m ³ /ton (using average value 1450)	78,764
Water canteen (m ³)			8976.36
Water university (m ³)			155,955.5
Total (m ³ /year)			3,879,143.0
Footprint / built campus area			22.86 (m ³ /m ² .year)
Daily footprint per			0.82 m ³ /student.day

capita			820 (l/student.day)
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(*) not considering the spent upon the students' access to the university

- a) Equivalence for gasoline: 0.07 – 0.14 gal H₂O/mile. = using average value = 0.105 / Average consumption of one car 14 km/liter

Total traveled = 36000 L *14km/L = 504000 km = 33171 miles

- b) Equivalence for diesel: 0.05-0.11 gal H₂O/mile (using mean = 0.08 gal water / mile) / Average consumption of an urban bus 2.57 km / L

Total traveled = 12000l*2.57 = 30840 km = 19163 miles

- c) Equivalence for gas consumption (Density 2.5 kg/m³) considering factor 2.51 l/kg lpg (Kandananond, 2018)

Ecological footprint

The ecological footprint of HEI will be estimated using the methodology described by Ortegog and Acosta (2019). The global ecological footprint and the footprint by students will be estimated for first comparison of the results with the values reported in the considered work. As the studied HEI does not have a series of necessary controls, several considerations will be made (and identified) and referenced for their subsequent implementation.

The seven items will be considered, namely: Energy (electric), water, waste, fuel from mobile sources, paper, food and building.

Considerations regarding the items included in the calculation

- d) **Energy consumption:** In this case, only the electric energy consumption already calculated in the carbon footprint estimate will be considered)
- e) **Water footprint:** The work associates the total water consumed in the campus and compares it with the volume of Olympic swimming pool
- f) **Waste footprint** (kg or ton) The work considers non-hazardous waste (i.e., organic, recyclable, common and inert waste) and toxic waste (biological and chemical). The result is expressed in the number of trees necessary to absorb the generated emissions (species Samanea saman). In this case, there is no control in the studied HEI, so the internet search which has already been made will be used both for the generation from UC and in the campus.
- g) **Energetic footprint of mobile sources.** The estimation considered in the calculation of the carbon footprint will be used. The result is expressed in the number of trees necessary to absorb the generated emissions (species Samanea saman)
- h) **Paper footprint:** This footprint, measured in reams, includes virgin fiber paper, recycled fiber and ecological paper (e.g. bagasse fiber). The results are expressed in terms of the number of trees (i.e. Samanea saman) necessary to produce this quantity of paper. As there is no control of this type of material in HEI, an estimate based on means verified in studies identified on the internet will be used, already elaborated in the carbon footprint
- i) **Food footprint:** A typical menu of a traditional meal (vegetables, proteins, etc.) within a normal diet will be considered. These results will be compared with the calories necessary per day (in a single meal). An internet search indicates that the annual consumption of a person is 39 kg cereals and vegetables; 28.9 kg fruits; 27.1 kg greenery; and 25.4 kg meat¹.
- j) **Land occupation (or building) footprint.** Finally, the built land footprint measures the area used for buildings and infrastructure. This footprint (measured in m²) includes buildings, parking lots, roads, forest and planted vegetation. The results are expressed in units equal to a standard football pitch. In this case, the available data shows that the non-built area of the campus is 120 thousand m² and the total built area is 160,629 m²,

Calculation of the Ecological Footprint

Parameters for determination of ecological footprint Source: Ortegog, K. & Acosta, P.(2019).

Parameter	Emission Factor (EmF)	Equivalence Factor (EQF)	SRL (*)	Consumption (C)	Footprint (gha/year)
Electric kwh RU	0.2 kg (CO ₂ / kWh)	1.29 (gha/ha)	(0.000192 ha-year/ kg CO ₂)	604,723 (kWh)	29.55
Electric (IES)	0.2 kg (CO ₂ / kWh)	1.29 (gha/ha)	(0.000192 ha-year/ kg CO ₂)	16,313,220 (kWh)	808

Water (IES)	0.5 (KCO ₂ /m ³)	1.29 (gha/ha)	(0.000192 ha-year/ kg CO ₂)	155,955.5 (m ³ /year)	19.31
Water (Water (RU))	0.5 (KCO ₂ /m ³)	1.29 (gha/ha)	(0.000192 ha-year/ kg CO ₂)	8976.36 (m ³ /year)	1.11
Waste (RU) (**)	0.557 kg /CO ₂ kg non-toxic	1.29 (gha/ha)	(0.000192 ha-year/ kg CO ₂)	23.62 t/year	3.25
Waste (IES) (***)	0.557 kg /CO ₂ kg non-toxic	1.29 (gha/ha)	(0.000192 ha-year/ kg CO ₂)	361 t/year	49.8
Paper		2.10 (gha/t.paper)		23629 reams / year	114
Cereals and vegetables	0.0017 ha-year/ kg.grains			72540 (kg/year)	123.3
Fruits	0.0005(ha –year/ kgfruits)			53754 (kg/year)	26.8
Milk	0.0011 ha yr kgmilk)	0.46 (gha/ha)		303180 (kg/year)	153.40
Meat	0.0069(ha- year/ kgmeat)	2.53 (gha/ha)		88350 (kg/year)	1542
Built area		2.53 (gha/ha)		16.9629 (ha)	42.91
Total					2913.42

(*) land sequestration rate, which is the average forest area required to sequester 1 kg of CO₂ per year; BL = built land, P; Productivity = 1 t paper/435 reams

(**) base: 1860 (user students), (***) base: students/teachers/servants (total 24397 people)

Equations used

a) Footprint related energy: $PE_{\text{energ.}} = C \text{ (Kwh)} * Emf * SRL * EQF$

b) Footprint related to water: $PE_{\text{water}} = C \text{ (m}^3\text{/year)} * EmF * SRL * EQF$

c) Solid waste: $PE_{\text{re.sol.}} = C \text{ (kg)} * EmF * SRL * EQF$

d) Paper footprint: $PE_{\text{paper}} = C \text{ ream} * P * EQF$

e) Footprint related to food: $PE_{\text{food}} = C \text{ kg} * EmF * EQF$

f) Footprint related to travel: it will not be considered in this work

g) Footprint related to the built area $PE_{\text{built area}} = BL_{\text{(ha)}} * EQF$

Preliminary analysis of the results

The estimated data show that

Environmental footprint	Global	Per capita	
Carbon footprint	6886.68 tCO ₂ eq/year	0.45 tCO ₂ eq/student.year	
Water footprint	3,879,143.0 m ³ /year	22.86 (m ³ /m ² *year)	0.82 m ³ /student.year
Ecological footprint	2913.42 (gha/y)	0.156 (gha/student.year)	

a) Water footprint: source: Nunes *et al* (2013) apud ortegon K and Acosta P (2019)

HEI	Country	Year	Population	Area (ha)	PE global (gha)	PE Per capita
University of Algarve	Portugal	2013	4.950	20	5.049	1.02
Ohio State University	USA	2006	77.120	711	650.666	2.4
Studied HEI	Brazil	2019	18606	42.91	2913.42	0.156

b) Carbon footprint Source: R. MENDOZA-FLORES *et al* (2019)

HEI	Country	Year	Total tCO ₂ eq/year	Per capita
Polytechnic University of Cartagena	Spain	2013	9,088.4	1.07
University of Cambridge	UK	2016	102,049.9	3.50
PUC (RJ)	Brazil	2011	5.782	0.29
Studied HEI	Brazil	2019	6886.68	0.45

c) Water footprint

HEI	Country	Year	Population	Area (ha)	Water footprint	
					Total	Per capita
Studied HEI	BR	2019	28.575	28.96	3,879,143.0 m ³ /year	0.45 m ³ /student.year
Keele Univ ¹ (*190 days teaching)	Eng.	16/20 15	11.328	250	532.415 (*)	0.247
Kathmandu Univ ²	Nepal		3655	18.11	628,375.55	0.513

1, Yifan Gu et all (2019), 2 Vaidya, B., Shrestha, S. & Ghimire, A.,(2021).

IV. CONCLUSIONS

As it is a central HEI, served by different modes of public transport, the contribution of student travel was not considered. It will be object of more detailed study, depending on the area of activity of the university.

Although HEI in question does not present an implemented, documented environmental policy broadly spread to its community and the external community, the environmental issue is consolidated in the Campus. Different graduate and postgraduate courses develop important projects on the subject, with potential to be applied in the university itself.

For effective inclusion of the environmental management in the analyzed HEI, the organizational chart of HEI shall be reviewed. There, it is recommended to include a formal unit responsible for the environmental management, composed of different representatives from the different segments of the university, which shall prepare a plan responsible for the logistics of the sustainability management.

It is indispensable for the university management to position in relation to sustainability, initially implementing a policy that involves the social issue as well.

For the analyzed HEI to move towards a sustainable movement, monitoring parameters shall be

adopted, such as electric energy and water consumption in the respective buildings of the campus. It is also recommended to monitor the consumption of the facilities (electric energy, water and gas) in the university canteen, and establish partnership with the UC operator for the food waste to be measured.

Although not much data about the analyzed HEI is available, an estimate of its sustainable potential was possible thanks to the adoption of parameters found in the specialized literature. The results serve as a base for analysis and future implementation by the organizational structure of HEI, for environmental policies to be systematically practiced.

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Sustainability in the Supply Chain: Conditions and Mechanisms for Waste Management in Medium-Sized Retail Supermarkets

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Keywords— Management practices,
Environmental knowledge, Market orientation,
Value generation.

Abstract— In view of legal and social requirements, sustainability became the core of the actions and actions of associations in adopting policies to reduce environmental damage with benefits to society. This study aims to analyze the relationship between waste management practices and the generation of value in medium-sized retail supermarkets. A research is justified by the researchers' emphasis on large retailers or small chains and is based on three hypotheses focused on management practices and value generation, environmental knowledge and market orientation. This is a survey, applied to a sample of 234 employees from two retail chains, from June to October 2021, analyzed using Structural Equation Modeling (SEM), characterized as a quantitative descriptive research. The results show that subjective environmental knowledge and market orientation moderate the relationship between waste and waste management practices and the generation of value in the production chain and that the more effective, the greater the generation of value.

I. INTRODUCTION

The convergence between multiple environmental problems of global reach and adverse consequences for humanity has driven a broad debate on the measures to be taken by society to face these challenges. An important milestone in this process was the publication of the report “Our Common Future” by the United Nations World Commission on Environment and Development in 1987. Since then, the notion of sustainable development based on three interconnected pillars has been established: environmentally correct, economically viable and socially fair.

The role played by companies and the environmental and social implications of their business models appear,

therefore, as key elements within this set of efforts. Sustainability is now at the heart of the strategies and actions of a growing number of companies that progressively change their policies to reduce the damage caused by their activities and bring benefits to the community and the planet. As a result, organizations increasingly incorporate attributes and practices that allow them to present themselves as sustainable and/or green (Kumar, Manrai, & Manrai, 2017).

This more ostensible and assertive position of organizations in favor of sustainability is accompanied by increased levels of demand from legislation and consumers. In this way, organizations need to go beyond listening to and meeting the purposes of these different stakeholders, but it is also appropriate to simultaneously

integrate these actors into the decision-making process of companies to allow the formulation of increasingly coherent and integrated plans and strategies, as well as enabling the anticipation of trends and accurate prospection of future scenarios (Hannon, Foxon, & Gale, 2015).

Overall, there is an emphasis of research on these issues in terms of prioritizing two extremes: large multinational retailers or small niche supermarket chains (Colla, 2018; Sparks, 2018). In the first case, there are references to broad projects aimed at the sustainability of networks such as Walmart, Tesco and Marks and Spencer, (Vadakkepatt et al., 2020; Goebel et al., 2018). As for the latter, case studies on alternative initiatives in the face of large “commoditized” networks predominate, highlighting attributes such as fair trade, community well-being and short production-commercialization-consumption circuits (Sparks, 2018).

There is, therefore, a gap with regard to the waste management by medium-sized supermarkets. With this as a background, this study aims to analyze the waste management practices of retailers and their relationship with value generation and with the moderating variables worked in the conceptual model (Reade, 2017; Reinartz, Wiegand, & Imschloss, 2019; Çankaya, & Sezen, 2018).

It is identified as opportune to analyze the relationship between waste management practices and the generation of value in the context of supermarkets. The central point is translated into an effort to advance on the following question: what are the interrelationships between waste management practices in value generation and sustainability performance in the context of retail supermarkets and their value chain?

In order to pursue an answer to this problem, this study aims to analyze the relationships between waste management practices and value generation in the context of medium-sized retail supermarkets in the Federal District, having as object of analysis two supermarket chains. In this sense, two main research fronts were identified that focus on retail constraints and restrictions in the context of food systems: pre-consumption and post-consumption (Dorward, 2012; Chen et al., 2017).

The latter constitutes the predominant focus of this study, aimed at analyzing these conditions and restrictions in a network of medium-sized supermarkets in the Federal District, a region that leads the economic and human development rankings, despite center-periphery disparities such as it happens in several other major cities.

Little is known about the relationship between environmental knowledge and market orientation with

sustainable management practices and value creation, as they are actions to ensure high business performance. To fill this research gap, this study analyzes a data set of 234 employees from two medium-sized supermarket chains in the Federal District, through Structural Equation Modeling (SEM), characterizing a quantitative and character research. descriptive.

In addition to this introductory section, the study elucidates four more sections. The next section deals with the development of hypotheses, contemplating aspects related to sustainability practices, the Stakeholders Theory, the sustainability and the retail value chain. The third section presents the methodological procedures outlined for the investigation; then, the analysis and discussion of the results obtained. Finally, the final considerations of the study are presented, with reflections for future research.

II. DEVELOPMENT OF HYPOTHESES

2.1 Sustainability practices

The idea of sustainable development refers to the concept of sustainable society that emerged in the early 1970s (Dresner, 2008). According to Reid (1995), its incorporation into the political debate gained strength with the publication of the “Our Common Future” Report (also known as The Brundtland Report) in 1987, being one of the main consequences of the work of the United Nations World Commission on Environment and Development.

Despite representing a fundamental advance, the definition of sustainability contained in the Brundtland Report is relatively vague, reflecting to some extent the inherent complexity of sustainability (Mebratu, 1998). This conceptual imprecision, associated with its growing importance in the formulation of national and international public policies, has led to a broad debate that mixes different definitions and implications (Santillo, & Johnston, 2007).

It is generally recognized that sustainable development involves three aspects: economic, social and environmental aspects (Mills, & Elkington, 1999). To make the concept of sustainable development concrete, some international political agendas have been formulated and implemented in recent decades. Progressively, discussions and implementation agreements have become more extensive by giving greater weight to the pro-sustainability contributions of companies and civil society. Indeed, business organizations are seen as key actors in achieving positive social and environmental changes, while pursuing economic goals (Bebbington, & Unerman, 2018).

Over the past two decades, scholars have increasingly explored and created theoretical and empirical documents

to prove that economic freedom is related to many positive socioeconomic outcomes. Added to this, the implementation of these precepts has faced a series of obstacles since then. Examples of this are the lack of measurement standards and the low credibility of decentralized measurement standards developed by different agencies and countries. There are also conflicts regarding the application and accountability of funds transferred from developed countries to developing countries (United Nations, 2020; Mehta, & Siddique, 2018).

On the other hand, these gaps show a window of opportunity for companies to contribute even more significantly to governance schemes and dissemination of sustainable practices. This active engagement of companies in the wake of sustainable development goals will allow successful organizations to differentiate themselves from their competitors and create space for sustainable innovations in their business processes and stakeholder relationships (Van Zanten, & Van Tulder, 2018).

The adoption of sustainable practices by companies involves government regulation and standards that include parameters in waste management, use of natural resources, levels of pollution and energy efficiency (Kumar, Manrai, & Manrai, 2017). Furthermore, this process presupposes the effective participation of companies in the formulation and implementation of public policies for environmental management and labor relations, ensuring the minimization of various social and environmental impacts that represent a public problem insofar as they can impact the quality of life and the well-being of the entire community at the local, regional, national and global levels (Singh, & Giacosa, 2019). Thus, it is understood that socially responsible businesses involve acting “beyond the walls” of the organization, aiming to support collective health, development and well-being (Dost et al., 2019).

From this point of view, a watershed for the adoption or improvement of sustainable practices along value chains is made up of increasingly collaborative, concerted and transparent relationships (Vadakepatt et al., 2020). To this end, holistic and integrated solutions have gained strength in the format of partnerships with the most diverse upstream and downstream stakeholders in order to support the improvement of sustainable or “green” practices, products and processes (Rodríguez-García, Guijarro-García, & Carrilero-Castillo, 2019).

In this sense, the need for coordinated action between companies, suppliers and public and private stakeholders in facing socio-environmental challenges is highlighted (SINGH; Giacosa, 2019; Erez, 2019). In terms of

sustainability practices, this includes going beyond conventional practices and, above all, encompasses a proactive stance (Yanagi, & Michels-Kim, 2018). It is therefore necessary to find paths for business models based on a decidedly proactive sustainable organizational culture. In view of these approaches, it is pertinent to highlight the following hypothesis for this study:

Hypothesis 1: H1- The more comprehensive and effective the waste management practices of retail supermarkets, the greater the generation of value.

2.2 The Stakeholders Theory

The Stakeholders Theory comprises a broad set of principles that have been developed in recent decades since the publication of the book *Strategic Management: a stakeholder approach*, by Robert Freeman (2010), and that have been gaining more and more space in management literature and in important international journals (Miles, 2015). One of the main differentials of this theory is the incorporation of an approach centered on the firm, but which emphasizes the weight of interactions and relationships with agents (stakeholders) that somehow have an interest or connection with the company (Freeman, 2010).

This view, also called the Value Creation Stakeholders Theory, contrasts with other more specific and instrumental approaches such as the Managerial Stakeholder Theory (Hörisch, Schaltegeer, & Windolph, 2015; Khojastehpour, & Shams, 2020). In fact, the classic aspect of this theory assumes that stakeholders are not only the agents with a financial interest in the firm's performance, as suggested by the concept of business responsibility to shareholder, but encompasses what the literature consecrates as responsibility to all stakeholders (Colvin, Witt, & Lacey, 2020).

As a result, the Stakeholders Theory conceives an integration between ethics and business as equally fundamental dimensions to value generation activities that, in turn, lend meaning to the very existence of companies. There would be purposes that go beyond making profits (Hörisch, Schaltegeer, & Windolph, 2015; Harrison, Freeman, & Abreu, 2015). Therefore, this approach includes imperatives of a strategic and normative nature (Colvin, Witt, & Lacey, 2020) that point out ways to maximize the benefits provided by an organization to society, as well as maximize value for stakeholders (Khojastehpour, & Shams, 2020).

Thus, the Stakeholders Theory presents an analytical tool that contributes to the understanding of complex problems of a multidimensional and multisectoral nature (Khojastehpour, & Shams, 2020). It is on this path that the

last decades have witnessed the emergence of various initiatives and metrics on sustainable performance such as environmental seals and certifications such as ISO 14001 (Chowdhury et al., 2020). On another front, Stakeholders Theory has been articulated with different lenses and approaches. This is the case, for example, with Corporate Social Responsibility. (Khojastehpour, & Shams, 2020).

Regarding the thematic areas that amalgamate the Stakeholders Theory with discussions on sustainability, there are a myriad of issues covering from the externalities of the supply chain and the social impact of inadequate disposal to discussions on accountability and accountability in sectors such as finance and ecotourism (Saraiva et al., 2016; Geuke, Groh, & Muncke, 2018; Palombini, City, & Jacques, 2017; Wondirad, Tolkach, & King, 2020). Despite this wide dissemination, it is worth noting the recommendation by Hörisch, Schaltegeer and Windolph (2015) to circumvent an excessive inclusion of stakeholders and sustainability topics in favor of a carefully based selection of stakeholders and topics more relevant to the context of each organization.

Thus, it is evident that companies increasingly consider environmental preservation in their market strategies, so that pro-environmental attitudes, that is, in favor of the environment and sustainable development, are well regarded by employees, suppliers, consumers and all a network of interest. Therefore, considering and analyzing the Stakeholder Theory in the context of the company's sustainability becomes essential for its strengthening (Colvin, Witt, Lacey, & 2020; Hörisch, Schaltegeer, & Windolph, 2015; Harrison, Freeman, & Abreu, 2015; Khojastehpour, & Shams, 2020; Parmar et al., 2010).

However, there are many studies that address the Theory of Stakeholders, sustainability in general and sustainable practices in retail individually, that is, independent of each other (Chen et al., 2017; Geuke, Groh, e Muncke, 2018; Goebel et al., 2018; Kumar, Manrai, & Manrai, 2017; Papadas, Avllonitis, & Carrigan, 2018; Mehta, & Siddique, 2018; Van Zanten, & Van Tulder, 2018; Dost et al., 2019; Miles, 2015; Freeman, 2010; Hörisch, Schaltegeer, & Windolph, 2015; Khojastehpour, & Shams, 2020).

Thus, there is a gap on how the Stakeholders Theory can contribute to the understanding of the adoption of sustainable practices in retail. Thus, this study addresses the way that the Stakeholders Theory influences attitudes towards sustainability in food retail. From the perspective of the conceptual and empirical literature on sustainable environmental behavior and knowledge, another research hypothesis is shown:

Hypothesis 2: H2 - The retailer's environmental knowledge moderates the relationship between waste management practices and the generation of value in the production chain, in such a way that greater (lesser) knowledge by the retailer will increase (decrease) the strength of relationship.

2.3 Sustainability and retail value chain

The development of a sustainable organizational culture by retail companies is directly related to the willingness to solve problems of a socio-environmental nature whose solutions are in the common interest of the actors directly and indirectly involved with the activities of the company and the value chain that it integrates (Singh, & Giacosa, 2019). Such predisposition involves obtaining concrete and tangible gains for the company and also, to some extent, by the altruistic engagement of companies in collective efforts to promote alternative and sustainable production, marketing and consumption models (Geissdoerfer et al., 2017).

Paying attention to the strategic link performed by retailers within the scope of their value chains, the primordial character of the management of retail companies in the adoption of sustainable practices that help to facilitate the transition to more conscious and socio-environmentally responsible models is highlighted, being the postures and decisions of supermarket managers and retailers in general fundamental, which can promote rapid changes that impact the functioning of the entire retail chain (Liu et al., 2018). Thus, it is faced with the expansion of the focus and scope of sustainable practices with a view to the ideal of proactively sustainable companies, giving rise to the creation of a specific type of market-oriented competitive advantage (Abdul-Rashid et al., 2017).

In the specific case of supermarket retail, such assumptions tend to be even more acute due to their key role in the confluence between different stakeholders within the value chain, spreading upstream and downstream from the extraction and processing of natural resources to the management and reuse of waste, including the optimization of processes that save raw materials and mitigate waste. By highlighting the need for waste management that does not allow for the transfer of problems and responsibilities, Brazilian legislation in the area has been strengthened since the Federal Constitution of 1988 by advancing both in the propositional sense and in the punitive bias (Cruz, & Ferreira, 2018).

This process leads to the formulation of specific legislation for solid waste, embodied in Law 12,305, of August 2, 2010, which instituted the National Solid Waste Policy (Política Nacional de Resíduos Sólidos - PNRS). In

general terms, retail is defined as a wide range of activities related to the sale of goods and services for personal use, whose variety of formats and structures primarily meet the demands and needs of consumers according to geographic, market and specific regulatory frameworks (Reinartz, Wiegand, & Imschloss, 2019).

From this perspective, the main protagonists of this network of relationships and value generation are supermarkets (Reinartz, Wiegand, & Imschloss, 2019) as they constitute the most visible strategic link connecting production and consumption (Sparks, 2018). When the dimension of sustainability practices is emphasized, with emphasis on waste management, the aforementioned multiplicity and multidimensionality of supermarket activities become even more evident (Reinartz, Wiegand, & Imschloss, 2019).

Sustainability has established itself as a competitive imperative that goes beyond the simple positioning of companies in terms of social responsibility, as the isolated actions of retail supermarkets are perceived as insufficient

to face the socio-environmental crises and impacts (Singh, & Giacosa, 2019; Erez, 2019). In this sense, sustainable practices in retail are seen as a competitive differential that can be added to the continuous efforts for greater competitiveness (Widlitz, 2020).

Considering all this range of conditions, another hypothesis emerges for the study, by aligning market-oriented sustainability with waste management practices and the generation of value in the production chain:

Hypothesis 3: H3 - Market orientation moderates the relationship between waste management practices and the generation of value in the production chain, in such a way that greater (lesser) market orientation will increase (decrease) strength of the relationship.

Given the research hypotheses, which deal with management practices, environmental knowledge, market orientation and their impacts on value creation, Table 1 can be seen, which indicates a summary of the constructs related to the hypotheses of the study and its respective theoretical bases.

Table 1. Constructs and synthesis of hypotheses

Constructs	Hypotheses	Theoreticalbasis
Waste management practices and Value generation	H1- The more comprehensive and effective the waste management practices of retail supermarkets, the greater the generation of value.	Mills e Elkington (1997); Mebratu (1998); Santillo e Johnston (2007); Dresner (2008); Bebbington e Unerman (2018); Mehta e Siddique (2018); Kumar, Manrai e Manrai (2017); Yanagi, Michels-Kim (2018); Van Zanten e Van Tulder (2018); Dost <i>at al.</i> (2019); Rodríguez-García, Guijarro-García e Carrilero-Castillo (2019); Erez (2019); Singh e Giacosa (2019); Vadakkepatt <i>et al.</i> , (2020).
Environmental knowledge and value generation	H2 - The retailer's environmental knowledge moderates the relationship between waste management practices and the generation of value in the production chain, in such a way that greater (lesser) knowledge by the retailer will increase (decrease) the strength of relationship.	Abdul-Rashid <i>at al.</i> (2017); Geissdoerfer <i>et al.</i> (2017); Cruz e Ferreira (2018); Liu <i>et al.</i> (2018); Sparks (2018); Erez (2019); Singh e Giacosa (2019); Reinartz, Wiegand e Imschloss (2019); Widlitz (2020).
Market orientation and value generation	H3 - Market orientation moderates the relationship between waste management practices and the generation of value in the production chain, in such a way that greater (lesser) market orientation will increase (decrease) strength of the relationship.	Freeman (2010); Parmar <i>et al.</i> (2010); Harrison, Freeman e Abreu (2015); Hörisch, Schaltegeer e Windolph (2015); Miles (2015); Saraiva <i>et al.</i> (2016); Kumar, Manrai e Manrai (2017); Palombini, Cidade e Jacques (2017); Geuke, Groh e Muncke (2018); Goebel <i>et al.</i> (2018); Mehta e Siddique (2018); Papadas, Avllonitis e Carrigan (2018); Van Zanten e Van Tulder (2018); Dost <i>et al.</i> (2019); Chowdhury <i>et al.</i> (2020); Colvin, Witt e Lacey (2020); Khojastehpour e Shams (2020); Wondirad, Tolkach e King (2020).

Source: Made by the authors.

Considering the hypotheses raised, waste management practices are independent variables that influence the generation of value (H1) and market orientation (H2) and environmental knowledge (H3) are moderating variables of waste management practices and value creation. Figure 1 presents the theoretical model composing the three research hypotheses presented.

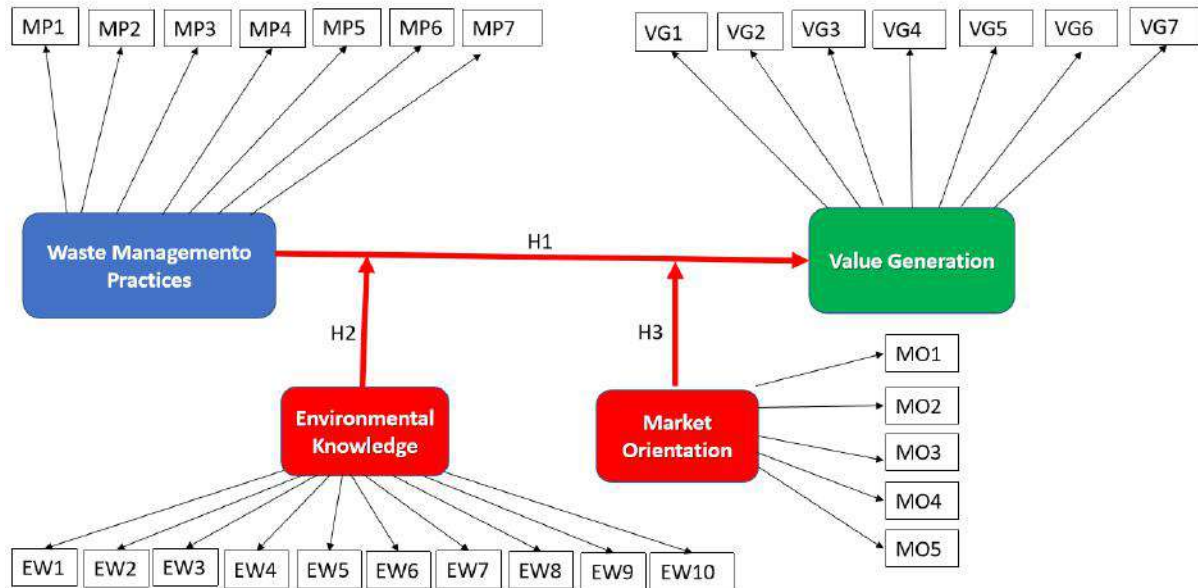


Fig.1. Proposed hypothesis model

III. METHOD

The method used in the research was based on Structural Equation Modeling (SEM), adopting a survey in the research, a method that can be developed in different ways and using various instruments (Hair et al., 2009). In addition to the cross-section cut, structured face-to-face

questionnaires were applied to collect data on the research sample. In this sense, the questionnaire, based on the constructs and definitions in Table 2, was applied directly to respondents linked to two medium-sized retail chains in the Federal District. The sample is made up of owners, managers and strategic-level employees.

Table 2. Definition of research constructs

Constructs	Item	Definition
Waste Management practices	WP	These are techniques applied in companies aiming to reduce the generation of waste and waste (DOST et al., 2019).
Environmental Knowledge	EW	It is a strategic resource that needs to be shared managed in order to promote sustainable competitive advantages that pave the way for the creation, acquisition and transfer of knowledge (MADHI; NASSAR; ALMSAFIR, 2019).
Market Orientation	MO	It refers to the downstream relationships of companies, in which the increase in concerns arising from multiple contemporary environmental crises contributes to the emergence of new forms of commercialization and consumption, causing companies to increase their adaptive and propositional capacities in order to continue operating in the market (KUMAR; MANRAI; MANRAI, 2017)

Value Generation	VG	Cooperation between two or more organizations (companies and community) that promote learning, organizational knowledge, economic high, sustainability etc, leading to the generation of tangible and intangible values that strengthen and diversify partnerships (EIRIZ; GONÇALVES; AREIAS, 2017).
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Source: Made by the authors.

The research instrument was structured through a set of items, consisting of a 5-point Likert scale. To verify the constructs defined in Table 2, the scale ranged from 1 "totally disagree", "occasionally", "rarely", "never" and "not important" to 5 "totally agree", "very frequent", "very important" and "almost always true" (Gonçalves-Dias et al., 2009; Foxall; Hackett, 1992).

Before starting data collection for the study, a pre-test was carried out, which aims to identify possible flaws in the questionnaire, such as redundant or confusing questions, inconsistent or complex questions and questions with difficult language, according to Malhotra (2012). Even when applied to a small sample of respondents, pretesting can help eliminate potential problems.

In addition to the constructs, the questionnaire applied measured the sociodemographic aspects of the sample, such as: gender, age, education and professional experience. The access and awareness of actors to the terms of the research were improved by the approach made to the research instrument presented to retailers. The collection period took place between June and October 2021, resulting in 234 completed forms.

Taking into account the treatment of the data, Exploratory Factor Analysis (EFA) was used to reduce the number of variables and group them into constructs. In addition, the substitute variable criterion is adopted for each construct, being the variable with the highest factor loading, as it has the greatest explanatory power (Hair et al., 2009). In this way, an overview of the metrics related to the sustainability programs of the two researched food retail chains is constituted, highlighting the potential, challenges and limits placed on each one of them, in view of their unique trajectories and the specific conditions with which they face.

IV. ANALYSIS AND DISCUSSION OF RESULTS

4.1 Data preparation

Preliminary data processing helps to identify what is not apparent, because in this type of analysis, hidden effects are easy to go unnoticed (Hair et al., 2009). Before moving

on to refine the data, such as Missing Datas and Outliers, some adjustments were made to the database.

The first step then was to download all data from the questionnaire respondents. For each respondent, an ID was created, an identification code that differentiates each respondent in the questionnaire. Then, some tabulations were made. As each construct was linked to a group of questions, and each question was given an identification code, thus creating a caption for the question.

In cleaning the data, we sought to identify univariate and multivariate outliers and missing data, resulting in the elimination of 7 forms. In addition to the elimination of questionnaires, the treatment was also carried out with the disregard of unanswered items. Data analysis was performed using SPSS® 0 software (Statistical Package for Social Sciences) (Version 24.0) for Windows® and AMOS® TM 18 software (Analysis of Moment Structures) coupled with SPSS®.

4.2 Sample profile

After making these necessary adjustments, a multivariate assessment that calculates the Mahalanobis distance (D2) is used to identify outliers. According to Hair et al. (2009), when researchers need to objectively measure the multidimensional position of each observation in relation to a common point, the Mahalanobis metric (D2) can be used.

Therefore, two multivariate analyzes are performed: the first analyzes all measurement variables, thus creating the MAH_1 variable. In the second analysis (MAH_C) the degree of freedom of the regression is considered, according to the number of variables under study. According to Hair et al. (2009), for atypical observations of large samples, it is recommended to consider values greater than $D2 / g1 = 3$ or 4. Therefore, according to the Mahalanobis analyses, respondents with ID 6, 16, 145 and 165 were considered outliers.

After excluding outliers, the valid sample now has 227 respondents. The characterization questions (gender, age, education and experience in the company) were applied to obtain the general profile of the sample. According to respondents, from the total sample, 115 respondents were

men and 112 were women. The age range of most respondents was between 21 and 30 years old, as can be seen in Table 2.

Tabela 2. Age group

AGE		
Description	N	%
Under 20	8	3.5
Between 21 and 30	141	62.1
Between 31 and 40	52	22.9
Between 41 and 50	22	9.7
Over 50	2	0.9
Notdeclared	2	0.9
TOTAL	227	100.0

Source: Research data.

Another characterization issue was related to the level of education of the respondents in the sample. According to the responses, most respondents have completed high school, as seen in Table 3.

Table 3. Degree of education

Degreeofeducation		
Description	N	%
ElementarySchool	23	10.1
High School	140	61.7
Incomplete Superior Education	33	14.5
Complete Superior Education	25	11.0
Notdeclared	6	2.6
Total	227	100.0

Source: Research Data

The last question in the characterization questionnaire was related to the respondents' experience, that is, how long they had been working in the company. The answers can be seen in Table 4.

Table 4. Experience in the company

EXPERIENCE		
Description	N	%
01 to 04 years	139	61.2
05 to 09 years	45	19.8
10 to 20 years	16	7.0
More than 20 years	12	5.3
Notdeclared	15	6.6
Total	227	100.0

Source: Research Data.

4.3 Descriptive Analysis

Descriptive analysis is an activity that aims to present qualitative aspects of the research, and show the characteristics of the variables of each construct, in addition to showing how they behave in the study (Luppi, 2017).

Thus, the Waste Management Practices (MP) construct was measured through 8 questions focused on environmental management actions carried out within the

company. The questions were about agreement and frequency, and the answers ranged from “totally agree” to “totally disagree” and from “very often” to “never”. Through the analysis of this construct, Table 4 was developed containing the mean, median, standard deviation and the minimum (of 1) and maximum (of 5) for each question.

Table 5. Descriptive analysis of the waste management practices construct

DESCRIPTIVE STATISTICS					
Variable	Mean	Median	Standard Deviation	Minimum	Maximum
MP1	3.48	3.48	1.16	1.00	5.00
MP2	3.43	4.00	1.30	1.00	5.00
MP3	3.69	4.00	1.13	1.00	5.00
MP4	3.57	4.00	1.08	1.00	5.00
MP5	3.50	4.00	1.36	1.00	5.00
MP6	3.26	3.00	1.21	1.00	5.00
MP7	3.48	3.00	1.22	1.00	5.00

Source: Research data.

The next construct measured was Value Generation (VG), through questions 8 to 14. The questions were related to the company's search for ways to expand learning in the adoption of sustainability practices. The answers were related to agreement, frequency and veracity, ranging from “totally agree” and “totally disagree”, “very

often” to “never” and “almost always true” to “almost always false”. Through the analysis of this construct, Table 5 was developed containing the mean, median, standard deviation and the minimum (of 1) and maximum (of 5) for each question.

Table 6. Descriptive analysis of the value generation construct

DESCRIPTIVE STATISTICS					
Variable	Mean	Median	Standard Deviation	Minimum	Maximum
VG1	3.48	4.00	1.38	1.00	5.00
VG2	3.35	3.00	1.29	1.00	5.00
VG3	3.28	3.00	1.36	1.00	5.00
VG4	3.19	3.00	1.23	1.00	5.00
VG5	3.50	4.00	1.21	1.00	5.00
VG6	2.64	3.00	1.29	1.00	5.00
VG7	3.49	4.00	1.15	1.00	5.00

Source: Research data.

The next construct measured was Market Orientation (MO), through questions 15 to 19. The questions were focused on how the company behaved in the market and its actions. The answers were related to agreement and frequency, ranging from “totally agree” to “totally

disagree” and “very often” to “never”. Through the analysis of this construct, Table 6 was developed containing the mean, median, standard deviation and the minimum (of 1) and maximum (of 5) for each question.

Table 7. Descriptive analysis of the market orientation construct

DESCRIPTIVE STATISTICS					
Variable	Mean	Median	Standard Deviation	Minimum	Maximum
MO1	3.34	3.00	1.26	1.00	5.00
MO2	3.70	4.00	1.11	1.00	5.00
MO3	3.80	4.00	1.11	1.00	5.00
MO4	3.91	4.00	1.29	1.00	5.00
MO5	3.86	4.00	1.05	1.00	5.00

Source: Research data.

Another construct measured was Objective Environmental Knowledge, through questions 20 to 24. For each question of this construct there was only one correct answer, and these answers were transformed into a single variable, by summing the correct answers, considering zero for the wrong answers and one for the

correct answer. The respondent who did not have any right answers got a score of zero and the one who got all the questions in the construct right got a score of five. Through the analysis of this construct, Table 7 was developed containing the mean, median, standard deviation and the minimum (of 0) and maximum (of 5).

Table 8. Descriptive analysis of the objective environmental knowledge construct

DESCRIPTIVE STATISTICS					
Variable	Mean	Median	Standard Deviation	Minimum	Maximum
OEK	2.22	2.00	1.08	0.00	5.00

Source: Research data.

The next construct measured was the Sustainable Competitive Advantage (CA), through questions 25 to 29. The questions were focused on the company's concern with its social and environmental responsibilities. The answers were related to agreement and frequency, ranging

from “totally agree” to “totally disagree” and “very often” to “never”. Through the analysis of this construct, Table 8 was developed containing the mean, median, standard deviation and the minimum (of 1) and maximum (of 5) for each question.

Table 9. Descriptive analysis of the sustainable competitive advantage construct

DESCRIPTIVE STATISTICS					
Variable	Mean	Median	Standard Deviation	Minimum	Maximum
CA1	3.81	4.00	1.07	1.00	5.00
CA2	2.98	3.00	1.28	1.00	5.00
CA3	3.68	4.00	1.15	1.00	5.00
CA4	3.71	4.00	1.15	1.00	5.00
CA5	3.86	4.00	1.09	1.00	5.00

Source: Research data.

The last construct measured by the questionnaire was Subjective Environmental Knowledge, through questions 30 to 34. The questions were subjective, that is, the respondent made a self-assessment of his environmental knowledge, through agreement responses, ranging from

“agree totally” to “strongly disagree”. Through the analysis of this construct, Table 10 was developed, containing the mean, median, standard deviation and the minimum (of 1) and maximum (of 5) for each question.

Table 10. Descriptive analysis of the subjective environmental knowledge construct

DESCRIPTIVE STATISTICS					
Variable	Mean	Median	Standard Deviation	Minimum	Maximum
SEK1	3.44	3.00	1.16	1.00	5.00
SEK2	3.24	3.00	1.34	1.00	5.00
SEK3	2.46	2.00	1.39	1.00	5.00
SEK4	3.14	3.00	1.21	1.00	5.00
SEK5	3.94	4.00	1.08	1.00	5.00

Source: Research data.

4.4 Measurement Properties

To study the model, three measures were used: Cronbach's Alpha, Composite Reliability and Discriminant Validity. Cronbach's Alpha is used to analyze simple reliability with values greater than 0.70. Composite reliability (CC) is used to check the internal consistency of the set of variables, reaching a value greater than 0.70. The extracted

variance (EV) is used to explain how the total variance of each variable is used to compose the construct evaluation, considering values above 0.50 (Hair et al., 2009). The number of respondents, except for outliers, was 227. Table 11 shows the values of the measures studied for each construct.

Table 11. Measures analyzed

Construct	N	Cronbah Alpha	compositereliability	extractedvariance
Waste management practice	7	0.751	0.762	0.324
Value Generation	7	0.831	0.842	0.459
Subjectiveenvironmentalknowledge	5	0.694	0.7	0.324
Market orientation	5	0.703	0.714	0.34

Source: Resarch data.

It is noticed that the variables PG2, GV5, GV6, CAS5 and OM1 had factor loadings below 0.60, and were excluded. After data purification, Table 12 was obtained.

Table 12. Measures after refinement

Construct	N	Cronbah Alpha	compositereliability	extractedvariance
Waste management practice	6	0.769	0.772	0.363
Value Generation	5	0.872	0.875	0.586
Subjectiveenvironmentalknowledge	4	0.691	0.696	0.365
Market orientation	4	0.691	0.702	0.377

Source: Resarch data.

Therefore, it is observed that, after refining the data, Cronbach's Alpha increased in all cases, except for the Subjective Environmental Knowledge construct, which was at 0.694 and changed to 0.691. The Composite Reliability measure, after refinement, was higher for the Waste Management Practices and Value Generation constructs, and lower for the other two constructs. As for

the Extracted Variance, after refinement, it was higher for all analyzed constructs.

4.5 Structural Model Test

The test of the structural model of this thesis was carried out using the moderator variables Market Orientation, Objective Environmental Knowledge and Subjective Environmental Knowledge, and the dependent variables Waste Management Practices and Value Generation. The

database with 227 respondents was considered, removing the outliers. Through the tests, Figure 2 presents the structural model, from the analysis of the results,

hypotheses and measures of the constructs, according to Hair et al., (2009).

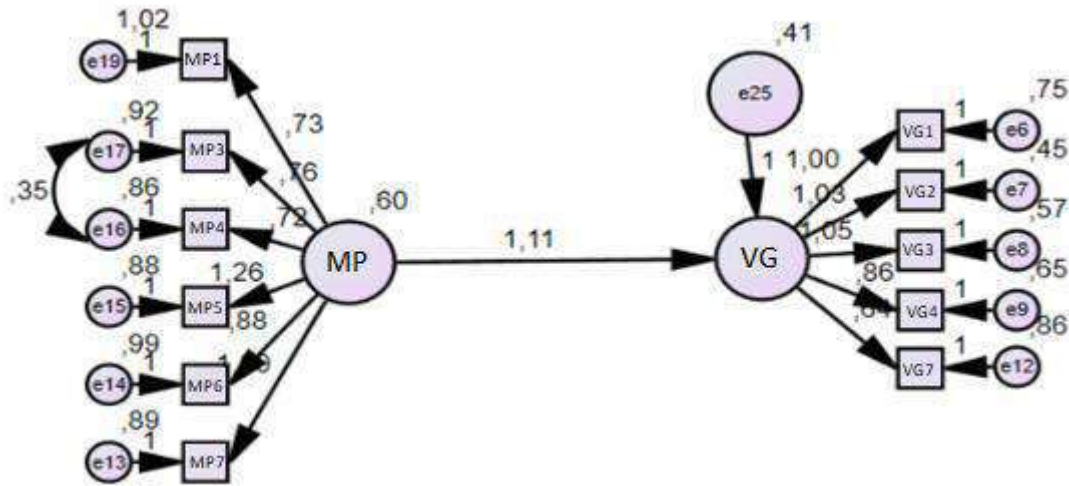


Fig.2.Structural model

Conforme as análises feitas, observa-se que a variável CAS (Conhecimento Ambiental Subjetivo) possui significância ($p=0,022<0,05$) sobre as variáveis GV e PG, mostrando que este tem um efeito moderador. Assim como o CAS, o CAO (Conhecimento Ambiental Objetivo) também possui significância ($p=0,001<0,05$), mostrando que esta variável independente tem efeito moderador sobre as variáveis PG e GV. Já a Orientação para o Mercado possui um valor de $p>0,05$, mostrando que esta variável não possui efeito moderador sobre as variáveis dependentes. Estarelação pode ser observada na Tabela 12.

According to the analyzes carried out, it is observed that the variable SEK (Subjective Environmental Knowledge) has significance ($p=0.022<0.05$) on the VG and MP variables, showing that this has a moderating effect. Like the SEK, the OEK (Objective Environmental Knowledge) also has significance ($p=0.001<0.05$), showing that this independent variable has a moderating effect on the MP and VG variables. Market Orientation, on the other hand, has a value of $p>0.05$, showing that this variable has no moderating effect on the dependent variables. This relationship can be seen in Table 13.

Table 13.Moderators' Relations

Relations	β (Alto)	β (Baixo)	Sig.
SEK (Subjective Environmental Knowledge)	1.384***	0.550***	0.022
OEK (Objective Environmental Knowledge)	0.920***	17.303	0.001
MO (Market Orientation)	0.705	0.909	0.604

Source: Resarch data.

Analyzing the hypotheses proposed by the research, it is observed that H1 shows that the more comprehensive and effective the waste management practices of retail supermarkets, the greater will be the generation of value, according to the significance tests applied.

H2 indicates that the retailer's environmental knowledge moderates the relationship between waste management practices and the generation of value in the production chain, in such a way that greater (lesser) knowledge by the retailer will increase (decrease) the

strength of the relationship, and this hypothesis is true according to the tested model.

H3 suggests that market orientation moderates the relationship between waste management practices and value generation in the production chain, in such a way that a higher (lower) market orientation will increase (decrease) strength of the relationship, however, by the tests made by this model, the relationship does not generate significance.

The chi-square index by degrees of freedom CMIN/DF (2.275), which is the index that compares the covariance matrix with the observed matrix, presented a

recommended value, which is less than 5. As can be seen in Table 13, all indexes were within the recommended parameters.

Table 14. Model fit indices

Index	Estimate	Parameter
CMIN/DF	2.275	< 5.00
GFI	0.928	> 0.90
NFI	0.910	> 0.90
IFI	0.948	> 0.90
TLI	0.931	> 0.90
CFI	0.947	> 0.90
RMSEA	0.075	0.050 < RMSEA < 0.080

Source: Resarch data.

According to Hair et al. (2009), the validation of the model starts with the results obtained through the fit indices. It was observed that the adjusted GFI quality indicators (0.928) and reached the theoretically recommended value which is greater than 0.90. The comparative adjustment index CFI (0.947) also reached an acceptable value in the literature, which is greater than 0.90, as well as the RMSEA index (0.075), which reached the value proposed in the literature, which is less than 0.08.

V. CONCLUSION

This study aimed to analyze the relationship between waste management practices and the generation of value in medium-sized retail supermarkets (Reade, 2017; Reinartz, Wiegand, & Imschloss, 2019; Çankaya, & Sezen, 2018), supported by moderating variables environmental knowledge and market orientation defined in the proposed model of hypotheses (Figure 1).

The research question investigated is aimed at understanding the interrelationships between waste management practices in the generation of value and, consequently, in sustainability in the context of medium-sized retail supermarkets and their value chain. The applied methodology proved to be relevant to meet the proposed research objective, as well as in the investigation of the research problem, focusing on Structural Equation Modeling (SEM) and on the analysis of applied survey data, according to Hair et al. (2009).

The proposed model of hypotheses (Figure 1) for analyzing the relationships between the constructs is an important research contribution to the analysis of sustainability in the value chain, as it helps to identify waste management practices and their relationship with the

generation of value and sustainability of the value chain, as well as the influence of environmental knowledge and market orientation in the relationship between variables.

The positive correlations found between the constructs contained in the structural model (Figure 2) is an important managerial contribution for medium-sized supermarket retail chains, as they have managerial implications, in which the recommendation for the use of a set of strategic guiding (EW and MO), as a way to achieve strategic objectives (WP and VG) to obtain greater competitive advantage and, consequently, a better position in the value chain.

Based on the results of the structural model (Figure 2) and the hypothesis tests (Table 2), it is considered that the H1 hypotheses (the more comprehensive and effective the waste management practices of retail supermarkets, the greater the generation of value) and H3 (market orientation moderates the relationship between waste management practices and the generation of value in the production chain, in such a way that greater (lesser) market orientation will increase (decrease) the strength of the relationship) were confirmed.

However, hypothesis H2 (the retailer's environmental knowledge moderates the relationship between waste management practices and the generation of value in the production chain, in such a way that greater (lesser) knowledge by the retailer will increase (decrease) strength of the relation) was partially supported, being verified in the applied tests that only the subjective environmental knowledge moderates the relation between the variables, and the objective environmental knowledge did not present significance.

This research is limited to the study of two medium-sized retail supermarket chains from a homogeneous region, therefore, it is suggested comparative studies in different regions of Brazil and the inclusion of regional economic factors as moderators of the relationships between the constructs, as well as the survey and testing of new hypotheses that can bring theoretical and managerial contributions, contributing to studies on sustainability in the value chain of medium-sized retail supermarkets, a segment that is still little studied.

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Productive dynamics in the Western amazon: An analysis of Agricultural Production in the state in Rondônia

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Keywords— *Agricultural production, Western Amazon, Rondônia, Shift-Share.*

Abstract— *This study sought to analyze the agricultural productivity dynamics of three relevant crops developed in the Western Amazon, specifically in the state of Rondônia. Thus, the productive variations of banana, coffee, and passion fruit for the period from 1997 to 2016 were studied. Also, the analysis of passion fruit was highlighted through the analysis of variations in Annual Production Growth Rates-TACP by state micro-region. The theory of modernization, based on the model of individual innovation, elicits the elaboration of the study. To measure the TACP of each culture, use the shift-share method. As a matter of principle, the factors that influence the TACP are the Efeito Erea-EA and Efeito Rendimento-ER. Coffee presented a negative growth rate in the period (-0.52%) while, banana and passion fruit showed positive growth, respectively 15.62% and 1.91% in the period. Exclusively as for passion fruit, it showed great fluctuations in its rates, but in most cases presenting a negative rate for the ER. Coffee presented a negative growth rate in the period (-0.52%) while, banana and passion fruit showed positive growth, respectively 15.62% and 1.91% in the period. Thus, it appears that the cultivation of passion fruit in Rondônia still has a low degree of technology, which harms the fruit's TACP. Quanto a análise das TACP do maracujá por microrregiões, Alvorada do Oeste foi a que apresentou maior percentual.*

I. INTRODUCTION

Agricultural production is one of the activities that has most concluded in the last decade with the

Brazilian economy. The great territorial space favored the exploration of diverse cultures in Brazil in addition to the country has experienced the process of modernizing its

crops at the end of the 1960s, which further contributes to the increase in production volume. The history of Rondônia, a state belonging to the Western Amazon and one of the youngest Brazilian states, is marked precisely by occupation due to the forest and agricultural exploitation of the region, like the rubber cycles (while it was still called the Federal Territory of Guaporé) (Nunes, 1996).

Currently, agribusiness is one of the sectors that most contribute to the formation of the Gross Domestic Product - GDP of the state. Among the cultures explored in Rondônia, following the national trend, the production of bananas, coffee, and passion fruit stands out. These three crops together have great productive representativeness when observing the universe of plantations of permanent crops explored in the state (IBGE, 2018). Although the rural sector has great relevance in the state's economic context, it is conjectured that Rondônia still has a low degree of agricultural modernization because it is a province still in development and because it is geographically disadvantaged from other producing states. Thus, it appears that technological restriction can negatively impact agricultural production in the state.

Some works have already been carried out in Brazil to analyze a productive dynamic in the rural sector using the shift-share model. For example, the studies carried out by Mendes and Fernandes (1976) in the state of Minas Gerais stand out; Igreja, Carmo, Galvão and Pellegrini (1983) who analyzed the evolution of agriculture in the state of São Paulo; Moreira (1996) investigated the sources of growth of the main cultures of Rio Grande do Norte; the sugarcane sector in the state of Paraná was the object of study by Shikida and Alves (2001); whereas Oliveira, Gomes, Rufino, Silva Junior and Gomes (2008) studied the structure and dynamics of coffee production in Minas Gerais; Santos and Araújo (2014) analyzed the performance of the main crops in the state of Paraná; and Bittencourt and Gomes (2014) analyzed the sources of growth in sugar cane production in the Midwest and Southeast regions of Brazil.

In this context, the objective of this study was to identify and analyze the growth dynamics of agricultural production of three important permanent crops in the state of Rondônia: bananas, coffee, and passion fruit, from 1997 to 2016. To achieve the results the shift-share method was used, which, in addition to contributing to obtaining the growth rates of crop production, can also assist in the analysis of the determining factors for variations in growth rates.

Thus, the relevance of the present study is due especially to the fact that no specific studies have been

identified in the literature using the shift-share model in the state of Rondônia, which may contribute to the adoption of relevant local public policies to maximize production and consequently promote economic development for the Western Amazon.

To achieve the purposes of the present study, the work was structured in four more sections. The second section deals with the theoretical sources that support the research; next, the methodology and data sources are established, emphasizing the shift-share analytical model; in the fourth section, the results obtained are presented and discussed; and finally, the main conclusions reached in the study are presented.

II. MODERNIZATION OF AGRICULTURE

Similar to what occurs in industries, in agriculture, changes in production structures are also constantly perceived. And this gradual substitution over time of rudimentary production techniques with more advanced techniques with technological use aims, most of the time, to increase agricultural productivity (Oliveira, 2007; Bittencourt; Gomes, 2014). However, it is undeniable that social, political, and especially economic issues have influenced the process of modernizing agriculture (Graziano Neto, 1985; Oliveira, 2007). Thus, the process of modernization of agriculture tends to contain affections of the capitalist model itself, and at certain times, although it aims at increasing agricultural production, it ends up on the one hand favoring certain products and producers to the detriment of the others, issues which are intrinsically related to economic problems (Teixeira, 2005).

In the understanding of Bittencourt and Gomes (2014), according to the theory of agricultural modernization - in particular, the high return input model attributed to Schultz (1965) - the supply and quantity of production inputs will only be available when the elements technologies are sufficiently capable of providing satisfactory economic gains through productive. In his thesis, Curi (1997) comments that some factors are essential for the process of modernization of agriculture, and without them, the advance of productivity would be compromised. According to Curi (1997), the improvement in the industry of manufacturing inputs for agricultural production; investments in teaching and research; immersion of more agricultural professionals; and the institution of strategic plans for agricultural development on the part of the State are some basic elements for effecting the modernization process in agriculture.

In this way, the present study will be based on the modernization theory, especially on the neoclassical model

of inductive innovation. In the neoclassical perspective, the means of production are considered fixed in the short term, and conversely, variable in the long term time horizon. In the neoclassical view, production inputs may or may not be limited, with technological elements being applied, especially in production to have greater production, with the adoption of the same amount of inputs. This would cause a sharp reduction in costs, mainly due to the effect of the economy of scale (Padrão; Gomes; Garcia, 2012).

The main studies on inductive innovation were those developed by Hayami and Ruttan (1971) and those by Araújo Schuh (1975). The model of induced innovation, according to the researchers, can subsidize, especially the interpretation of the shifts of technological changes and in the identification of the obstacles encountered during the modernization processes experienced in practice. Also, in this perspective, according to Hayami and Ruttan (1988), technological and institutional changes would be elements endogenous to economic systems. Such a modernization process would be triggered, on the one hand, from the economic perception of the analysis of the supply of factors, and on the other, the demand for products. With that, it would be possible to theoretically support the technological delineations of certain regions in a different way in relation to other regions given the specific economic characteristics. This would make technology as an endogenous factor in production linked to market mechanisms (Oliveira, 2007).

For Alves, Lopes, and Contini (1999) and Faria (2002), the inductive innovation model is fragmented into four major groups of technology: biochemical technologies - linked to land savers through the use of fertilizers, corrective materials, etc.; mechanical technologies - characterized by labor savers through the use of instruments, such as tractors, sprayers, harvesters, etc.; product-saving technologies - by reducing waste between production and the consumer; and organizational technologies - with the search for efficiency between the use of product savers and land technologies. In this way, the real development of rural activity will occur when there are analyses and appropriate technological applications of the scenario, that is, the implementation of a technological alternative that seeks to equalize a real deficiency of a scarce resource. Thus, in areas lacking labor in the application of mechanical technologies such as the use of tractors, machines, and other types of equipment, this would be ideal to optimize production as well as the development of new seeds, fertilizers, and pesticides, that would be a biochemical technological alternative in scenarios where the land is not abundant or deficient.

However, Hicks (1932), cited by Padrão, Gomes, and Garcia (2012), emphasizes that for the inductive innovation process to work, some factors mustn't be absent. Initially, the price systems must express the reality of the market so that the analysis of supply and product demands is not distorted and consequently does not lead to the promotion of wrong technological investments. As a result, it is necessary to have a good engagement between farmers and research institutions without the existence of information asymmetry. It is also essential that public investments take place in a targeted and assertive manner regarding the necessary and appropriate technologies for certain regions and in certain periods. Quadra (1994) emphasizes that some of the main criticisms of the model are precisely the possibility of producing technology for resources that already exist in abundance and the state generation of technology for interest groups, excluding the technological benefits to producers who need the technology.

However, for Bittencourt and Gomes (2014), with the correct and current reading of these scenarios, coupled with the constant implementation of technological actions, it can provide a continuous dynamic of optimization of production and consequently of economic development. Also, inductive innovation is established as a relevant tool for analyzing rural productive variations in certain regions and, or in certain temporal spaces (Padrão; Gomes; Garcia, 2012).

III. METHODOLOGY AND DATA SOURCE

3.1 The Shift-Share Model

In the present study, the analytical model used was the shift-share, also known as structural-differential. One of the works that made the use of the model more intense was developed by professor Edgar Dunn in 1960. Andrade (1980) mentions that the shift-share has a significant empirical use, especially by economists. For Dunn (1960), the elementary emphasis of the model is based, on geographic location, making it possible, for example, to verify the comparative advantages in the production of certain agricultural products based on their locational advantages - when applied in the rural scope. It occurs through the analysis of production variations between periods and regions, thus establishing the variables responsible for the growth or decrease in the production of certain crops.

In Brazil, as already highlighted, there are some works developed that used the *shift-share* model in the rural context, such as the studies carried out by Mendes and Fernandes (1976) in the state of Minas Gerais; Igreja et al. (1983) who analyzed the development of São Paulo

agriculture; Moreira (1996) who addressed the sources of growth of the main cultures of Rio Grande do Norte; Shikida and Alves (2001) who carried out a study on the sugar cane sector in the state of Paraná; Bittencourt and Gomes (2014) who analyzed the sources of growth in sugar cane production in the Midwest and Southeast regions of Brazil; Bini and Canaver (2015) evaluated the growth in the value of the production of beans and soybeans in Rio Grande do Sul (RS); Garcia and Buainain (2016) investigated the dynamics of occupation of temporary crops in the Cerrado Nordeste; and Ponciano, Castro, Souza, Nogueira and Ney (2017) studied the productive dynamics of the main cultures in the State of Espírito Santo. However, no specific studies were identified in the literature using the model in the state of Rondônia, focusing on the production of passion fruit

As perceived and highlighted by Haddad and Andrade (1989), the shift-share is normally used for originating descriptive analysis at the regional level, using the variables of interest in the study in the desired period. In the present study, the objective is to analyze the performance of passion fruit production in the state of Rondônia, together with the production of bananas and coffee, from 1997 to 2016¹, emphasizing the rate of productive growth.

Thus, the analysis was broken down into three effects (or components), which were: Area Effect (EA), Yield Effect (ER) and the Geographic Location Effect (ELG). In the EA, the variations of production concerning the productive area (increase or decrease of the cultivation area) are analyzed, keeping the ER and ELG unchanged; in the ER, variations are identified based on oscillations exclusively due to productivity (expansion of production due to the application of production technologies, for example), with the EA and ELG not changing; and finally, the ELG that analyzes the variations in production due to the existence of geographical locational advantages (State, Country ...), which in the specific case of the study, will be the variations among the micro-regions of the state of Rondônia.

3.1.1 Mathematical Description and Variables Used

In the sequence, the version of the shift-share adopted in this study is considered in detail, proceeded from the adequacy of the versions used by Igreja et al. (1983) and Santos and Araújo (2014), especially the establishment of the sub-indices, variables, coefficients and consecutive equations used.

¹ According to IBGE data, the sum of the production of the three crops is equivalent to approximately ¾ of the agricultural production of the period in the State of Rondônia, specifically considering permanent crops.

Sub-indices used:

c represents each of the three cultures analyzed in the study (passion fruit, banana, and coffee), varying from 1 to k (being $k = 3$);

m represents each region (municipality) of the state of Rondônia, being of 1 and n (being $n = 52$);

t represents the period that varies between i and f , portraying, respectively, the initial period and the final period analyzed.

Variables used:

Q_{ct} : quantity produced of the c -th crop in the state of Rondônia, in the period t ;

A_t : total area cultivated with the three crops in the state of Rondônia in the period t ;

A_{ct} : total area cultivated with the c -th crop in the state of Rondônia, in the period t ;

A_{mt} : total area cultivated with the three crops in the m -th region of the state of Rondônia, in the period t ;

A_{cmt} : total area cultivated with the c -th crop, in the m -th region of the state of Rondônia, in the period t ;

R_{cmt} : average yield of the c -th crop, in the m -th region of the state of Rondônia, in the period t ;

γ_{cmt} : proportion of the total cultivated area of the c -th culture of the m -th region in the total cultivated area of the c -th crop in the state of Rondônia (A_{cmt}/A_{ct}), in the period t ;

λ : coefficient that measures the change in the total cultivated area with the set of crops studied in the state of Rondônia between the initial period and the final period (A_f/A_i).

The quantity produced of the c -th crop in the state in the period t is represented by the following equation:

$$Q_{ct} = \sum_{m=1}^n (A_{cmt}R_{cmt}) \tag{01}$$

The quantity produced of the c -th crop in the state in the initial period ($t = i$) is given by:

$$\begin{aligned} Q_{ci} &= \sum_{m=1}^n (A_{cmi}R_{cmi}) \\ &= \sum_{m=1}^n (\gamma_{cmi}A_{ci}R_{cmi}) \end{aligned} \tag{02}$$

The quantity produced of the c -th crop in the state in the final period ($t = f$), in turn, is given by:

$$\begin{aligned}
 Q_{cf} &= \sum_{m=1}^n (A_{cmf} R_{cmf}) \\
 &= \sum_{m=1}^n (\gamma_{cmf} A_{cf} R_{cmf})
 \end{aligned} \tag{03}$$

If in the period considered there is a change only in the total area cultivated with the c -th crop in the state, production in the final period, Q_{cf}^A , will be represented by:

$$Q_{cf}^A = \sum_{m=1}^n (\gamma_{cmi} A_{ci} R_{cmi}) \tag{04}$$

If the area and yield vary, and the geographical location of the crops in the state remains unchanged, the quantity produced of the c -th crop at the end of the period Q_{cf}^{AR} can be represented by:

$$\begin{aligned}
 Q_{cf}^{AR} &= \sum_{m=1}^n (\gamma_{cmi} A_{cf} R_{cmf})
 \end{aligned} \tag{05}$$

Varying the geographical location of the c -th crop in the state's regions, along with the cultivated area and yield, the amount produced of the c -th crop at the end of the period will be given by:

$$\begin{aligned}
 Q_{cf}^{ARL} &= \sum_{m=1}^n (\gamma_{cmf} A_{cf} R_{cmf}) \\
 &= Q_{cf}
 \end{aligned} \tag{06}$$

In this way, the total change in the quantity produced of the c -th crop of the c -th crop between the initial period and the final period is given by $Q_{cf} - Q_{ci}$ being:

$$\begin{aligned}
 Q_{cf} - Q_{ci} &= (Q_{cf}^A - Q_{ci}) + (Q_{cf}^{AR} - Q_{cf}^A) \\
 &\quad + (Q_{cf} - Q_{cf}^{AR})
 \end{aligned} \tag{07}$$

on what:

$Q_{cf} - Q_{ci}$: total variation in the production of the c -th crop between the initial and final period;

$Q_{cf}^A - Q_{ci}$: total variation of the quantity produced of the c -th crop between the initial and final period, when only the cultivated area changes, being called Area Effect (EA);

$(Q_{cf}^{AR}) - Q_{cf}^A$: total variation in the quantity produced of the c -th crop between the initial and final period when the yield varies and the other variables remain constant, being called the Yield Effect (ER);

$Q_{cf} - (Q_{cf}^{AR})$: total variation in the quantity produced of the c -th crop between the initial and final period when the geographic location of the crop varies within the state keeping the other variables constant, being called the Geographic Location Effect (ELG).

The above results - EA, ER, and ELG - can also be presented in the form of annual growth rates to facilitate the interpretation of the results. Thus, dividing both sides of equation (07) by $Q_{cf} - Q_{ci}$ and multiplying them by:

$$\begin{aligned}
 r &= \left(\sqrt[p]{\frac{Q_{cf}}{Q_{ci}}} - 1 \right) 100
 \end{aligned} \tag{08}$$

where, root index, represents the number of years of the period under analysis, given by $t_f - t_i$ and r corresponds to the average annual percentage rate of variation in production, also called the annual production growth rate (TACP) of the c -th crop, where if:

$$\begin{aligned}
 r &= \frac{(Q_{cf}^A - Q_{ci})}{(Q_{cf} - Q_{ci})} r + \frac{(Q_{cf}^{AR} - Q_{cf}^A)}{(Q_{cf} - Q_{ci})} r \\
 &\quad + \frac{(Q_{cf} - Q_{cf}^{AR})}{(Q_{cf} - Q_{ci})} r
 \end{aligned} \tag{09}$$

on what:

$\frac{(Q_{cf}^A - Q_{ci})}{(Q_{cf} - Q_{ci})} r$ = Area Effect (EA), expressed in annual growth rate (in%);

$\frac{(Q_{cf}^{AR} - Q_{cf}^A)}{(Q_{cf} - Q_{ci})} r$ = Yield Effect (ER), expressed in annual growth rate (in%);

$\frac{(Q_{cf} - Q_{cf}^{AR})}{(Q_{cf} - Q_{ci})} r$ = Geographic Location Effect (ELG), in annual growth rate (in%).

3.1.1.1 Area Effect (EA) decomposed into Scale and Substitution.

In the analysis of the EA, one can also analyze the variations that occurred especially in two ways: by the Scale Effect (EE) and the Substitution Effect (ES). In this, the incorporations (or losses) of areas of culture are observed within the total area within the system itself (participation in the system). On the other hand, it is analyzed in association with the variations of the culture to the variation of the total area of the system, keeping the participation of such culture in the total of cultures unchanged.

Thus, by defining A_{cf} the area cultivated in the state with the c -th crop in the final period, and being A_{ci} the area cultivated in the state with the c -th crop in the initial period, the variation in the area occupied by this c -th crop (EA represented in hectares²) can be expressed by $(A_{cf} - A_{ci})$.

Considering λ the coefficient that measures the change in the size of the system (in this work considered as the set of cultures analyzed) between the initial and the final period (that is, $\lambda = A_f/A_i$), the variation in the area occupied by the c -th crop between the initial period and the final can be decomposed into two components, according to formula 10:

$$(A_{cf} - A_{ci}) = (\lambda A_{ci} - A_{ci}) + (A_{cf} - \lambda A_{ci}) \tag{10}$$

on what:

$\lambda A_{ci} - A_{ci}$ corresponds to the EE expressed in absolute value (in hectare), that is, it expresses the variation in the cultivated area of the c -th crop attributed to the variation in the size of the system, keeping the participation of this culture in the system constant;

$(A_{cf} - \lambda A_{ci})$ is the ES expressed in absolute value (in hectare), that is, it represents the variation in the cultivated area gives c -th crop attributed only to the change in the participation of the culture in the system.

Thus, a positive value for $(A_{cf} - \lambda A_{ci})$ represents that the value observed for the area cultivated with the c -th crop at the end of the period (A_{cf}) exceeded that expected value if the variation in the area with the crop had been exactly the same proportion as the variation in the size of the system (λA_{ci}), and therefore it would represent that the c -th culture absorbed area of other culture (s) inserted in the system. Conversely, a negative value for $(A_{cf} - \lambda A_{ci})$ represents that the value identified for the area cultivated with the c -th crop at the end of the period was

less than the expected value if the variation in the area with this crop had been precisely the same proportion as the variation in the size of the system, therefore, it would represent that the c -th crop yielded area for another crop (s) inserted in the system.

Assuming that all the crops that yielded the area did so only for other crops that are part of the system, it can be said that the entire area provided by one crop was consumed by another crop (s) belonging to the system. Therefore, it is deduced that, when considering the complete system, the sum of the identified substitution effects, expressed in absolute value (in hectare), will be null, that is:

$$\sum_{c=1}^k (A_{cf} - \lambda A_{ci}) = 0 \tag{11}$$

These effects can also be expressed in annual growth rates. Thus, dividing both sides of equation (10) by $(A_{cf} - A_{ci})$ has:

$$1 = \frac{(\lambda A_{ci} - A_{ci})}{(A_{cf} - A_{ci})} + \frac{(A_{cf} - \lambda A_{ci})}{(A_{cf} - A_{ci})} \tag{12}$$

Multiplying both sides of the equation 12 EA expressed in growth rate (%), we have:

$$EA = \frac{(\lambda A_{ci} - A_{ci})}{(A_{cf} - A_{ci})} EA + \frac{(A_{cf} - \lambda A_{ci})}{(A_{cf} - A_{ci})} EA \tag{13}$$

being that

$\frac{(\lambda A_{ci} - A_{ci})}{(A_{cf} - A_{ci})} EA$ it is the scale effect, in the annual growth rate (in%);

$\frac{(A_{cf} - \lambda A_{ci})}{(A_{cf} - A_{ci})} EA$ it is the substitution effect, in annual growth rate (in%).

3.1.1 Data Source and Treatment Form

The basic data used for the present study were obtained through electronic information provided by the IBGE Automatic Recovery System - SIDRA of the Brazilian Institute of Geography and Statistics - IBGE. The data refer to the Municipal Agricultural Production Report - PAM 2016 (table 1613) related to the passion fruit, banana, and coffee crops in the state of Rondônia, which are used for own calculations and consecutive obtaining the growth rates of the crops through the shift-share model. The results found were presented in the form of tons (when related to production), in hectares (in situations involving area), and in percentages (especially for the presentation of growth rates, EA, EE, ES, ER, and ELG).

² Unit of measure represented by "ha", commonly used in the agrarian field. It corresponds to an area of 10,000 m².

As mentioned, the analysis period covered the interval between the years 1997 to 2016. In addition to the total period, shorter intervals were also calculated, corresponding to half a decade (5 years). This segregation served to observe the productive variations in different economic and political periods experienced by the country and the state of Rondônia.

Finally, it is worth noting that, in addition to the global calculation of annual growth rates, rates were also determined by micro-regions of the state of Rondônia, specifically for the production of passion fruit. The state of Rondônia, belonging to the Western Amazon and the Northern region of Brazil, and currently (2018) has 52 (fifty-two) municipalities. Thus, the municipalities of the state, according to the IBGE, are distributed in 8 (eight) microregions: Alvorada do Oeste, Ariquemes, Cacoal, Colorado do Oeste, Ji-Paraná, Vilhena, Guajará-Mirim, and Porto Velho. The analysis of the micro-regions served to observe the production behavior of each one and the trends of productive vocation.

IV. RESULTS ANALYSIS

4.1 The behavior of the Agricultural Production Series in the state of Rondônia

Initially, the historical series of agricultural production in the state of Rondônia (production in quantity/tons) will be presented, as well as the respective evolutionary information in percentage terms. Thus, figures 1 to 3 represent, respectively, the evolution of the quantity (in tons) produced in the state of Rondônia during the period 1997 to 2016 for the three crops analyzed: banana, coffee, and passion fruit, with the following being, emphasized the growth of the main rate (positive or negative) of the crops.

Analyzing the figure 1, representant of banana production, an upward trend can be observed in the series, when considering the entire period, that is, there was an expansion of production, mainly in the years after 2000, a year that marks a change in the level from the series. Thus, the production of bananas, in the period from 1997 to 2016, in percentage terms grew at an average rate of 15.62% per year, due to this structural change. However, when considering only the period after the change in level (2001 to 2016), it appears that the average rate of growth is 2.11% per year.

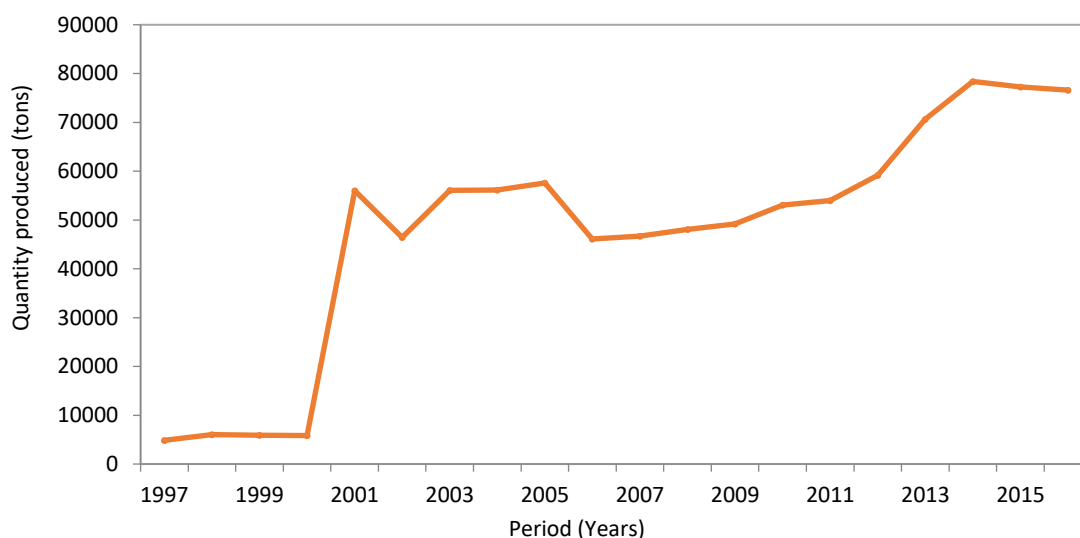


Fig.1: Graphical representation of the quantity (in tons) of bananas (bunches) produced in the state of Rondônia from 1997 to 2016.

Source: Research results

As for the coffee culture, shown in figure 2, there is a retraction in production when considering the entire period. The series up to 2001 shows an upward trend, with

an annual growth rate of 27.72%. In 2002 there was a sharp drop in coffee production, establishing a growth rate of -0.25% per year for the period from 2002 to 2016.

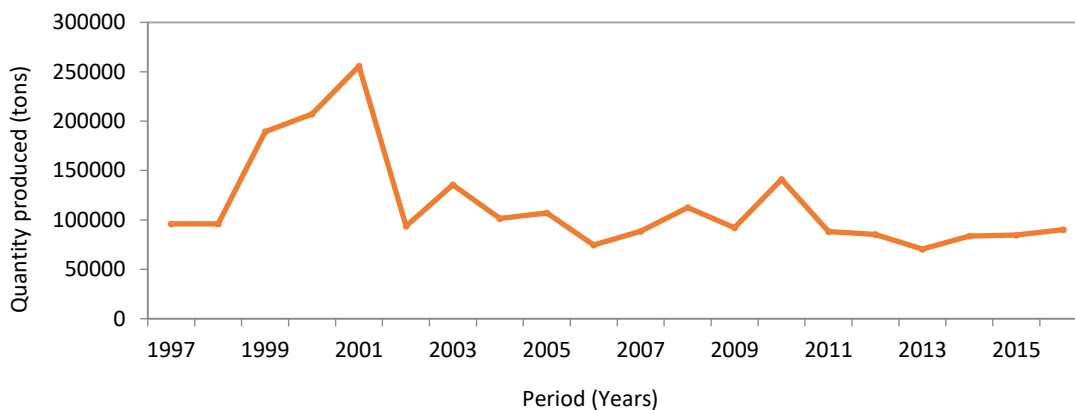


Fig.2: Graphical representation of the quantity (in tons) of coffee (in grain) produced in the state of Rondônia from 1997 to 2016

Source: Search results

In figure 3, the upward trend for the production of passion fruit is revealed during the period from 1997 to 2016. The fruit presented a growth rate of 1.91% per year in the period. However, this rate is not representative of the interstice since the passion fruit culture has undergone several changes over that time. Between 1997 and 2001, there was a drop in production, with a growth rate of -

31.69% per year. Between 2001 and 2006, production remained costly. In the final analysis periods, 2006 to 2009, fruit production started to grow again, and from 2009 to 2011, it suffered a retraction again. Finally, from 2011, the production of passion fruit showed significant growth, with a rate of 35.96% per year for the period from 2011 to 2016.

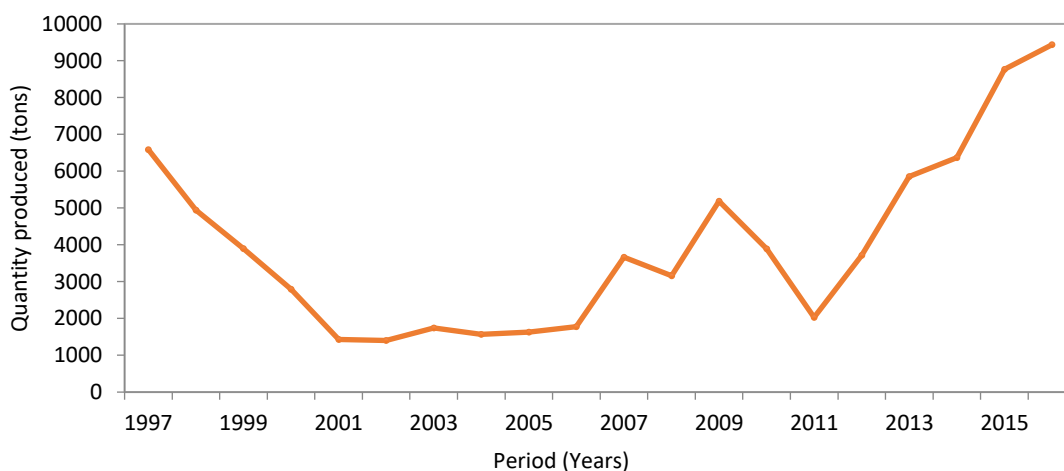


Fig.3: Graphical representation of the quantity (in tons) of passion fruit produced in the state of Rondônia from 1997 to 2016.

Source: Search results

Thus, in summary, it is observed that the production of banana and passion fruit has been growing in the last analyzed periods, with banana-growing through a controlled rise since 2002 and passion fruit with strong growth after 2011. On the other hand, coffee, after the peak of production (among the analyzed period) in 2001, has been losing productivity until maintaining a certain stability since 2011.

Thus, to better show the reasons for the productivity variations mentioned above for the crops, the growth rates are presented in the sequence considering the EA (total and decomposed into EE and ES), ER, and ELG for the passion fruit, banana, and coffee for the period from 1997 to 2016.

4.2 Analysis of Agricultural Production Growth Rates in the State of Rondônia

In this section, the TACP findings for the analyzed cultures will be presented through the application of the shift-share model. The calculation of the TACP is accompanied by the presentation of its fragmentation into EA (subdivided into EE and ES), ER, and ELG for the period from 1997 to 2016 and five-year intervals. In the end, growth rates exclusively for the passion fruit culture

in the period and the specific rates by micro-region of the state of Rondônia are also presented.

Thus, as can be seen in figure 1, the crop that obtained the highest growth rate among the complete period of analysis (1997 to 2016) was banana, which perceived an annual growth rate of 15.62%, followed by passion fruit with annual growth in the order of 1.91 and lastly coffee, with a rate of -0.32%.

Table 1: Annual Production Growth Rate (TACP), Total Area Effect (EA) decomposed into Scale Effect (EE) and Substitution Effect (ES), Yield Effect (ER), and Geographic Location Effect (ELG) for the state of Rondônia, in the period from 1997 to 2016.

Culture	TACP (%)	Effects (%)				
		Area Effects (Total and Decomposed)			ER	ELG
		EA	EE	ES		
Banana	15,62	0,32	-0,24	0,56	14,31	1,00
Coffee	-0,32	-1,44	-1,25	-0,19	0,46	0,66
Passion Fruit	1,91	23,27	-1,02	24,28	-22,27	0,92

Source: Search results

The overriding factor for the result obtained by the banana was the yield effect, responsible for 91.61% of the period's TACP. Passion fruit, on the other hand, although there was a moderate growth within the full period of analysis, there is a significant counterpoint between EA (and this one, especially due to the absorption of passion fruit from areas of other crops - achieved

exclusively by ES) and ER, or that is, if the passion fruit culture had not expanded its planting area, it would certainly perceive a negative growth for the period due to the fall in production yield.

Table 2 shows the TACP for the period from 1997 to 2002. In this period, the expressive growth rates of banana (positive) and passion fruit (negative) stand out.

Table 2: Annual Production Growth Rate (TACP), Total Area Effect (EA) decomposed into Scale Effect (EE) and Substitution Effect (ES), Yield Effect (ER), and Geographic Location Effect (ELG) for the state of Rondônia, in the period from 1997 to 2002.

Culture	TACP (%)	Effects (%)				
		Area Effects (Total and Decomposed)			ER	ELG
		EA	EE	ES		
Banana	57,07	-0,62	3,34	-3,96	60,48	-3,06
Coffee	-0,52	6,16	5,78	0,38	-6,50	-0,18
Passion Fruit	-26,60	9,74	9,67	0,07	-36,35	0,0026

Source: Search Results

For both cultures, the main elements responsible for the TACP were obtained in the period outside the ER.

However, for the banana positively (60.48%) and the passion fruit negatively (-36.35%). On the other hand,

coffee, as in the analysis of the complete period, noticed a small drop in the growth rate for the period from 1997 to 2002, highlighting the loss of productivity (RE) and the gain with the planted area (EA) practically equivalent, as shown in figure 2.

It is also noted that for all cultures from 1997 to 2002, there was positive growth in production due to EE (subitem of EA). One of the possible reasons for the rate

increase through the Scale Effect is because the state of Rondônia is one of the youngest in the Brazilian Republic and thus could have new internal agricultural frontiers yet to be explored in the period.

Therefore, table 3 shows the TACP for the period from 2002 to 2007. In this interstice, there is stability in the growth rates of the banana, coffee, crop, and strong growth in the TACP of the passion fruit.

Table 3: Annual Production Growth Rate (TACP), Total Area Effect (EA) decomposed into Scale Effect (EE) and Substitution Effect (ES), Yield Effect (ER), and Geographic Location Effect (ELG) for the state of Rondônia, in the period from 2002 to 2007.

Culture	TACP (%)	Effects (%)				
		Area Effects (Total and Decomposed)			ER	ELG
		EA	EE	ES		
Banana	0,11	-0,53	2,56	-3,09	0,19	0,44
Coffee	-1,09	2,73	2,63	0,11	-4,11	0,28
Passion Fruit	21,16	13,65	1,69	11,97	4,34	3,17

Source: Search results

In this period from 2002 to 2007, it is the only one that shows a certain stabilization in the rate of banana cultivation (0.11%). Coffee again showed a negative growth rate of -1.09%, influenced once again by the loss of productivity (ER). The passion fruit culture, on the other hand, reached an intensive growth of 21.16%. The main

reason for the positive growth of the passion fruit culture in the period from 2002 to 2007 is mainly due to the EA, and this by the ES (responsible for 87.69% of the TACP), that is, among the analyzed cultures, the passion fruit absorbed to the planting area of the others.

Table 4: Annual Production Growth Rate (TACP), Total Area Effect (EA) decomposed into Scale Effect (EE) and Substitution Effect (ES), Yield Effect (ER) and Geographic Location Effect (ELG) for the state of Rondônia, in the period from 2007 to 2012.

Culture	TACP (%)	Effects (%)				
		Area Effects (Total and Decomposed)			ER	ELG
		EA	EE	ES		
Banana	4,84	5,17	-4,36	9,53	-0,95	0,62
Coffee	-0,72	-4,49	-4,17	-0,32	3,33	0,44
Passion Fruit	0,31	-2,37	-4,09	1,72	-0,50	3,19

Source: Search results

Table 4 shows the TACP for the period from 2007 to 2012. Thus, it can be seen that among the periods analyzed, this is the one with the lowest growth rates if the set of the three cultures is analyzed. The crop with the highest TACP in the period was banana, with a rate of

4.84%. It should also be noted that coffee for the third consecutive period has a negative growth rate (-0.72%). Although, differently from the periods from 1997 to 2002 and 2002 to 2007, which showed a reduction in production due to yield (ER), in the period from 2007 to 2012 coffee

managed to obtain a positive yield rate, however, in the final total of the growth rate, presented a negative rate due to the reduction of the planting area (EA).

Finally, in table 5, the last five-year period analyzed is presented: 2012 to 2016. In table 5, it is observed that for the first time, during the analysis period, all three cultures showed positive growth rates.

Table 5: Annual Production Growth Rate (TACP), Total Area Effect (EA) decomposed into Scale Effect (EE) and Substitution Effect (ES), Yield Effect (ER), and Geographic Location Effect (ELG) for the state of Rondônia, in the period from 2012 to 2016.

Culture	TACP (%)	Effects (%)				
		Area Effects (Total and Decomposed)			ER	ELG
		EA	EE	ES		
Banana	6,68	3,00	-7,53	10,53	4,59	-0,91
Coffee	1,40	-8,88	-8,14	-0,74	8,29	1,99
Passion Fruit	26,21	29,16	-5,67	34,83	-4,37	1,43

Source: Search results

In this period, the recurring positive growth rate of the banana crop, 6.68%, is verified. For the first time, a positive growth rate is perceived for the coffee crop (1.40%), mainly achieved by productivity gains. Passion fruit had an important growth in the last analyzed period,

in the order of 26.21%. The growth in passion fruit production is primarily a credit to ES, which includes EA.

A specific analysis was also carried out on the TACP of passion fruit production among the micro-regions of the state of Rondônia for the period from 2007 to 2016, shown in table 6.

Table 6: Annual Growth Rate of Passion Fruit Production TACP (r) by Microregion of the state of Rondônia for the period from 2007 to 2016.

Microregion	TACP (%)
Alvorada do Oeste	32,31
Ariquemes	13,22
Cacoal	21,43
Colorado D' Oeste	11,50
Guajará-Mirim	-9,41
Ji-Paraná	11,42
Porto Velho	23,77
Vilhena	-0,63

Source: Search results

With that, it can be seen that the microregions of Guajará-Mirim³ and Vilhena⁴ were the only ones that had a negative growth rate in the period (-9.41% and -0.63%,

respectively). The micro-region of Alvorada do Oeste⁵ had the highest TACP in the period under analysis, with a growth of 32.31%.

³ Microregion formed by the municipalities of Costa Marques, Guajará-Mirim and São Francisco do Guaporé.

⁴ Microregion formed by the municipalities of Chupinguaia, Parecis, Pimenta Bueno, Primavera de Rondônia, São Felipe d'Oeste and Vilhena

⁵ Microregion formed by the municipalities of Alvorada do Oeste, Nova Brasilândia do Oeste, São Miguel do Guaporé and Seringueiras.

Although the micro-region of Alvorada do Oeste congregates small municipalities (with a total estimated population of 72 thousand inhabitants in 2017), and therefore, inferred that there is little demand for the product, the passion fruit can be transformed into a semi-elaborated and commercialized product in the form of fruit

pulp, which after frozen can be stored for a long time. These situations favor the production of passion fruit in more distant locations of large consumer centers.

Finally, table 7 presents a synthesis of TACP exclusively for the passion fruit culture from 1997 to 2016 and the four five-year subperiods analyzed.

Table 7: Annual TACP Production Growth Rate, Total Area Effect (EA) decomposed into Scale Effect (EE) and Substitution Effect (ES), Yield Effect (ER) and Geographic Location Effect (ELG) for the passion fruit culture in the state of Rondônia for the periods 1997 to 2016, 1997 to 2002, 2002 to 2007, 2007 to 2012, 2012 to 2016

Culture	TACP (%)	Effects (%)				
		Area Effect (Total and Decomposed)			ER	ELG
		EA	EE	ES		
1997-2016	1,91	23,27	-1,02	24,28	-22,27	0,92
1997-2002	-26,60	9,74	9,67	0,07	-36,35	0,00
2002-2007	21,16	13,65	1,69	11,97	4,34	3,17
2007-2012	0,31	-2,37	-4,09	1,72	-0,50	3,19
2012-2016	26,21	29,16	-5,67	34,83	-4,37	1,43

Source: Search results

Thus, there are strong fluctuations in the TACP of passion fruit production, when there is a significant negative rate as in the period from 1997 to 2002 (rate of -26.60%), and in other opportunities, significant positive growth rates, such as those in the periods from 2002 to 2007, and from 2007 to 2012 (21.16% and 26.21%, respectively). However, as noted, in general throughout the period, it shows a small growth of 1.91%.

Also, it is observed that passion fruit, except for the period from 2007 to 2012, always perceives a positive AE, mainly due to the ES. It demonstrates that among the analyzed crops, producers are believing, in this crop, making their planting area absolute those of other crops. However, the increase in production across the area is not matched by the effective productivity (RE) of the fruit, which in most periods of analysis was negative (with the exception of the period 2002 to 2007).

V. CONCLUSION

The main objective of this study was to identify and analyze the growth dynamics of agricultural production of three important permanent crops in the state of Rondônia: banana, coffee, and passion fruit, with emphasis on this one. In addition, it also sought to quantify these production variations between the period 1997 to 2016 and in five-year subperiods.

In this way, it was possible to verify that the variations in the production of the crops occurred basically due to the AE and the RE, both in a positive and negative way. Regarding the EA, in the first cycles of analysis, it was noticed that the EE was largely responsible for the results, which is believed because the state of Rondônia has not yet reached its full agricultural frontier. In the last ten years, the main responsibility has become ES. ELG, on the other hand, practically did not significantly influence the results of any of the cultures, remaining practically constant during the analysis period.

As for the banana crop, it was the only crop that always had positive TACP throughout the analysis cycle, driven mainly by the ER. Coffee, on the other hand, was the crop that lost the most productive in the period, with a negative TACP of -0.52%. What contributed most to the bad result of coffee was the loss of planted area (EA), and in some periods there was also a loss of productivity (ER). However, it is possible to sustain the situation experienced by the coffee culture for macroeconomic issues and also for regional public policy issues.

In the 1990s, the state government had a large project to support farmers in the state of Rondônia called "Plante Café". From the 2000s onwards, there were no more significant state investments in the culture in the state, which may have discouraged the planting of the grain and, consequently, provided the results obtained, mainly

regarding EA. However, it is estimated that there may be a new increase in coffee productivity in the state in the coming harvests (until the 2020 harvest) due to the recent resumption of new state projects linked to coffee culture, such as the project called “Plante Mais”.

Passion fruit, on the other hand, had a negative result for the first cycle of analysis, including a significant drop, but with recovery in the sequence. In the penultimate period of analysis, some stability in the TACP was perceived and finally presented a strong growth rate, in the order of 26.21% for the period from 2012 to 2016. The TACP obtained by the passion fruit was also marked by the influence of the EA and the ER. However, as for the AE, the striking gain in planting area obtained by the fruit was verified (except for the period from 2007 to 2012), obtained mainly due to the ES. On the other hand, the negative results regarding the ER did not allow the culture to obtain a more expressive growth rate. With this result, it is inferred that the state of Rondônia still suffers from the low degree of technology used in the cultivation of passion fruit, which directly influences the yield of fruit production.

However, such a scenario experienced by passion fruit (ER) is reversible. According to Resende (2017)⁶, the cultivation of passion fruit in the state of Rondônia requires greater attention than in other regions due to the humid climate typical of the Amazon region. Such a scenario is conducive to the attack of insects, an example that directly interferes with the fruit's productivity. Public investments in research/studies that can identify more resistant fruit varieties for the region, or increase the availability of technical assistance for preventive action against pests, are examples that can contribute to the increase in the passion fruit productivity in Rondônia.

It is also noteworthy that, except for the microregions of Guajará-Mirim and Vilhena, all other microregions achieved positive TACP of passion fruit production within the analysis period. It should be noted that the micro-regions of Alvorada do Oeste and Cacoal, even though they are far from the largest consumer centers, were some of those that had the highest positive growth rate.

Finally, it should be noted that the main limitation of the work was the number of cultures analyzed. Thus, it is suggested to build future research with the inclusion of other cultures, mainly temporary cultures. As a main consequence of the work, it is conjectured that it is the identification of technological deficiencies in agricultural

production in the state of Rondônia, mainly for passion fruit, and consequently being an alert instrument the need for public investment to reverse the scenario.

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⁶ Speech given by Agronomist Huigor Fernando Lobo Resende at the State Seminar on Culture of Passion Fruit, President Médici, 08 Apr. 2017.

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Great Diplomacies from 1884 to 1939 and Some Essential Impacts on International Relations

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Abstract— This important subject's objective will go a long way to show some diplomatic movements amongst states, countries and nations of the world especially between great personalities. Also student will find it interesting, how decisions taken changed the course of events among nations of the world with either in bilateral or multilateral perspectives. Furthermore, we shall move ahead to examine glaring issues on the wars, its course manifestations and effects on the balance of power system as a conduct for the quest of great power hegemony. More so, the weaknesses or relaxation of some diplomacies adopted by some states members via organizations led to the beginning of new pattern or standard. At a certain level, diplomacy sprang up aggression that plunged the world into greater power domination in 1939. Worth noticing is the fact that the nature of evolution in diplomacy from 1915 to the 1940 could not be left out entirely. At the end of this topic readers would understand, peace seeking is the goal for international relations. As sensitivity play vital role, usually a successful role in establishing diplomacy and the outcomes, always, positive, when use the methods. As method we use some available sources which of most important is the written source got from schools and public libraries and archives centers. The results show clearness of diplomacy at work which has been the solution for conflicts, holding on peace. More so, we find out and diagnose and give as result, positive results how diplomacy yield more fruits. These are proving to say that Diplomacy is the best alternative to advocate for peace.

I. INTRODUCTION

Open or hidden Diplomacy as objective is for peace and without the notion of future peace then it's not Diplomacy, thought or thinking, such example could be The Atlantic Charter at the Heart and offshores of the Atlantic Ocean held by the Great Powers while talks at Yalta and Potsdam avoided unknown and accepted to be known. As concerns the changing nature of Diplomacy the British Diplomat Sir Harold Nicolson in his classic or Diplomacy.' Diplomacy is the management of

International relations are adjusted and managed by Ambassadors and envoys..." Diplomacy today still involves the art of negotiation and practiced by ambassadors and envoys, the nature has changed which is the focus on the role of the embassy and ambassador, the role of the public as opposed to secret diplomacy like the Red or Red Orange War, [20]a Diplomacy that deals with Europe Versus the Pacific, was no longer within the realm of probability, but the Atlantic area occupied more of the attention of the strategists after 1938, as well as the role of multi-lateral as opposed to Bilateral diplomacy, the role of

facet as opposed to explicit or formal diplomacy. [14] Today Ambassadors can conceivably trace their roots as far back as prehistoric times when even the members of primitive societies no doubt occasionally felt the need to deal with mutual concerns through emissaries of some sort. In some circumstances for example the United states, nonprofessionals were found in this Ambassadorial duties like that of Mixon to the count of St. James in London but it was ancient which had much problems but nowadays it has become more professionalized because of the advanced communication and travel technology, has made leaders less reliable to their Ambassadors. Our center of concern here is how public versus secret Diplomacy, multi-lateral versus Bilateral Diplomacy works. [8] [14] Therefore to better understand these subject it will be good to diagnose our center of concern which is diplomacy in all its meaning so as to make known our focus objectives which is the already done and the future event to come which is in the making. The question pose here is What is diplomacy and how was it applied in current issues during the period 1884 to 1939 and how did these diplomacy actions impacted some worldly events during and after this period? To better answer this question it will be interesting to expound on the following key aspects, Some Conceptual Framework, Origin, evolution of Diplomacy, global historical context on some diplomacy before 1884, diplomacy centered around and within the two great wars in the world, universal diplomacy within and outside 1884 and 1939 and its impact on international relations.

SOME CONCEPTUAL FRAMEWORK

Diplomacy refers to the activity of managing relations between different countries, states and among nations. It should be emphasized that the skill or talent of doing this is known or called International Diplomacy. Diplomacy is to obstruct war and as such better than war. Diplomacy usually deal with difficult situation that is always very dangerous or crucial and must not led to up-seething or offending (offensive) the personalities and countries representative, it should have much with tact hence shuttle diplomacy. Shuttle diplomacy will refer to international talks carried out between countries of members who travel to talk to the different government that involved hence these members are diplomat.

A diplomat therefore refers to a diplomatist thus a person whose job is to represent his or her country in a foreign country. For example, in an embassy, in a conference hence this is a person who is stilled at dealing with other people in the struggle for peace using diplomatic means. Diplomatically, this will refer to the methods, means or manner a problem was resolve either

by isolation (secluding) or coming to closeness with one another usually among countries.

State will denote an organized political community forming part of a country for example the state of Victoria, and Western Australia, the Southern state of the U.S. Also state means a country considered as an organized political community controlled by one government for example the Baltic states, the state of Israel, European union member states, city state of Greece, nation state, police state, welfare state, the United States of America thus informal. The state could be referring or known to be the government of a country hence matters, affairs of state, people who are financially dependent on the state for example state owned company, they wish to limit the power of the state. Furthermore, a state is a geographically bounded entity governed by a central authority that have the ability to make laws, rules, decisions to enforced them within its boundaries. A state is also a legal entity recognized under international law as a fundamental decision. Analytically, making unit of the international legal system. States determined their own policies at best in theory and established their own form of government which may differ significantly from state to state. The citizens of a state depended on the law passed by the government of that state. Regent less of their citizenship states and subject to the law of that state. While a nation by contrast need not necessarily geographically banded or legally defined. A nation is a grouping of people who viewed themselves as being link to one another in some manner. A nation is therefore as mush a psychological fixation as anything else, groups of people who consider themselves to be ethnically, culturally and linguistically related may hence be consider a nation. Nation may exist without territorial control for example the Jewish nation before 1947 until when the state of Israel was founded. The nation state, therefore, will denote the geographical bounded entity under a government. The population is related and shaped. Historically, nation state is more related than either state or nation that reflects the growing convergence of recent event. For example, the Rome-Germanic Empire that ended with the treaty of Westphalia then established a state system in the European system that extended to other areas of the world. They created overseas colonial empires in 1870. Europeans states constructed empires in the 17th and 18th countries to increase their wealth, power and prestige that became effective when they laid down the ground work of the conquest, partition in colonization of Africa during the Berlin Colonial Conference of November 1884 to February 1885.

As of what concern national interest, it refers to the ways a state defines its own interest and achieved it for

(generalities) all its citizens. In this case states determined their own policies at best in theory which established their own government which may differ significantly from state to state. A state interest is called national interest in method and actions, it employs in the attempt to achieve, are called national policy. Therefore, the concept of national interest is ambiguous and the winner defines the state national interest.

Sovereignty means complete power to govern a country, the state of being a country with freedom to govern itself. It was usually seen under the declaration, proclaimed the full sovereignty of the republic; Many countries, nations, states used methods in the political, socio-cultural, economic, military, linguistic and others to gain diplomatic links hence sovereignty. Many have undergone conflictual stages to gain sovereignty. For example, how China and Japan see each other was coupled with a lot of different ideologies and national interests. Chinese and Japanese of western imperialism in the nineteenth century in almost diametrically opposite ways, each struggling to gain her sovereignty, Japan accommodated herself to an incorporated modern technology while China disintegrated as a social system and required a century before she could begin her own modernization under conditions of national unity, as such attain her sovereignty. International Relations is a branch of political science concerned with relations between political units of National rank and dealing primarily with foreign policies, the organization and function of government agencies concerned with foreign policies. [1]

Conventions: It often includes many signatories and for which the original signatories encourage other countries to join long after the original agreement is reached. In 1973, for example, representatives of 80 countries agreed on a convention on International Trade in Endangered Species (CITES) to protect rare plants and animals around the world. Treaties: It must be signed to by the U S Senate and ratified by the President. The United States and Great Britain ended the Revolutionary War with the treaty of Paris in 1783. Alliances: Among nations are often formed for mutual economic, political or security benefits and can be multilateral or bilateral. The North Atlantic Treaty Organization (NATO) was formed in 1949 to serve as a bulwark against threats by the Communist Warsaw pact in Eastern Europe. Since the fall of the Berlin Wall in 1989 and the dislocation of Pact nations, many Eastern European Nations have joined NATO, thus changing and expanding its defensive outlook. A bilateral example is the U S South Korea Mutual Defense Treaty of 1953. Accords: These are voluntary agreements that countries enter into instead of a treaty or which they try to work out the terms of a treaty. The Kyoto Accord is an

agreement among nations to limit the emissions of greenhouse gases.

-The subjects of treaties span the whole spectrum of International relations: Peace, trade, Independence, reparations, territorial boundaries, human rights, immigration, and many others.

-The final result of negotiations is usually a formal written communiqué or agreement that spells out the actions and responsibilities of each side. The most well-known is, of course, the treaty, a formal, written agreement between sovereign states or between or among countries and International organizations.

Cultural Diplomacy: China is also escalating cultural outreach. It does so largely through Confucius Institute, nonprofit public institutions that aim to teach and promote Chinese language and culture around the world. Diplomacy: Is the act of dealing with other nations usually through negotiation and discussion. It involves meetings between political leaders, sending diplomatic messages, and making public statements about the relationship between countries. [17]

II. ORIGIN, EVOLUTION OF DIPLOMACY

One of the fathers of history, Thucydides who recounted, discussion geared in certain episodes made references to diplomatic missions through treaties signed. As an eye witness to some negotiations in other contexts associated with diplomacy gives it legal official start. As far as this is known the first professional diplomatic corps appear in the Byzantine Empire due to the collapse of Rome. Byzantium established the world first diplomacy of foreign affairs that developed strict and complex diplomatic protocols with actively sort intelligence about friends and enemy alike. Surrounded by enemies, Byzantium needed all the skills in diplomacy it could master.

Furthermore, the act took an advance level or greater height hence might say plan in Italy during the 5th and 6th centuries. The Italian city states of Rome and Athens engaged in constant intrigues against each other. During this era, diplomacy became identified with behind the scene scheming duplicity with double dealings. However, Nicolo Machiavelli of Florence stresses the system internationally, in his book "the prince" 1532. He explains that royals should use whatever means they had at their disposal to stay in power. More so, when European diplomacy further evolved in the 17th and 18th Centuries particularly in France under Louis XIV, the minister of foreign affairs became an important adviser to the king Louis XIV, also established embassies in all major foreign

capitals. For the first time, international treaties and agreement also required exact and specific wordings: foreign affairs, embassies, protocols-intrics Ambassadors, treaties, agreements and its people.

The realization of international interest of diplomacy

The act of Diplomacy according to Prince Metternich is the act of according victory. Since Napoleon Bonaparte Empire failed the conquerors had more say than the vanquished power. According to John W. Stoessinger, diplomacy can be defined as the conduct of international relations by negotiation. It is a process through which nation attempt to realize their international interest. It is of course not always an instrument of political order. It objects at times may be the intensification of a struggle between nations or it may be a mutual two that regard other as irrelevant or pursuance of national interest. [14] But more often than not diplomacy is an important instrument of political order for the very process of negotiation implies that nations settled their differences through peaceful change in the frame work of given system rather than by resorting with the over throw of the system through violence. The eruption of war means diplomacy has not yield it instrumental goal hence becomes super flows as far as the national interest detects the avoidance of war, *diplomacy work on behalf of peace*, then since most nation feel most of the time that their policies may be realized by means of war, diplomacy has been a major highway for political order. In the Far East and the pacific, the main powers involved were Russia, Japan, Britain, Germany the USA and France. Britain used Forceful diplomacy to strengthen her interest by the policy of lord Palmerstone and China Grant to Britain special trading facilities in the five treaty ports and at the same time gain the lease of Hong Kong. This diplomatic act brought Germany and America who occupied Fiji Islands and Samba was divided respectively. Furthermore, Germany in 1884 gained control of part of New Guinea and purchase from Spain Caroline Islands. In 1902 Russia completed the Trans-Siberian Railway as a result of British forceful diplomacy. [4] [12] To better explain this study, the question we need to ask is, how was diplomacy carried out between 1884 to 1939 in the World? To answer this question, we shall examine the following points or axis below.

III. GLOBAL HISTORICAL CONTEXT ON SOME DIPLOMACIES BEFORE 1884

As a flashback, not only from 1884 to 1939 that, great diplomacies were carried out. Before this date much was done.

1. InSome Places of Continental Europe

The only way Napoleon could think to solve French enormous difficulties like the French revolution was to establish an aggressive foreign policy of constant attacks. His limitation ended him in a fiasco. Statement had the gigantic task to resolve the crisis. At Vienna in November 1814 after the renounced West-Phalia in 1684, a diplomatic corps was set under Alexander of Russia, Prince Metternich for Austria, and Lord Castlereagh for England, king of Prussia, and Talleyrand for France. Decisions were those of the great diplomat. Aggression was checked, territorial dispute and effective alliance. This actually further boil down with the support of the Quadruple Alliance, the Holy Alliance, the Congress of Aix-La-Chapelle, Congress of Troppau/ October 1820. Troppau protocol/oct/1820, the congress of Laibach January 1821, the Verona congress October 1822 including others. The congress system (diplomacy) became or brought modern idea, like the League of Nations as an inter organization. [14]

Also, in Europe a diplomatist Lloyd George seek to solve the Anglo-Irish problem by diplomacy in the 19th centuries, when it was fashionable to speak of international problems in the 19th Centuries, when it was fashionable to speak of international problems in terms of “Questions” proved particularly intractable for successive British governments. The long problem between Great Britain and Ireland. Diplomatically, Ireland was divided into two as first attempted solutions – Northern Ireland came into existence while southern Ireland came to a still born. L. George negotiation with the Irish nationalists and Ireland had a status within the commonwealth like Canada and other dominion. Northern Ireland opted, a month and retain its status within the United Kingdom, hence or therefore, the solution was unsuccessful with the partition of Ireland. N. Ireland was never stable and eventually become unworkable within its existing framework. [7]

Germany diplomacy could by and large term “strings of diplomacy” with Austria and Russia due to the 1870 detent over France so as to stay on Alsace-Lorraine. Bismarck’s foreign policy of 1871 onward to 1890 was very successful. His diplomacy and king Kaiser William I was known as lightly protective diplomacy. The defensive and protective history of the chancellor ended with the charismatic maneuvers policy in Europe under Bismarck and King Kaiser William II was known as highly protective diplomacy. The defensive and protective history of the chancellor end with the charismatic Kaiser W II, in 1890 emergence. World diplomacy or throughout the 19th C diplomatic practices were for malaise in regularized ambassadors in their embassies attempt on the immense international importance often creating and implementing their countries foreign policy on the scene with detail

control from their home capital. Diplomats were drawn almost exclusively from the nobility. Most diplomacy was bi-lateral, directly between two countries for example, Germany and France. [7] [10]

2. In Some Areas of the Americas.

The united states of America and the huge dominion of Canada was established. Thanks to the events in Europe, long interconnected with that of the world by the only twentieth century became emerged with it entity, hence underwent the same process of national consolidation already traced from Europe. Due to economic importance Europe stabilizing economic diplomacy that led to immigration into the continent, new world Diplomats like Lincoln Abraham, Du Bois, and others advocated across conferences to end slavery and slave trade in the Americas. By 1850, the “companies of 1850” agreed to enforce the laws on runaway slaves aroused abolitionist sentiment to a higher pitch. [5] Finally determined confederated states of America, Lincoln ordered the armed forces to defend the territory of the United States and the resulting civil war, or war of southern independence. The continual infiltration of European power way for deadlock as once France and Great Britain had fought for control beyond the Alleghenies thus north and south fought to occupy and control of Mississippi. In 1846 the United States made war upon Mexico by methods at which Bismarck would not have blushed. Due to diplomatic moves or company the hits new state California was created called “Missouri compromise”. The Monroe Doctrine violated laws made against the Negroes of the America which diplomatically some blacks landed back to Africa. In 1861 the Russian serf owners face an overwhelming loss of property value as owners of liberated slaves were never compensated. Finally, the union armies (civil war) preserved the united of the United States by 1870s, America undergone reconstruction and industrial growth, hence the dominance of business and Finance. The civil war reduced English speaking America to a scramble of jealously competing minor republics which resulted in Economic, political, liberal and democratic consolidation hence its political principles, and committed, enthusiastically to private enterprise, in its economic system. [6] [9]

3. In The Continent of Africa

Before the coming of the Europeans into the continent of Africa diplomacy had existed, in the assume “Dark continent” or as South-South, indigenous diplomatic meetings in routines within the different groupings as tribes, clan and villages took place. Also, trade diplomacy existed known as the exchange of goods and services. As time went on conflicts were usually resolved between

states or African communities diplomatically using slaves as payment of damages or indemnity.

However, the scramble and partition of Africa mark a turning point in Africa diplomatic will practices. Europeans signed treaties with Africa kings and chiefs which became exasperating as Africans were vex because the accords were never respected. Missionaries, explorers and individuals first opened this world to Europe. Before 1841 Scot David Livingstone a medical missionary arrived Southeast Africa before the imperialist stage. He and Stanly Henry Morton, the roving journalists open friendly diplomacy which permitted him to be let alone. David was permitted freeness which he explored the Zambezi river and Victoria Falls. [19]

In 1878 king Leopold with the same notion at heart China, Formosa, the Philippines and Morocco attracted his fancy. Stanley and Leopold founded at Brussels with a few financiers, an international Congo Association emanated in 1878. He struggled but for the African central basin which was like a “terra nullius” like America inland in the days of Columbus. In 1882 Stanley returned to Congo and open diplomatic contacts which he signed about 500 treaties with some chiefs which he gave them some few trinkets or a few yards of cloth put their marks on his mysterious European papers and accepted the blue- and gold flag of the association. [13]

Others exploratory diplomatist from various domain ignorant of internal frontiers in the “Dark continent” such as Karl Peters – concern with Zanzibar sign treaties with the chiefs of East Africa. The Frenchman Brazza departing from the West coast distributing “Tricolor” as a symbolic method of, to claim the Congo river. All these people mention used pressures, trickish, peaceful, and generous diplomacy accords to achieve their goal. The Portuguese applied or do same to Angola, Mozambique. Bismarck personnel diplomatic interest on Africa cannot be left out of this discussion. In late 1884-to early 1885 summon the conference of Berlin of what was style “the African question to international regulation”. The two goals were to “set up the territories of Congo Association as an international state, under international auspices and restrictions. Secondly, to draft the code governing the way in which European powers wishing to acquire Africa territory should precede, Prince Otto Edward Leopold Von Bismarck the Prussian statesman who established the Unified German Empire and became the first Chancellor in 1871, used open diplomacy across a large conference. [11]

4. In Middle East and Far East Asia

Open, secret, hidden or close door shuttled diplomacy had been use in several occasion as regards on

states, Nations and countries ways to resolve conflicts. In the Middle East before 1884 in the long past, the Byzantine became very aggressive against the Israelite which threatened the peace of the holy land of Jerusalem and the tomb of Jesus. At this circumstance Europe seeks measures to protect their original religion, origin and vital trade zone. To draw an end to this threat religions crusade was enforce from Europe into the Middle East at Israel. This action diplomacy, several crusades amounting from one and extending to the seven. Thanks to this form of diplomacy that ended the danger at the time. [4]

Japan and china were sociologically, quite different societies and western imperialist pressure impinged up on each of them in different ways; some specific history occurrences continue to mold Chinese and Japanese attitude towards each other, in addition to the lowered pressures on the two nations of different ideologies and national interests. Their common Semitic civilization, closed to foreign intercourse since the 17th C which the west opens up in the 1840s and both faced common challenges. [20]In 1895 the “Celestial Empire” the Chinese suffered from the Japanese that led to the annexation of Taiwan (Formosa). This occupation evokes the first Chinese revolutionary movements into being was to blame their own independent Government. The western world used modernization diplomacy to have a grip in the far Eastern part of the world. This distinctive national identity and continuity with the past Diplomatic history was very barbaric and uncivilized due to a fusion of traditional cultures and incessant foreign humiliations which dismantle national dignity. Furthermore, ideological warfare let to the struggle or hammering on economic balance of power system. This is linked to the Chinese seriously, with their attitude toward their continental neighbors as somewhat comparable to the English or German industrialist’s attitude toward an Italian or Spanish aristocrat that recently, gone into commerce. The leaders Sun yat-sen, Chiang ka-shek, Mao Tse-tung showed the culture, capitalism and communism practices at various levels. For example, Mao Tse-tung Hundred Flowers campaign. The long march, the Cultural Revolution acted as active intelligent methods or diplomatic moves to implement and foster communist gripe in China. [11] [9]

IV. DIPLOMACY CENTERED AROUND AND WITHIN THE TWO GREAT WARS IN THE WORLD

At this juncture the diplomatic links between American and Europe was not very open nor serious. Some diplomats in certain or some conferences acted very slow and served as observers only. But activities in

Europe, Africa and Asia plunged the world into two great wars due to failures to apply diplomacy by diplomat, in other worlds, struggling to apply diplomacy others looked at it as an assault.

1.Before the first world war 1914

Peace movements before 1914 was pacifist and major influences opposed to war was gathering strength. The “Nobel peace prize” was instituted at the cause of peace. Diplomatic moves under taken by Czar Nicholas II of Russia called for The Hague Peace Conference in an effort to secure some accepted measures of disarmament among the Great power. This brought about 26 countries in its first meeting in 1907; the matters on actual disarmament became “greatest nonsense” as one agreement was not meted at.

The Berlin congress of 1878 change the course of history in Europe, the formation of alliances; system or strategies was the struggle for a balance of power system. Bismarck cognoscente of the fact after 1870 built up the alliances system as diplomatic moves and sense to counteract any ideological warfare. But to Bismarck greatest dismayed, he was dismissed by the Kaiser William II in 1890. But before the German chancellor left the diplomatic podium he had set the pace for the alliance system. Some of these alliances were the Dual Alliance of France and Russia in 1893 to counterweigh the triple Alliance between, Austria, Germany and Italy. The alliances system brought tension in certain crisis in the Balkan, Egypt, Persia, Afghanistan and the Far East not leaving out Moroccan crisis of 1905-1906. [13]

Other close diplomatic peaceful alliances for war and against war were the Anglo-Japanese Alliance 1902, the Anglo-French Entente 1904, the entente cordiale 1904, the Algeciras conference of 1906, the second Moroccan and the Agade incident all in 1911 which nearly brought a general war on this year. The Balkan problem of 1878-1919 and the Balkan war of 1912-1913 resulted to the Great War that only came to an end in 1919 at the Paris Peace Settlement. Diplomats could resolve conflicts of interest, reconcile hostile forces and enhance all nations’ safety and well being. Combined diplomacy that in value diplomatist such as Vitorio Emmanuelle Orlando of Italy, David Lloyd George of Great Britain, George Clemenceau of France, and Woodrow Wilson of the United States examine situations in their light as they accepted the responsibility at their interest. [6][15] [12]

Bismarck policies stemmed from his experiences combined with his nature temperament. He supported the William with that of the king. As a care diplomat worked in the Prussian Diet. At Frankfurt he became, was sent as Prussian Ambassador to Russia. Bismarck became

president of the country in 1862 he organized the military in 1862. He organized the army so well that he gains the popular. In 1872 he brought three Emperors to reasoning known as Dreikaiser bund: Empower of Germany, Austria and Russia thus mutual security and support in attaining the object of their respective foreign policies: Russia in the Balkans; Russia against Turkey; and Germany against France. But any such "understanding" was too artificial to endure the test, had few interests in common and many that were divergent. In particular, the aims of Russia and Austria in the Balkans were bitterly opposed to each other: Austria, while anxious to extend in the southeast, wished also to uphold Turkey in order to counterbalance Russia; where as Russia wished to dismember Turkey and seize Constantinople, it was the treaty of Berlin of 1878 which emphasized these differences: for after Russia had beaten Turkey and had dictated the treaty of San Stephano, the European Congress at Berlin insisted on the modification of the terms of the treaty; and foremost among the opponents of Russia at the Congress were Germany and Austria. The result was that, in spite of continued negotiations, the Dreikaiser bund a natural death before Bismarck fall in 1890. [15]

Furthermore, Diplomacy also surfaced due to Bismarck initiation through he had personal interest but was highly peaceful. He accepted the drawness together of Germany and Austria in case of Russian attack, out of this then neutrality was to be maintained. This was called the triple alliance of 1882 which Italy also enter the alliance, hence, being friction with France on the question of Tunis. It was territorial alliance designed to secure the territorial integrity of its members. But it was unnatural superficial as only time could test its durability.

More so the Dual Alliance of 1891, the consequent isolation of Russia in the East and of France in the West, tended to draw those two powers together. The two powers signed in 1891 a binding treaty or agreement. Furthermore, the Anglo-Japanese alliance of 1902 to counter balances the menace of Russia on Japan over Manchuria and others. More so, the Entente cordiale of 1904. The "epoch-Making" an agreement achieved by the diplomacy of Délcassé hence an attempt to the Anglo-French Agreement. Before 1914 Triple alliance and Triple entente were ranged against each other hence conceivably be able to maintain such a suitable and stable balance of power for peace preservation, some number of event throw them into the mess and violent tragedy in 1914. [12]

a. The Versailles Diplomacy for peace settlement after November 11th 1918.

The conference began at Paris on the 20th of January 1919 two months after the signing of the

armistice, 32 nations were officially represented as well as large number of unofficially delegations and pressure groups. Here the type of punishment for Germany was to be discussed, senior politicians and communities of expert assisted in the deliberation of the treaty on Germany and that of the other countries. The main actions of the diplomacy (diplomats) consisted of members from Britain, France, USA, Italy and Japan. Lloyd George Clemenceau, Woodrow Wilson, Vittorio Orlando and the Prince Minister of Japan. Italy and Japan withdraw which became a conference headed by the Big Three. The minor left the conferences in annoyance. Diplomats who came for peace came with differences as personalities had views contrasting with one another. Their differences could be examine below. [14]

The Diplomat Wilson came with the dislike of the house of senate or congress not an accepted personality by the country. He was an inflexible idealist but only dictate to his close men because he knew less of European diplomacy. He did not take advice from anybody but establish an unbending temperament hence made it difficult for him to take advice or to adjust his views with colleague. He needed a lenient peace but the German refused his fourteen points and imposed the harsh Brest-Litovsk treaty on Russia. Therefore, Germany was to be disarmed severely and hard reparations imposed. This diplomat supported nations that will be democratic and free from foreign influence. He wishes individual countries should choose a government for their self hence via genuine elections. Globally Paris seems to relaxed to him but emphases on 14 points.

1. 'All diplomacy and negotiation between states was to be carried on openly- "frankly and in public view"
2. Absolute freedom of navigation on the seas both in peace and war-except in territorial waters
3. Equality of trade conditions between nations and the abolition of tariffs- "so far as possible"
4. The nations to give guarantees that they would disarm to "the lowest point consistent with domestic safety"
5. When the question of colonies was being settled the interests of the colonial peoples themselves must be given equal weight with those of the government who put forward claims to mandates
6. Evacuation of all Russian territory and assistances "of every kind that she may need and may herself desire"
7. Belgium to be completely freed.
8. France to receive back Alsace-Lorraine

9. Italy to receive her proper ‘national frontiers’

10. The people of Austria-Hungary to be given the opportunity of independent development

11. Rumania, Serbia and Montenegro to be evacuated and Serbia gives access to the sea

12. People under Turkish rule to be autonomous and the Dar-danelles to be open to the ships and commerce of all nations

13. An independent Poland to be established inhabited by ‘indisputably Polish population’

14. An international organization to be formed to guarantee the independence of all States both great and small. [14]

Another diplomatist who came to Versailles was Lloyd George from Britain was the British Prime minister. He was charismatic and Energetic like one with deepness and Celtic humor which gave him success. Character wise, he was sympathetic to particularly European disorder that hinders him the wind of nationalism. He wanted sanctions that will enable Germany to recover rapidly in order for him to trade with Germany hence a major client. Due the any back at home push him to yield and deem necessary to imposed hash sanctions on Germany in line with his brother Clemenceau

Georges Clemenceau of France interest firstly was to make known his state of country destruction by Germany France was classed while as French Premier. In his dream, it has occurred twice which need not happen again. He demanded a harsh peace that will paralyse Germany economically and militarily. He feared Germany will struggle to the oppressor that France security could be preserved.

Finally, talks were focus on Wilson 14 points that arranged the practical territories and Frontiers thus paving the way for a League of Nations; searching for a just and lasting peace and accordance of war. Critics hold firm that it was a court verdict but not a negotiated settlement searching for peace. This shows that another war must emerge.

b. The disarmament Diplomacy from 1920s to 1930s

The first of this was discussed at Versailles realized by the word leaders (diplomats). The was the need for the reduction of arms. In 1920 a temporary mixed commission was set up. On September 1921 the resolution XIV under the League of Nations limitation was achieved. Secondly, the Washington Naval Conference of November 1921 to February 1922, the conference achieved limited results for the disagreement on parity and

land forces, Francs in particular rejected the idea of having the same parity with Italy. She contended that, overall parity for her in the Mediterranean. However, Francs was forced to yield to the nation of 5:5:3:1 for America, Britain, Japan, Francs and Italy, respectively. Weakness to this fifteen-year agreement that was signed only applied to the tonnage of capital ships (over 10.000tons). Lighter ships and submarines had to be excluded.

Furthermore, the Locarno agreement raised some hopes that peace would be lasting and that disarmament will continue to prevail in the nearest future. From 1925 to May 1926, the involvement of the USA and later Russia participation advocated for pre-war level of general reduction hence a ‘Unilateral disarmament’. France advocacy proceeded to disarmament. Britain and Francs opinion was accepted by all but was considered by the Russians as an attempt to spread capitalists to spread imperialism. Additionally, the Kellogg FB Briand Pact (1928). Kellogg, an American secretary of state and Briand the French Foreign Minister agreed to renounced war as an instrument of national policy. Weakness to this was that the pack was vague because no clause was proposed for sanctions against any country to break the pledge for example Japan sign but attack China and no action was taken by the western powers.

Henceforth, the young plan (1929), an America banker advocated. Reparation levied on Germany created tension especially when the ‘wall street crash’ caused the great depression which resulted to wide spread unemployment. The Dawes plan had left the total amount to be paid uncertain. As condition improved francs became compromising willingly thus a committee headed by Owen young reduced out of diplomacy amounted to £6,600 million to £2.000 million, to be paid on a graded scale over the next 59 years. This figure was suggested by Keynes at Versailles ten years back hence an admission of error by the Allies. The plan was received well in Germany but failed because events deteriorating and destroyed the fragile harmony of Locarno. The death of Stresemann in October 1929, the Wall Street Crash in the same month which led to the great depression and later to mass employment and finally the rise of Hitler the whimsical diplomat to power destroyed all hopes as such international tension mounted.

2.Prelude to the second world war 1939

A peace that was meant to end war later brought an uneasy war. Many historians find the structural interpretation convincing. Diplomats came from Great nations lay the ground foundation of another war. Woodrow Wilson fourteen points could not rightly manifest due to his absent in later conferences on

disarmament, hence America went into seclusion or isolation. Britain isolation could not carry the weight of the burden to resolved crisis in Europe which he could only come in for a support of her brother France hence they jointly opposed Germany right as the “war guilt Clause” was propounded on her. At this juncture the Russian support of Britain and France ideologies in Europe was shattered by her internal problem. The successive Czar government could not revalue resolved Russian problems. A revolution in 1917 charge the course of international relations even before the First World War came to an end. In 1919 the crises in Asia remain chaotic due to the differences of the Bourgeoisies and the proletariat. On the communist manifesto Marx and Engels scientific ways Karl Marx 1818-1883 and Frederick Engels 1820-1895.

The Paris peace settlement of 1919 to 1923 set a pace for diplomat to reflect rationally on great power rivalries, arm race, secret alliances in balance of power politics. The policy makers experience at Versailles palace reevaluate assumptions about the roles of state-craft principles for building a new war order. The diplomatist played nationalistic sentiment. Worth of note are the Various treaties at Versailles as seen by the illustration of the table.

Date signed	Name and place of treaty	Defeated country concerned
28 th June 1919	Versailles	Germany
10 th September 1919	St. Germain	Austria
27 th November 1919	Neuilly	Bulgaria
4 th June 1920	Trianon	Hungary
23 rd July 1923	Lausanne	Turkey

Source: Peter Wales, World Affairs since 1919, Versailles to the Chinese Atomic test may 1965

Following the above peace treaties, the Balkans and Europe were disintegrated and a new shape taken to maintain world peace and security. Woodrow Wilson’s idea about world order expressed in his 14 points speech gave voice room for idealism hence it was enforced by the creation of an international Organization this a diplomacy to safeguard peace and substituting collective security for interlocking alliances in the balance of power system as they brought state sovereignty under jurisdiction of international law permitting internal national independence movement to determined their own fate according to the principle of self-determination as seen in the creation of Poland, Czechoslovakia, Yugoslavia thus promoting global

prosperity through free trade. The Locarno agreement tried to rival the Russian crisis in 1923. But before this agreement the League of Nations had gone operational. Next was the treaty of Brend Kellog (pact) under the Washington Naval conference thus the pact of Paris in 1928 that outlawed War as part of a design to substitute peace methods of dispute settlement. [18]

The rise of aggressors in the world gave another peace for the establishment of Diplomatic meetings to resolve errors put in place as a result of vex over Germany having caused the Great War. Joseph Chamberlain a British Diplomat initiated talks with Hitler that amounted to right some wrongs at Versailles. But, the British peace maker was parochial as Hitler Adolf (Chairman Chancellor) demands were unlimited. Hitler Whimsical Diplomacy went across his Meinkampf and his propaganda. The Diplomatic “Führer” invited Czech President at Berchtesgarden and bully him to let go the Sudentalend and Czech to Germany hence he should surrender power. The head of the Nazis had before established and demanded Alsac and Lorraine. From Hitler’s target was Poland, before Poland event in Europe and Far East Asia had also been to the limelight. The Rome Berlin-Tokyo Axis was signed, the Stressa front Agreement, the Locarno and several others. [6]

Furthermore, Japan is the Far East continued with it expansionist policies. When approximately in 1895 down to the treaty of Versailles Japan seizure of Manchuria in 1931. Chinese and nationalists of many different political hues traveled to Tokyo to learn modern scientific culture and emerged or were attenuated. Some Japanese gave considerable aid and assistance to Chinese revolutionaries such as Sun Yat-sen. Equally, Japan provided the climate for political discussion and ideological exploration that was so essential to the education of revolutionary Leaders. Contemporary Chinese vocabulary of politics terms like anarchism, socialism, communism, nationalism entered the Chinese language from Japanese rendering of these European words. The Japanese bolstered their international, the Far East Asia and the Sino-Japanese was bred further animosities and hatreds. In later periods or years, Japan experienced her economic miracle, thanks to America Economic Diplomacy. Japan militarism was criticized due to her control over Okinawa and her close ties with the rim land states of East Asia. Failure of diplomacy to cheek Japanese military might pearl Harbour (USA) was bombarded. [20]

Italy under the “Duce” had to revenge some assault like the Italian humiliation by Ethiopia in the 19th century. In 1936 Ethiopia was attacked. He also spread his

tentacles in the Balkans and North Africa. His diplomatic alignment with Hitler what is known as the Dictators together gave greater growth for Hitler to trouble men, France and Britain at Berchtesgarden 15th September 1938, Godesberg 21st September 1938 and Munich 28th September 1938 diplomacy conferences. He signed the Russo-German pact of Non-aggression on 23rd August 1939. This amazement set the world into confusion Munich. [12]

“How horrible, Fantastic, incredible it is that we should be digging trenches and trying on gasmasks here because of a quarrel in a faraway country between people of whom we know nothing... I would not hesitate to pay a third visit to Germany if thought it would do any good”. [6]

As America went on Isolation, Britain thought of self-determination and the League rest on Nonintervention diplomacy, hence it prevented foreigners who became passive even when Germany bombarded Guernica in 1937. Benito Mussolini sent 60,000 troops to Spain; Russia discovered poor manufacture of her tanks and withdrew. Finally, by March 1939 there was over and Spain surrender to the dictatorship of General-Francisco Franco. This encouraged the tyrants to usurp and commit more act of aggression. This could be work upon as military diplomacy without words. [6]

Finally, the League of Nations became a toothless Bull Dog that can back but could not bit. There was limitation in diplomacy in the 1920s and the 1930s. Ties between countries' Nations and states were established through secret treaties. The US came to witness or experience a great slump or depression in 1929. The lack of dialogue hindered prosperity that was marred by Gangsterism such as Alcapone and the Ku Klux Klan, the southern Negro and export mainly to the USA of a few commodities. For example, Brazil depended on the sale of her coffee. The depression in the USA therefore led to suffering in Latin America. Roosevelt had to open-up with the world and created internal projects. For example, he created or introduced the Tennessee River Valley project as well as in 1935 and 1937 congress passed “Neutrality Acts as the nation wanted peace in the next future in the Atlantic Charter and other negotiations, America join Russia to defeat Japan and Germany hence aligned with an opposite camp the Communist state of Russia. “Roosevelt is the only president who has ever cared for people like us” said one American voter in 1932 election.[3][6]

In the 1930s power politics was a reality. From 1932-1933 at Geneva a conference was held Germany calling for global equality of armament. This was felt by

others as calling for rearmament. The conference was handicapped by constant opposition from Russia. France had a warm attitude due to support for the Nazis in Germany. Britain and Italy were sympathetic to Germany as viewed by League but in 1934 the conference ended in Franco-Germany embarked seriously for arm production and uncompromising with the system of the League. Another Organization was the United Nations that is now at work after a series of diplomatic Conferences. [11] [10]

V. UNIVERSAL DIPLOMACY WITHIN AND OUTSIDE 1884 AND 1939 AND ITS IMPACT ON INTERNATIONAL RELATIONS

The universal or general effects of diplomacy run throughout the course from one event to another. Much is also viewed from 1939 into the 1940s.

1. Within 1884-1939 (Blunders, flashback, compare.)

The US diplomatic vision toward Great powers should have assumed the role of Tran's maritime balance after the First World War to counteract the power of the united Germany. The Versailles treaties became unfavorable as it absents serve as a catalyst to the Second World War. Her participation in later period gave stability to Europe. She certainly continues to play similar role even if the soviet break apart. [5] A comparative analysis of the Vienna and Versailles diplomacy were aimed for peace keeping hence one of the best means to preserve national and international integrity and security. After 1919, diplomacy became or changed from maintaining peace to real dialogue and reconciliation especially with Hitler in the 1930s. Treaties were abrogated and military regimes installed hence diplomacy was use to accommodate and to express maximum goals and advantages amongst States, countries and Nations. [5]

During the 1920s and 1930s difficulties, about two decades, the beginning of Aggression and New patterns of diplomacy during the 1940s came to be realized or stalemate, couple with the atmosphere of uncertainty. Well, the five treaties signed had doubt if all it will or objective laws will practically be manifested. The Great powers decision faced much challenges especially from Japan, Italy, Germany and Spain under Hideki, Tojo, Benito Mussolini, Hitler distorted the international framework and the patterns of diplomacy which however affected the conduct of inter- relations, the post Versailles period. In 1931 Japan attack Manchuria and made it a puppet state, the League of Nations did nothing. Mussolini dissatisfaction with following the Rome Agreement lost one position as regard the question of armament provoked. Hitler to be hostile to Britain and France as such distort

international diplomacy benefited at this time by Britain and France. Therefore, open diplomacy was not experience but rather secret diplomacy such as that of 1887 of Bismarck Germany and Austria. Also, that of the Czars Russia and Germany, therefore the diplomacy of Europe was in the interest of Germany from the 1930s as it was in 1887. Russia was for Austria-Hungary. [2]

Additionally, the November 5th 1937 Anschluss secret conference thus secrete diplomacy could be term power diplomacy since as Hitler united the two countries by bringing Georing, Von Nerrok, Von Fritsch, Von Blomberg (General), Arrival Racder and colonel Hosback hence Germany and Austria became strong once more to gain international position for war. Hitler started carrying out conscription. He revamps foreign affairs and ministers of war (Keitel l'eberkommaunts der Wehrmacht). On the path of Britain, the growing suspects of Hitler unlimited demands the *Gentlemen diplomacy* was carried out with Chamberlain rapprochement on January to February 1938 at Berchtes-garden, Godesberg and Munich. Following this action Italy, Britain and France signed an accord to re-enforced measures of investigation against parity in the Mediterranean, Chamberlain also was entertain by the Italian Ambassador to Britain in February 1938 by name Edden as conflict mounted. Chamberlain was put to work by dictators hence the Italian empire of Ethiopia was recognized. Further approval was made accepted or granted by Winston Churchill between lord Perth and comte Gane. After Anschluss, they accelerated and signed an accord in Rome on April 16th 1938 known as the Accord of Paque by Italian historians. Winston Churchill won elections in Britain because of matter arising in Europe. He became the war time Prime Minister of Britain which he promised the people that he had nothing to offer at his desperate moment but blood, sweat and toil to stop Hitler aggressive moves hence using Radar and Ultra to detect war planes emergences at the horizon. Hitler lost much plane in his lightening war term (Blitzkrieg) "Operation Sea Lion". This battle was styled by Hitler. Hitler and Mussolini used propaganda, whimsical or carry force and bulky diplomacy that characterized and is attributed to tyrants. Head or leader and war mongers. This form of diplomacy is to achieve what is not deserved of them using brutalities measure. Summarily, the gentlemen Agreement gave upper hands to the aggressors over the Mediterranean zone and the Middle East but avoided Italy not to participate in any military service out of their territory. This to guaranteed security of religious communities in East Africa and their usage of the Suez Canal found close to the red sea. [14]

In the 1930s the strategies of alliance initially applied became diplomatic appeasement of British, France and

USSR. While America applied and hold strong to isolationism, diplomacy of avoiding close interaction. All these plunged the world into a great disaster on 1st of September, at 4.45 AM, 1939 Hitler lunched war of nerves over Poland. Poland received full-hearted support from Britain and later France, since Russia had signed a Non-aggression pact with the Germans. Mussolini also extended to the Mediterranean with hostilities. It is with this note that we move into the consequences from 1940s and onward. [20]

2.From 1940 Onward...

To end the war several treaties were signed with diplomats from the western power. To mention few of the conferences: The Casablanca 1943, Atlantic Charter August 1941, and Washington Conferences. Among the diplomats were Roosevelt of USA, Winston Churchill of Britain and Joseph Stalin of Russia met in the Teheran conference in December 1943, they talk on postwar demilitarization of Germany, an international organization later and strategies of winning the war. Churchill apprehension "Steeped in traditional balance-of-power politics, he sensed that without diplomatic bargaining and political arrangements, the victory over the Nazi would leave Russia dominant over all central and eastern Europe. He proposed Mediterranean and Balkan invasion. Conforming that launching was to take place in France in 1944 in spring. In the Atlantic Charter of 1941 that took place off shore of Newfoundland Roosevelt and Churchill expounded on sovereign rights and self-government that all nation will have equal access to world trade and world resources, together to achieved, improved living standards and end force and aggression in international affairs. Other conference that was close, end the enumerated war were the February 1945 conferences at Yalta (Crimean city in Soviet Union and in July 1945 at Potsdam, in the new diplomat join the team Clement Atlee from Britain and Harry Truman U S A, (Roosevelt died and Churchill faced defeat from the labour party). Issues of reparation were discussed, denazification, demilitarization Democratization and partition of Germany and Berlin and the mapping of Germany boundaries. An International Organizational scenario was set up, hence effectuated the diplomatic movements (talks) laid down by the diplomatic corps at Yalta. [2][6]

The UNO was form after the second world war as after the First, this conference of all anti-Axis powers held at San Francisco in 1945, hence drew up its Charter and lay the framework and functions. This world organization had been making some successes which up to date no aggressor like that of the Axis-Powers had emerged. The UN had solved problems in Africa, Europe, America and

middle and Far East. Its standing arm force is the Blue-Cap. [2]

VI. CONCLUSION

Let us examine here the Rules for Good Diplomats. For those who feel the key to diplomatic negotiations is deception, then the chief "virtue" a good diplomat presumably should have been the ability to lie with a straight face. Indeed, diplomacy has often been defined as "The ability to say and do the nastiest thing in the nicest way" another famous definition described a diplomat as "an honest man sent abroad to lie for his country" In the 1940 a push assigned at Moscow commented on a soviet diplomat by name Vyshinsky "In a way Vyskinsky was the perfect Diplomat. He was capable of telling an obvious untruth to your face you know it was a lie and he knew that you knew it was a lie but he stubbornly adhered to it. No other diplomat was able to do this such nonchalance" [14] Given the importance of the credibility factor that we noted earlier, however deceitfulness is hardly very used as a diplomatic quality. While any bargainer might well wish to conceal certain Information, and there can be some occasion when duplicity is necessary, there is all usually is good reason for a diplomat, on balance to be honest and truthful when conducting negotiations-if only to retain future credibility and effectiveness of the few qualities that Handel Nicolson lists as essential to being an ideal diplomat, the first is truthfulness. The others include precision, in terms of clarity of Expression, calmness, modesty, since vanity makes a diplomat more likely to alienate the other side with arrogant behavior or to succumb to its flattery, and loyalty to ones own government, a quality that can sometimes be lost, especially in cases where a particular post spent so much time abroad in a particular post that he or she unconsciously develops an affinity for the local culture and people which can affect one's judgment concerning the interest one is representing. Some countries exhibit certain "diplomatic claimed sometimes based on ideological point of view on cultural traits that Characterize their negotiating teams in general rather than any individual diplomatic representative forexample, the soviets are often to be deliberately brusque an offensive in manner at the negotiating table, while the Japanese are often self-effacing. Much has been made of the American diplomatic establishment have been lawyers and have tended to adopt a legalistic approach in diplomatic negotiations. [14]

However, too much can be made of these kinds of national negotiating stereotypes. The soviets have shown themselves to be capable of exercising tact and civility in

moments when sound diplomacy called for it, while American negotiators frequently have been quite pragmatic and willing to overlook legal niceties, in pursuit of diplomatic goals. The personal factor-the qualities a specific negotiator brings to the bargaining table-should never be completely overlooked, even in an age when emissaries are often more messengers of their governments. The Good Diplomat must obtain Good Diplomacy with the following six Rules to follow, Determine whether the other side is serious about negotiating, do not discuss what might appear to be purely cosmetic or symbolic procedural concerns expressed by the other side, Related to point 1 and 2, show some empathy and understanding toward the other sides position, offer proposals that are correct enough for the other side to think about and respond to, if a comprehensive settlement of all aspects of a dispute is not possible slice up the problem into narrower more manageable issues to be negotiated separately. Finally, do not humiliate the other side. [14]

In a successful bargaining, promises and threats that might be potent but lack credibility are just as likely to fail as those that are credible but lack potency. The needly to communicate in a credible fashion is especially important in an era in which misperception and miscalculation can lead to nuclear holocaust. Furthermore, the "came Theory" as a large body of literature exists nature of International bargaining and the way in which cooperation can occur amidst conflict. Two basic types of games are common to discussions, the "Zero-sum" games and the "variable sum" (mixed-motive) game. The zero sum game is structured so that what one party wins, the other party automatically loses, conflict in other words is total. An example would be a territorial dispute in which two states claim the same parcel of land but obviously cannot exercise sovereignty over it at once. Through creative Diplomacy the zero sum can be tum into the variable-sum game in which both parties can simultaneously win something, even though one might benefit more than the other. If the disputants determined that they could share the land the game would feature a "win-win" outcome. However, customary laws, conventions, treaties, constitutions and others build international laws for peace. [14] How are informal diplomacy versus formal Diplomacy manifest itself in the International systems, and how are all these applicable after 1939?

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Solid Waste Management in Large Events: A Pathway Towards Socio-Environmental Responsibility

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Keywords— *Event management, Corporate sustainability, Solid waste, Gastronomy.*

Abstract— *Large events in ecologically dynamic environments can generate serious environmental footprints, if inadequately planned. Poor management practices can cause environmental and economic damage of large magnitudes, directly and indirectly, to the local community and the surrounding areas of seaside cities and towns. This can be especially problematic in North-eastern Brazil, where tourism is a highly relevant source of income. Therefore, this study focuses on the analysis of waste management in large-scale events in coastal areas. The objective of this work was to evaluate the management of the solid waste generated during the Dragão Fashion Brasil 2019 event, which took place in Fortaleza, Brazil. The methodology employed was of qualitative-quantitative, exploratory, and experimental nature. Firstly, on-site monitoring was carried out for the qualitative-quantitative characterization of solid waste, along with an accelerated composting experiment using electromechanical equipment. The processes of separate waste collection, sorting, and final disposal of waste during the event proved to be environmentally beneficial, as it avoided the disposal of over 1,900 kg of solid waste and 200 kg of organic waste into landfills. It also prevented the pollution of close-by marine ecosystems. Additionally, six institutions benefited from the donation program by receiving 731*

kg of recyclable waste. This has also contributed a discount on the energy bill of one NGO. It was concluded that the adoption of an environmental management program for solid waste ensured its environmentally friendly redirection and the avoidance of cross-contamination by mixing it with recyclable waste. The sustainable practices observed in this large-scale event, carried out in a coastal and touristic region, can be said to have left a legacy for other events with a similar potential for social and environmental impacts.

I. INTRODUCTION

The organization of large events can bring clear benefits to local communities, such as economic boosting, job generation, income diversification, cultural appreciation, investment attraction, among others. These benefits are consonant with a prior strategic planning and the careful execution of such events [1]. On the other hand, failures or inadequacies in their planning and/or execution can cause negative economic, social, environmental, and cultural impacts, such as unexpected changes in the way of living of the local community, energy inefficiencies, gas emissions, waste generation, etc.

Private enterprises require planning that is underlined by a socio-environmental responsibility [2], and the organization of events also demands such sustainable approaches, especially in regard to their ecological, social, and economic dimensions. While an event is a passing occurrence with a fixed duration, sustainability “[...] is dynamic, and it presupposes continuous improvement; it is a pathway, something on which we rely when faced with decisions, choices and future advances. Thus, it is understood that nothing is fully sustainable, but (...) there is an attempt to constantly contribute to sustainability” [3].

Clearly, the classification of an event as ‘sustainable’ requires a balanced act among its different responsibilities: the environmental, exemplified by low emissions of greenhouse gases or minimal generation of solid waste; the social, by a thorough consideration of human resources and inclusion of minorities; and the economic, when there is a drive for transparency and via job creation strategies [4].

For Portugal et al. [5], events with audiences ranging between 10,000 and 100,000 people are considered ‘super events’. The Brazilian Association of Technical Standards (ABNT) [6], through its NBR 16004, also categorizes these as large-scale events, given their great economic, environmental, and social impacts, in addition to the high degree of complexity in their organization, visibility, and their national and international outreach. This is reflected by the participation of a large number of individuals involved, which include both the attending public and the organizing professionals. Sustainability is a key principle to be

followed by organizations that create and promote events, with a view to improving quality of life and environmental awareness, given the fact it encompasses the economic and social realms. Therefore, the need to cater to the three aforementioned dimensions is highlighted, especially in the case of events located in peculiar areas of dynamic, fragile and tourist-reliant characteristic, such as coastal zones [3].

In these areas, the most serious environmental problems are those related to the generation of solid waste. When incorrectly managed, they show a great potential to impart negative environmental impacts, such as the eutrophication of seas, contamination of beaches, and the compromising of the marine biota and of the local health [7].

These problems may generate environmental impacts and economic losses of crucial relevance to the wider society and, above all, to those who subsist on the local natural resources. In the case of the Brazilian Northeast, the coastal tourism industry is an essential source of income for the regional population.

The correct management of the resulting waste promotes several environmental, economic, and social benefits, since there can be many alternative end routes for the recycled materials [8]. For example, recycling 1 ton of aluminum saves 5 tons of bauxite and 95% of energy, as it takes 17,600 kWh to manufacture aluminum from virgin raw material, against 750 kWh for recycled aluminum. In addition, there is a reduction of 85% in air pollution and 76% in water consumption [9].

Such principles are related to the concept of circular economy, whose approaches are underlined by the elimination of waste and pollution, the continuous maintenance of products and materials in use, and the regeneration of natural systems.

As countries around the world seek to rebound their economies after the impact of the Covid-19 pandemic, the transition to a circular economy becomes even more relevant and urgent [10]. Among major events held in Brazil, the *Dragão Fashion Brasil* (DFB) Festival is a fashion-related initiative held since 1999, in the city of Fortaleza, state of Ceará, which has become the largest author-fashion event in Latin America. It presents the latest trends in the sector and makes use of a multicultural

platform to welcome and promote national talents and artists in the following areas: fashion, gastronomy, culture, and related subareas. Furthermore, it promotes the exposure of regional artists and professional knowledge exchange through workshops, courses, and theme-specific presentations.

The attraction variety and the magnitude of the DFB festival highlights the need for commitment to social and environmental agendas, due to the products and services generated and, most importantly, to its location – the sandy shores of the city’s coastal zone. This requires careful planning in order to prevent landscape and environmental impacts from happening. Within this scope, the generation of solid waste is particularly challenging and sensitive, considering its volume and type of disposal.

Thus being, the relevance of this study lies in the understanding of the generation of waste in large-scale events, through its quantification, the implementation of action plans aimed at its management, and the guarantee of a sustainable destination. Considering the preservation of the coastal and touristic environment, the proposition of sustainability regarding waste management is an urgent health-related matter to the quality of life of the local community. The objective of this work was to evaluate the management of the solid waste produced in the large-scale event *Dragão Fashion Brasil* 2019, held at Iracema beach, in Fortaleza, Ceará, Brazil.

II. METHODOLOGY

The methodological approach taken was of qualitative-quantitative, exploratory, and experimental nature. To this end, three main stages of study were outlined. The first encompassed the surveying of the theoretical and document-related foundations to this research. Subsequently, on-site techniques were carried out for the qualitative-quantitative characterization of the solid waste generated during the event. An accelerated composting experiment using electromechanical equipment was also carried out at this stage. The last step consisted of the analysis and interpretation of the data collected and the generation of the final results.

The bibliographic survey was carried out on virtual scientific and journalistic platforms, aiming at acquiring the scientific and documental support required to substantiate the topic to be explored. Keywords were pre-established to enable a thorough scientific search in national and international platforms, such as *Scielo* and *Capes Periodicals*, namely: ‘recyclable waste’, ‘mega-events’, ‘event management’ and ‘sustainable actions’. Furthermore, the legal basis in legislation 12.305/10, which institutes the National Solid Waste Policy (PNRS) [11] and

supports the regulation and deliberations regarding the correct disposal of solid waste in Brazil, was used as a benchmark in this study.

The exploratory and experimental research was carried out between May 3rd and 29th, 2019, during the *Dragão Fashion Brasil* (DFB) Festival, a large-scale event dedicated to fashion exhibitions. The event took place in the highly touristic region of Iracema Beach, in the city of Fortaleza, state of Ceará, Brazil. The study area covered three points of analysis: the area destined to food environments (restaurants and bars), which are the locations with the greatest generation of organic waste; the waste sorting and temporary storage areas; and lastly, the stationary container in the external area of the event, primarily set to collect waste classified as ‘tailing residues’, i.e., those not subjectable to recycling, reuse or composting, as indicated in (Fig.1).

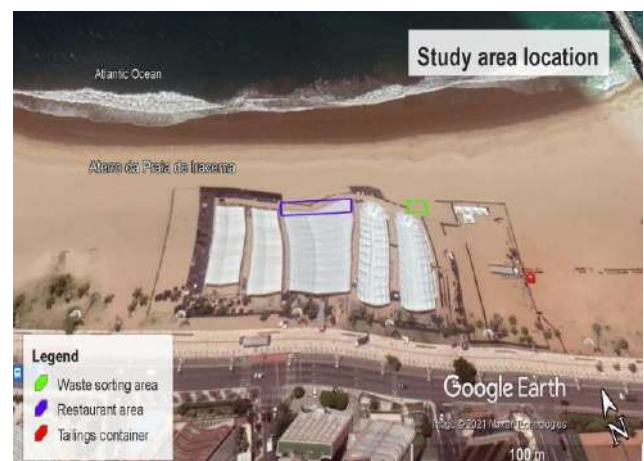


Fig. 1: Location of the study area

Source: *Google Earth Pro* (2020).

In order to clearly define the location of the wastesorting area and to better organize the collected data, four previous meetings were held among the event organizers, the company responsible for managing the waste, and the cleaning service providers. Also, it was decided that the recyclable waste generated by the event would be redirected to the *EcoEnel* program, run by the company ENEL, which is the Italian electricity distribution company largely responsible for the energy supply in the state of Ceará.

The program compensates donors with a discount on their energy bill. It is important to highlight that the company was chosen by the organizers of the DFB 2019 due to it being one of its sponsors.

It was also defined that the School of Development and Social Integration for Children and Adolescents (EDISCA), a non-governmental entity located in Fortaleza, would be the recipients of the financial bonus on their electricity bill.

Finally, concerning other wastes that could be reused, such as scraps of fabric and wood, a survey was carried out by the waste management company as to potential Non-Governmental Organizations interested in receiving them.

During the event, technical observations were carried out *in situ* to firstly identify and characterize the local dynamics. At this stage, we sought to evaluate and plan the logistics to be executed by the cleaning team responsible for collecting and moving the waste to the sorting area, as shown in the Fig. 1 above.

To this end, the displacement and packaging of waste materials relied on a team of ten people – three in supervisory roles and seven in operational roles. A timetable was then drawn up with the division of the event stages, dates of operation and number of employees involved in the waste collection, sorting and conditioning groups, as shown in (Table 1).

Table 1: Event stages

Stages	Dates	Number of collaborators
Pre-event	May 3 to 10, 2019	01
Pre-event	May 10 to 14, 2019	02
Event	May 15 to 18, 2019	10
Post-event	May 19 to 29, 2019	03

Source: Authors.

Collection and packaging of waste started on May 3, 2019, in the pre-event phase, with one member in the operational team. On this date, the assembly of the collection structures and the marking of the space to be occupied by them took place.

The operator remained onsite until May 10, 2019, and was responsible for the sorting, separation and packaging of the waste collected by the outsourced cleaning team. From that date and for the four subsequent days, one more operator joined the team to cater for the increase in the generation and disposal of waste by the growing number of companies working in the assembly of structures.

With the cultural and musical activities starting on May 15, as well as the opening of the space to the public, an extra eight people were hired during the four days of the DFB, totaling 10 workers. Naturally, the peak of waste generation took place during these days.

Finally, in the post-event phase, two operators remained in the field for the following eleven days. It is important to highlight that the members of supervisory team constantly carried out activities to monitor the operators' work and coordinate with the recipients of the recyclable and reusable wastes. For the sorting and packaging of waste, the following instruments and materials were used: a)

plastic bags with a capacity of 200 liters (L) for waste storage; b) self-adhesive labels for identification; c) latex gloves; d) plastic tarpaulins; e) pendulum-type scales; f) calculators; g) camera phones; h) two wooden benches; i) five bulk bags of 1,000 kg each; and j) 20L raffia bags.

Also, aiming at a more accurate weighing of the different categories of waste collected, the waste destined for reuse was weighed in kilograms (kg), with recyclable materials being weighed with digital scales.

Tailings were accounted for in volume units (m³). Organic waste was collected from the 15 food shops in operation. After separation from the other waste types, these underwent an *in-situ* accelerated composting process.

According to the Brazilian Association of Technical Standards (NBR 13591) [12], this is a composting method performed by electromechanical equipment that can greatly expedite the start of the inherent biological process by maintaining a highly controlled environment. The electromechanical composter used was of the model 'Express 20', with a loading capacity of 20 kg, as shown in (Fig. 2).



Fig. 2: Electromechanical composter, model Express

Source: Authors' files.

The organic residues identified were, in their majority, food residues of similar composition to household waste, such as citrus peels (e.g., orange and lemon), vegetable peels (e.g., tomatoes and cabbage), meal leftovers, rice, coffee grounds, bread, and others.

No criteria were adopted to restrict the use of organic waste for composting, such as critical fruits, bones, or fat-rich foods (these are usually neglected and restricted by other composting methods).

In the process, a total of 200 kg of organic waste was processed per day of the event. For the weighing process, a pendulum-type portable digital scale was used. Subsequently, the organic waste was disposed of in plastic

boxes, for visual analysis and manual separation from inorganic waste such as plastic films, bottle caps and others. These data were recorded and compiled in an Excel spreadsheet.

Subsequently, sawdust from the wood discarded in the same event was used, in an average ratio of 3 kg for every 20 kg of organic waste, to reduce odors and leachate, which are very characteristic derivatives of this type of organic decomposition. After sorting and manual mixing, the residues were placed in the equipment's loading box prior to the decomposition process. The operating time of each decomposition cycle was 45 minutes. Each 20 kg load of waste processed required the input of 1.4 kg of mineral-based limestone material.

Also, 2.6 kg of vegetable-based raw materials were added five minutes before the completion of the composting process.

During four days of event, 10 composting cycles of 45 minutes each were performed, totaling an operation time of 7 hours and 30 minutes. Finally, it should be noted that during the entire period of the event, the waste classified as tailings was packed in a 5m³ container, located outside of the event area, and sent to the Municipal Sanitary Landfill of Western Caucaia (ASMOC).

III. RESULTS AND DISCUSSION

Due to the hazards they may pose and their commercial and service origin, the waste collected during the DFB 2019 were categorized as Class II waste, as defined by the Brazilian Association of Technical Standards NBR 10.004 [13].

As a result of the organization's estimate of 40,000 people in the event, the accumulated residual amount totaled 1,906.53 Kg of Class II recyclable wastes.

In Graph 1, the types and weights of the collected materials are shown. The largest amount of waste materials recorded were PVC (polyvinyl chloride) plastic films (533.73 kg), cardboard (426 kg), and glass (316 kg). In addition to these, PET (poly terephthalate) plastic (302.8 kg), aluminum cans (200 kg), metal wires (83 kg), paper (35 kg) and cooking oil (10 kg) were also identified.



Graph 1: Illustration of the amount (in kg) of the waste materials collected

Source: Authors (2020).

All the recyclable waste was separately collected, weighed, and sent for recycling. Among the main benefits of this approach are the prevention of air, water and soil pollution; the minimization of landfill and dump overloading; clandestine disposal; and the promotion of separated collection and environmental education, according to legislation 12.305/2010 of the National Solid Waste Policy [11]. The selective or separated collection of waste from the event (Fig. 3) allowed for the environmentally appropriate disposal of paper, cardboard, glass, plastics, metals, and oils to their respective recycling industries, in accordance with municipal guidelines. The redirection of this waste for recycling also generated a credit of R\$725.05 in the EDISCA's energy bill, through the EcoEnel program.



Fig. 3: Separated collection and waste redirection to the EcoEnel program

Source: Authors' files.

From the perspective of appropriate redirection, waste that could be reused or repurposed was packaged during the sorting process, for subsequent donation. The plan was for them to be used internally or by other institutions, NGOs and/or by teaching and research entities, as shown in (Table 2):

Table 2: Types and destination of wastes

Type of waste	Destination	Amount (kg)
Textile scraps (fabrics and carpets)	Institution <i>Irmão Sol Irmã Lua; Clara de Assis</i> Charitable Home; the Sustainable Women Entrepreneurs Network	626
Coffee pods	<i>Amigos de Jesus</i> home	17
PET lids	<i>Amigos de Jesus</i> home	8
Sawdust	Undergrad research project at Pitágoras de Fortaleza University (internal reuse)	47
Wood pieces	<i>Parque Escola</i> honey bee farm	33
Raffia bags	Internal reuse (residue storage)	12
Total (kg)		743

Source: Authors.

In the relationship with the above institutions, the commitment to correct disposal was clearly noticeable, as well as the social and environmental valuation of their charitable and entrepreneurial roles. A highlight among these was the delivery of 140 kg of fabric and carpet scraps to the Sustainable Women Entrepreneur Network organization (REMES) for the development of educational items and articles (Fig. 4-1).

The institution *Amigos de Jesus* home, in turn, sells the materials received to recycling companies to raise funds. At the event itself, wood sawdust was reused in the accelerated composting process (Fig. 4-2). Also, raffia bags originating from the ice delivery logistics, were repurposed in the storage and packaging of waste (Fig. 4-3).



Fig. 4-1: Repurposed carpet scraps; 4-2: Sawdust; 4-3: Raffia bags

Source: Authors' files.

Another highlight was the donation of 33 kg of wood sawdust, generated in the process of assembling and decoration of stands and stalls, to undergraduate research projects of students in the courses of Gastronomy and Environmental Management at the University Pitágoras de Fortaleza. These projects were on the topic of composting in the gastronomy laboratory. The material was used to stabilize liquids and odors during the composting process (Fig. 5) and generated 10,305 kg of organic compost for direct application in the local vegetable garden. It contributed to the complementary study of the purchase, use, disposal, and recycling cycles of food waste.



Fig. 5: Sawdust being reused for vermicomposting

Source: Authors' files.

The organic waste collected (200 kg) was subjected to an accelerated composting process. According to the literature, this volume can yield 70 to 80 kg of compost, i.e., less than half of the initial volume. The rest is turned mainly into carbon dioxide and water vapor [14]. Compared to the amount of waste processed, the 10 cycles in the electromechanical composter generated a total of 80 kg of composting material (Fig. 6), which was donated to the event organizer.



Fig. 6: Organic composting material donated

Source: Authors' files.

Non-reusable wastes, such as Styrofoam plastic, wood, contaminated fabrics, disposable plastics, and sanitary paper, were classified as 'tailings' and collected by a specialized outsourced company. 25 m³, or five full standard containers, of tailings were collected (Fig. 7) by a compactor-type truck and destined to a sanitary landfill.



Fig.7: 5m³ container

Source: Authors' files.

It has been shown that approaches with a sustainable agenda, as noted in this analysis, can foster the advancement of environmentally responsible events. These can also contribute to the direct achievement of Sustainable Development Goals (SDGs), as established by the United Nations (UN) [15] organization, as shown in (Table 3):

Table 3: SDGs achieved, directly or indirectly

SDGs achieved			
SDG No.	Direct achievement	SDG No.	Indirect achievement
12	Sustainable production and consumption patterns	13	Urgent actions to combat climate change and its impacts
14	Conservation and sustainable use of oceans, seas, and marine resources for sustainable development	15	Protect, restore, and promote the sustainable use of land ecosystems

Source: UN Brazil, 2021.

Therefore, the ecological, economic, social, cultural, and political dimensions can be said to have been considered in this process, given the good socio-environmental practices followed. It was possible to confirm that the actions taken in the event contributed to the circular economy and sustainability in large-scale events.

IV. FINAL CONSIDERATIONS

With the results of this work, it can be concluded that an environmentally correct disposal of the waste collected in the event analyzed was achieved by adopting a solid waste management program, which included the separation of organic waste and an *in-situ* accelerated composting.

Contamination by mixing organic with recyclable waste was avoided, and the viability of employing sustainable practices in large-scale events located in coastal and touristic environments was confirmed.

The processes of separate collection, sorting and final disposal of waste during the event were also environmentally beneficial, as they avoided the discard of 1,906.53 kg of solid waste and of around 200 kg of organic waste into sites unfit for such materials.

This merited notoriety for safeguarding the local ecosystem and for preserving the dynamics and the laws applied to the beach environment in which the event was inserted. Concerning the social and environmental aspects, six institutions benefited from the event's donation program, which received 731 kg of recyclable or reusable waste. In addition, the donation contributed a discount on the energy bill of one NGO, through the *EcoEnel* program.

Such measures portray an important aspect of the social responsibility of these events.

The event also contributed to the environmental education of all those directly or indirectly involved in the waste management processes, and to raising awareness and creativity towards the use of materials subject to disposal. Four SDGs were achieved, directly and indirectly, leaving a legacy for event organizers and employees that value socio-environmental sustainability.

The articulation with sponsors and the systematization of the collaboration team was also fundamental. Due to the careful definition of the planning, execution, and completion phases, it was possible to carry out this large-scale event in a coastal environment while simultaneously mitigating negative environmental impacts linked to the solid waste generated. Sustainable practices of this nature also promote credibility and good visibility of these events on the eyes of public bodies and the wider society.

Finally, the study of this subject allows for continuing and in-depth future investigations, given the intense dynamics of the environments involved and the streamlining of intelligent approaches for the management of waste, which counteracts the conventional economic reductionism.

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Multidisciplinary oral rehabilitation with active utilization of roots using a fitting system and removable partial denture – Case report

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Keywords — *Removable partial denture, Dental prosthesis retention, Dental esthetics, Intraradicular retainer technique, Multidisciplinary rehabilitation.*

Abstract— *Oral rehabilitation consists of dental and esthetic prosthetic treatments that aim to recover or improve the oral health of patient, when it is affected. Currently, partially edentulous patients have a very active social life and thus they should feel safe with their prostheses. Aiming at the correct establishment of balance of the stomatognathic system, restoring function and esthetics, preserving the remaining structures and replacing lost structures, with reversibility and good cost/benefit, the removable partial dentures favorably rehabilitate partially edentulous patients within the context of Brazilian health. In this case report, removable partial dentures in the upper and lower arches were made with retention on spherical retainers (O'rings) in the remaining dental roots, which allowed the active utilization of these roots as abutments of partial dentures, minimizing the torque on teeth that could lead to loss of insertion and consequent mobility. The esthetic gain achieved with the use of these retainers should also be highlighted, due to elimination of extracoronal clamps on anterior teeth. The utilization of dental roots with retention devices proved to be an effective device to increase the retention and stability of prostheses, emphasizing the esthetic benefit in cases of removable partial dentures that involve the anterior region.*

I. INTRODUCTION

Despite the evident progress of Dentistry in the field of oral rehabilitation, especially in relation to endosseous

implants, the high rate of individuals with tooth loss, and the harmful impacts on the lives of affected people challenge dentistry to minimize this problem, and conventional

removable partial dentures (RPDs) are the treatment of choice for most individuals. Oral rehabilitation with a removable partial denture (RPD), when well indicated, plays a direct role in reestablishing the oral and systemic health of partially edentulous patients [1-4].

Tooth losses caused by trauma, periodontal disease or caries interfere with the quality of life of patients. Dental prostheses aim at partial or total rehabilitation to restore the esthetics and function, reestablishing the physical and psychological wellbeing of patients, since tooth loss causes functional damage, impairing the masticatory capacity, negatively influencing the speech and esthetics [1,5-8]. With a significant advance in preventive dental care and a greater awareness of the population, there was a reduction in the incidence of tooth loss. This, associated with the increase in life expectancy of patients, led to an inversion of the age pyramid with more patients reaching the third age, consequently influencing the increased demand for partial rehabilitation.

Since not all patients have adequate physiological or even financial conditions to receive another type of rehabilitation, RPD becomes a viable option when fixed partial dentures are unfeasible due to the arrangement of remaining teeth and lack of bone support for rehabilitation with endosseous implants [5,9,10]. RPDs replace lost teeth and surrounding tissues, integrating with the stomatognathic system, enabling functional restoration, comfort and esthetics with their limitations, without the need to expose the patient to long and complex surgical and prosthetic treatments [11-17]. These prostheses are widely used due to their fast resolution and affordable costs to most population, some patients fear them due to the unfavorable esthetic aspect [18-20].

The search for correct maxillomandibular relationship is the objective of oral rehabilitation in prosthetic treatments [21]. Tooth loss has a direct influence on the imbalance of the stomatognathic system, since it can cause changes in chewing, speech, esthetics and facial harmony. Besides the esthetic and functional impairment, inadequate dental, skeletal or muscle relationships can also lead to pain and wear of joint structures and teeth and muscle stress [22-25].

Tooth loss worries and impacts several aspects; losing a tooth means not only a damage to esthetics, but also an involution of periodontal tissues, especially the alveolar bone. The alveolar ridge crest loses the functional stimulus and, as a result, bone loss in volume is increased in the region. Besides bone changes, the gingiva also presents alterations: a less keratinized oral mucosa starts to insert into the alveolar bone and, as a result, there is increased predisposition to trauma [26].

Assuming that the surrounding structures change when there is tooth loss, is necessary to reestablish such absence. In the case of partially edentulous patients, specifically, the present anatomical structures (remaining roots) are used as much as possible, always aiming at bone maintenance, as well as any concern to postpone the atrophy of periodontal tissues.

For a long time, remaining dental roots have been maintained and used to promote greater retention and stability of removable dentures [27]. With the advancement of endosseous implants, the use of roots with retention devices has decreased; however, the addition of retainers to natural roots that would be extracted can still be a therapeutic option, especially for patients who cannot or are not willing to undergo surgery for implant placement [28].

Tooth loss causes several damages, related to both health and social life. The clinical aspect includes bone resorption, decreased proprioceptive capacity of the masticatory cycle and loss of masticatory capacity. One way to avoid them is to maintain the remaining roots, to support a denture on those roots. The overdenture is described as a removable partial denture (RPD) or full denture supported on one or more remaining teeth, roots and/or dental implants. It has some advantages such as reduced bone absorption, maintenance of the periodontal ligament and proprioception, besides the possibility of using fitting systems (retainers) for the denture, which improve the retention and stability of the prosthesis, providing greater patient satisfaction [29,30].

The rehabilitation treatment using resilient fitting systems is an alternative for the rehabilitation of partially edentulous patients [31,32]. The use of resilient fitting systems provides greater comfort by a more stable and esthetic reconstruction. The roots that will be abutments of this denture must have good periodontal implantation and favorable position for the placement of retainers [33].

The retainer is a mechanical device for fixation, retention and stabilization of dentures [34]. The retainer consists of a male component that is usually located in the region corresponding to the crown of the abutment tooth, and the female component is attached to the structure of the removable denture [35]. The two parts (male and female) of the retainer overlap, so that separation is precluded by the friction generated at the interface between walls [36].

An ideal fitting system should present good retention, biomechanical capacity to aid the distribution of functional loads to the adjacent bone and easy maintenance, if replacement is necessary. In addition, it must present low height, so that it can be used in reduced intermaxillary spaces, favoring the patient's esthetics [37]. The *O'ring* fitting systems have resilience as their main property, which

allows the movement of dentures aiming to distribute the masticatory load between the abutments and mucosa [31]. It is a spherical system, composed of male and female parts, and the male component is usually attached to the implant or root, presenting a projection, in which the rubber ring of the female component is fitted. This rubber ring is the component with higher occurrence of complications; if necessary, it can be easily changed, and this is considered an advantage of the system [37-39].

This system is indicated in cases of overdentures retained by independent roots [40]. This system requires parallelism between retainers, with maximum divergence of 10° , otherwise, it will present marked wear of the retention rings [35]. According to *Tabata et al.* [37], when the *O'ring* system is used, there should not be a divergence greater than 5° between them, since a divergence greater than 5° does not allow passive insertion and removal of dentures, which would cause rapid deterioration of the *O'ring*. According to *Telles* [33], it is only contraindicated in roots or implants with more than 20° of divergence.

To use this system, the professional should consider the minimum space required for effective use (6-mm height in the average) and, when added to acrylic resin and artificial tooth, it requires at least 15-mm height [37].

This paper reports a clinical case in which remaining roots were actively used for oral rehabilitation of a patient by the fabrication of cased posts associated with a fitting system with removable partial dentures in both dental arches.

II. CASE REPORT

Female patient S.M.S.M., aged 56 years, presented to the Dental Clinic at the University of Marília (UNIMAR) in the Extension Course in Esthetic-Functional Rehabilitation aiming to receive a new prosthesis, so that she could smile, eat and live in society in an effective and safe manner.

The patient had removable partial dentures with severe color changes, with marked wear of artificial teeth, poorly fitting unsuitable and without adequate retention, due to loss of the supporting teeth. Anamnesis, clinical and radiographic examinations of the patient were performed, which revealed the presence of tooth 11 with composite resin restoration on the mesial and distal surfaces, involving the incisal edge, both unsatisfactory and requiring replacement; tooth 13 presented fracture in the cervical third, good bone implantation and satisfactory endodontic treatment. Tooth 16 presented satisfactory amalgam restoration (mesio-occlusal-distal) and tooth 21 presented an unsatisfactory composite resin restoration on the distal surface. Tooth 23 had an unsatisfactory cast metal post, not

covered by any type of crown; also, the remaining dental structure around the post was carious. In the mandibular arch there was presence of teeth 31, 32, 33, 41, 42, 43 all healthy, besides tooth 44 with great coronal destruction and satisfactory endodontic treatment.

Initially, the decayed tissue in tooth 23 was removed, which also resulted in removal of the cast metal post in this tooth. It was observed that the dental remnant presented satisfactory conditions to be used as support for a future denture. Initial study models were obtained by simple alginate impression using metallic trays (Fig. 1 A).

Due to the clinical situation, in which the patient had three dental remnants (13, 23 and 44) requiring needing prosthetic reconstructions using them as abutments of a future removable partial denture, The treatment planning proposed included cast metal posts associated with a fitting system on them, which would act as retainers for the new removable partial denture.

The option to fabricate a removable partial denture using with the *O'ring* fitting system, using teeth 13 and 23 as abutments in the anterior region, with active utilization of these roots, would benefit the patient's esthetics because there is no need to use extracoronary retainers (clamps) in this region of the arch. The *O'ring* fitting system (CNG) is a mechanical system known for its passivity, due to the cushioning effect provided by the rubber ring. Regardless of the direction of forces applied to the female component, the rubber ring will always be present undergoing deformation, relieving the efforts transmitted to the male component of the system and consequently to the anchorage in the remaining roots.

The first session comprised the necessary intraradicular preparations of the root canals of teeth 13, 23 and 44, including adequate removal of root canal filling using Rhein tips and Gates Glidden drills, respecting the ideal principles of length, taper and diameter of these canals (Fig. 1 B-C).

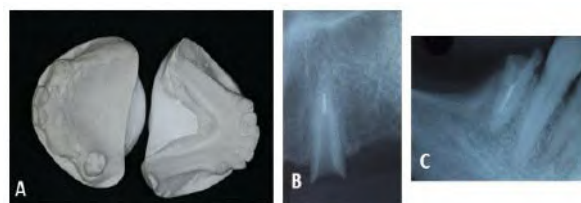


Fig. 1 – (A) Initial study models of the partially edentulous patient; (B-C) Root canals properly prepared for molding the posts.

Following, the root ducts were molded using Pin canal™ and acrylic resin with better dimensional precision (*Duralay™*) by the direct technique (Fig. 2 A-F).

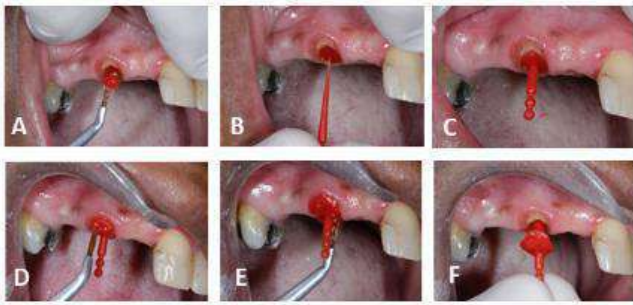


Fig. 2 – (A-F) Molding of the root canal for fabrication of cased cast metal post, using Pin canal™ and Duralay™ acrylic resin.

In the coronal portion, finishing was performed with burs and sandpaper discs. At completion of finishing, these posts presented full coverage of the remaining coronal structure with acrylic resin, a characteristic of cased posts (Fig. 3 A-D).

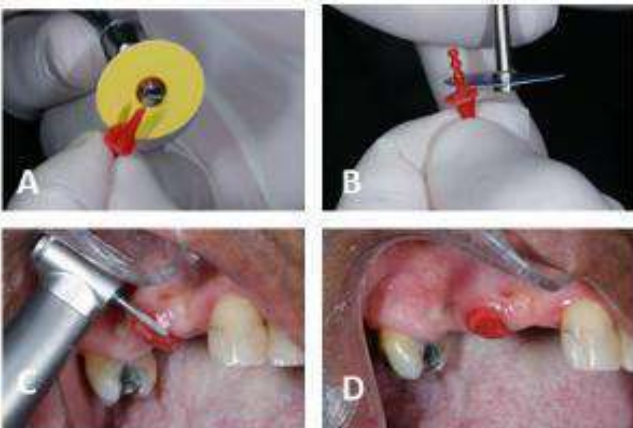


Fig. 3 – (A-D) Finishing of the coronal portion of cased posts.

Thereafter, the components of the O'ring fitting system were fixed with acrylic resin to the coronal portion of posts for later casting in the laboratory (Fig. 4 A-C); the posts were removed from their position by simple impression with alginate using a metallic tray (Fig. 4 D-E).

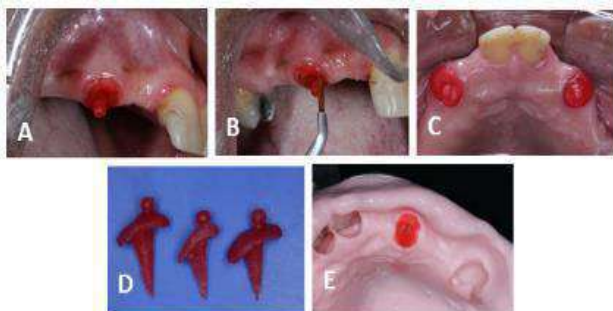


Fig. 4 – (A-B) Fixation of the fitting system component with acrylic resin; (C-D) Cased posts with the

fitting system component properly fixed; (E) Removal of the posts from their position inside the alginate impression.

Then, the acrylic resin posts were cast in metallic alloy and, after adjustments to achieve perfect adaptation to the root remnants, they were definitively cemented inside the root canals using zinc phosphate cement, according to the cementation protocol recommended for indirect posts (Fig. 5 A-F).

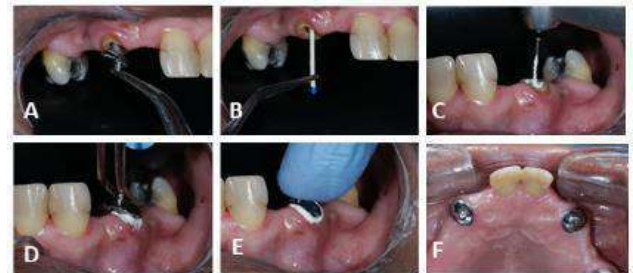


Fig. 5 – (A-F) Sequence of definitive cementation of cased posts inside the root canal.

The upper removable partial denture of the patient was provisionally adapted over these posts. In the upper arch, an occlusal niche was made in tooth 16 and palatal niches in teeth 11 and 21. In the lower arch, the niches were made in teeth 33 and 43. After specific preparations, functional impression of the dental arches were achieved to fabricate the metallic frameworks of removable partial dentures. The metallic frameworks were then properly tested and adjusted in the mouth for subsequent intermaxillary registration. In this session, a reduced intermaxillary space was observed and thus it was necessary to keep the cased posts of tooth 44 only as a simple metal coping, without the fitting system on it. In the following session, with the teeth mounted in wax, the functional test of dentures was performed, assessing all fundamental aspects as occlusion, esthetics and speech. Re-impression of the edentulous area was achieved using a light impression material (condensation silicone), for better adaptation of the denture base (Fig. 6 A-E).



Fig. 6 – (A-C) Functional test of removable partial dentures in both arches; (D-E) Re-impression of the upper arch with light condensation silicone.

After denture polymerization in the laboratory, they were placed in the patient's mouth. In this case, capture of the retention capsules with the rubber rings of the *O*'ring system was performed directly in the patient's mouth with chemically cured acrylic resin. With the finished denture, with open spaces to accommodate the capsules, they were captured directly in the mouth, with the patient keeping the mouth closed in light occlusion until direct resin polymerization. If, during this period, there was interference with seating, there might be movement leading to an incorrect capture. A spherical or similar drill is used to further grind the acrylic internally until correct opening of the capsule space, and then self-curing resin is placed in the plastic phase inside the denture. After curing, only an internal finishing is performed around the capsule. Although it is possible to fabricate the denture acrylics with the capsules in place, this is technique more subjected to error, since there may be a difference in the movement of capsules during the process, and correct adaptation on the abutments may not occur (Fig. 7 A-F).

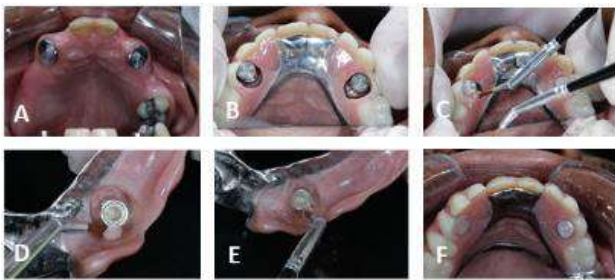


Fig. 7 – (A-F) Capture of the retention system capsules.

After capture was completed, the upper removable partial denture presented excellent final adaptation and retention, thus the patient was extremely satisfied (Fig. 8 A-B). The patient was instructed on placement and removal, as well as about denture cleaning. Occlusal adjustments and replacement of composite resin restorations on teeth 11 and 21 were performed, which were unsatisfactory and, in subsequent controls, some adjustments (reliefs) in the acrylic base region were performed due to small areas of trauma.



Fig. 8 – (A-B) Final clinical situation, with the denture adapted in the patient's mouth.

III. DISCUSSION

Increased denture stability and masticatory efficiency, better dissipation of occlusal loads, prevention of height and volume of the adjacent alveolar ridge, maintenance of the sensory functions of teeth and better psychological acceptance by the patient are some advantages of *overdenture* removable prostheses [41-43].

The use of *O*'ring fitting system provides retention with cushioning of axial forces on the supporting teeth, due to the rubber ring present in the female component of the system. Also, it reduces the lever arm in relation to the rotation axis of the root, thus allowing better distribution of masticatory forces on the roots and alveolar ridge [40]. An *in vitro* study by Freitas et al. [44] reported that the retention of the *O*'ring fitting system decreased over time, yet without total loss of retention.

According to Cunha & Marchini [45], if possible, the remaining teeth should always be maintained, since after extraction there will be bone remodeling due to the gradual process of alveolar ridge resorption. This resorption is delayed when the roots are maintained, by biological stimulation of the periodontal ligament, and maintenance of these roots aids the retention and stability, helping to restore the function and prognosis of dentures. The maintenance of roots is considered beneficial, since it reduces bone resorption, maintaining a more favorable bone level, allowing the future implant placement if necessary [45].

When the roots are maintained, the proprioception of the tooth is kept, since even endodontically treated teeth have periodontal fibers that transmit the load to the alveolar bone, thus gaining masticatory efficiency [46]. Maintaining teeth, even in small numbers, contributes to maintenance of the sensory response. This provides to the patient the benefit of differentiating the intensity of loads, food thickness and texture, which are important factors for the control of forces during mastication [45]. Also, the maintenance of roots has a psychological benefit, since tooth loss is usually seen by the patient as a synonym of aging [28].

In this case report, esthetics was an extremely important factor, being one of the aspects considered when choosing to use the fitting system; without this, the esthetics would be impaired, since it would be necessary to use clamps on the anterior direct abutments, namely the incisors in this case. The use of retainers compared to clamps often responds to an esthetic need [47]. The partial denture with clamp is always behind, especially in terms of esthetics, since the clamps may constitute obstacles that preclude the acceptance of the proposed treatment.

Removable dentures fabricated with fitting systems for increased retention ensure greater longevity to abutment teeth, especially those without a good crown/root ratio, since their components do not generate oblique forces that

could impair the uniform distribution of these forces [27]. The esthetic gain obtained with the use of these retainers in removable partial dentures should also be highlighted, which allows the elimination of extracoronary clamps on anterior teeth [39]. The use of dental roots is an option to increase the retention and stability of removable dentures, especially in patients who cannot receive endosseous implants, besides presenting a good cost-benefit relationship [28].

IV. CONCLUSION

The oral rehabilitation with removable dentures associated with the *O'ring* fitting system on roots is a good option for patients who cannot receive implants. As observed in this case, when well planned and performed, the denture provides rehabilitation but also harmony and balance of the stomatognathic system, providing comfort, favoring the esthetics, with good predictability, and meeting the patient's expectations.

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Relations between vitality and crime in the urban macroscale

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Keywords— *Spatial syntax, urban morphology, road integration and connectivity, public spaces, Cidade Industrial de Curitiba - Brazil.*

Abstract— *Faced with the problem of non-vitalized environments that are promoters of insecurity in cities, the research aims to contribute to the field of studies on interfaces of conditions of morphology and vitality from their interactions with crimes in public spaces. In this context, its general objective is to analyze the relationship between the results of spatial syntax, obtained with the software DephtmapX, and the occurrence of crimes in these places, adopting, as a macroscale case study locus, the neighborhood Cidade Industrial de Curitiba (CIC), Brazil, which has high rates of violence. To achieve these goals, the work was divided into four main sections: theoretical foundations, related to the structuring themes of research; methodological procedures, referring to techniques and methods employed; analytical results, related to empirical interpretation in two parts (spatialization of crime spots and application of spatial syntax) and critical discussions, pertinent to the joint analysis of scientific findings. Clear interconnection of road integration with the criminal occurrence is diagnosed, with a predominance of thefts, which use precisely areas of greater quantities and densification of users. For the connectivity of pathways, the clipping and conformation of the urbanized tissue of the studied region do not allow the establishment of effective reciprocity between attributes examined. It is concluded, therefore, by the achievement of the stated objective, even if future investigations should address in more detail the connection variable and others provided by the syntactic construction of spaces in this broad scalar approach of the contemporary city.*

I. INTRODUCTION

Starting from the recognized problem that empty areas, with few social interactions between private and public environments, as well as between the users themselves, are more susceptible to the occurrence of crimes, it is possible to infer that vitality in cities, understood as a quality that would lead to the permanence of people in a given place [1], is fundamental in the relations between spatial morphology and urban crime. Thus, vitalized locals are those with high intensity, frequency and richness of appropriation, as well as with interaction of activities abroad and inside buildings [2].

The importance of spatial morphology can still be reinforced in the way of enjoying community environments by its users. In view of the current recurrence of problems related to public insecurity, there is a scarcity of urban vitality and inefficiency of urbanistic forms for more adequate service to citizens.

The ineffectiveness of public policies aimed at better safety indexes based on studies on individual punishment is already proven. Thus, contemporary discussions about the city and violence are no longer limited to the view of crime as a police occurrence or as a misconduct, resulting in its current understanding as a sociological phenomenon, provided with context [3]. Thus, the analysis of socio-spatial relationships provides important contributions to the understanding of the theme.

Among the analytical possibilities of the relationship between crime and space, the focus of environmental criminology stands out, which, since the 1980s, has been studying how the ambient can favor the practice of delicts [4]. To this end, it adopts configurations of both socio-economic contextual and socio-spatial situational analysis, focusing on the conditions of the possible crime scene. It is understood, therefore, that elements of the city's shape interfere in the urban vitality and, consequently, in the criminal occurrence in public spaces.

Several morphological studies start from scalar divisions, since landscape elements are specific to each scale. Thus, they can be identified from the three space instances, starting with the implementation of the buildings, passing through the set of blocks and finally reaching the street system.

An important theory of urbanistic analysis consists of spatial syntax [5]. The interpretation of the city from the three scales also develops the concept of 'natural paths', indicative of the tendency of urban flows to following the simpler scripts, with smaller changes of direction [6].

By relating accessibility to the city with the street system, from displacements of people in the urbanized

network, this last conceptual approach constitutes an important basis for this work. Thus, spatial syntax was adopted as a theory and as a method for analysis in macroscale of the morphological relations of public spaces with the occurrence of crimes.

The selection of the neighborhood Cidade Industrial de Curitiba (CIC) in the state capital of Paraná, Brazil, is justified, among other reasons, because this region is the subject of previous investigations by the same research group. In this context, an evaluation of the ways in which public spaces in this urban sector are appropriated by individuals concludes that specific spatial conditions are not the only responsible for promoting vitality, also indicating the relevance of urban insertion [7]. In addition, the territory's pattern of occupation and the high rates of violence recorded [8] make them an ideal region for the application of spatial syntax.

From the above, this research aims to contribute to the field of studies on interfaces of morphology conditions with the promotion of vitality from their interactions with crimes in public spaces. Therefore, its general objective is to analyze the relationships between the results of spatial syntax and the occurrence of crimes in these places, adopting, as a *locus* of case study in macroscale, the aforementioned CIC district.

In this perspective, preliminary are identified the main theoretical foundations related to spatial syntax, urban vitality and public criminality, followed by the exposure of the methodological procedures employed in the development of the research. From the exposition of the analytical results found, the intended relationships are discussed in the light of the contributions of relevant theories and concepts.

II. THEORETICAL FOUNDATIONS

Since the beginning of the last century, Chicago School theorists have sought to understand urban crime with the support of biographical studies and information mapping, resulting in spatialized analyses of criminal occurrences and socioeconomic contexts [9]. These scientists also coined the concept of 'social disorganization', the product of the urbanistic concentration, according to which the weakening of neighborhood relations and attributes of solidarity and companionship, incompatible with the large urbanized centers, potentiate the criminal behavior [10].

In historical terms, violence is constantly associated with the expression of power, with the formation of communities by conflicts. In ancient societies, it was intended to subdue and inhibit the spread of similar actions by other individuals. In the Middle Age, the violent act

was tied to the search for enrichment and power by taking land and other goods as a battle estate. One of the most relevant results of this process, which culminated in the absolutist states, was the confirmation of the power of rulers, who began to centralize the right to punish [11]

Modern man watched the substitution of physical by psychological violence, still perpetrated by the centralizing domain of the State and corroborated by the other social institutions, which assumed the pacification of the subjects with the benefit of the maintaining of the *status quo* [12]. More recently, the concern with the phenomenon has been exacerbated, because society - and especially the Brazilian one - has been in the presence for decades with a remarkable increase in techniques and modes of its production [13].

Its causal analysis points to two coexisting and complementary strands: the structural one, originated by social tensions, and the situational, associated with the specific conjuncture, which can increase the possibility of coaction [14]. While the first demands a broader and multidisciplinary view of the situation, incorporating socioeconomic issues to understand the phenomenon, the second is focused on local environmental aspects that facilitate the likelihood of violent occurrences. Both should be considered in studies on the subject.

There is also some overlap between the various types of urban violence. These, in turn, can be classified into three main categories: politics (e.g.: guerrillas, conflicts paramilitaries or armed between organizations, and 'white collar' crimes), institutional (e.g.: police aggressions, abuses of public servants, mainly in the areas of health and education, and militias), socio-economic (e.g.: intimidation, violent acts in financial disputes, thefts, robberies, kidnappings, drug trafficking, smugglings, property assaults, exploitation of prostitution, gang acting, psychological and sexual abuses, and incivilities).

Several of these typologies are strongly related to the particular scope and other can happen both in the public and in the private spaces. As this research focuses on urban localities of common use, mainly the streets, the types of crime of investigative interest are thefts and robberies, more commonly linked to locals with intense and free attendance, which may, even, possess beneficial or deleterious conditions for these offenses.

From the 1960s, emerged a new current derived from environmental criminology called 'Crime Prevention through Environmental Design' (CPTED) [15]. Based on postulates of the widespread concept of 'eyes on the street', related to 'natural surveillance' by citizens [16], several researchers present different approaches to the interaction of crime with the environment. In common,

they expose questions of visual and/or physical permeability as fundamental in increasing security in public spaces.

The study of the forms of the city necessarily presupposes the disaggregation of the total into its parts, which, evaluated individually, allow the understanding of its effects as a whole [17]. Urban vitality is understood in this conjuncture as a reflection of adequate characteristics of specific morphology and as a fundamental condition for the prevention of the public spaces. .

The urban landscape can be interpreted from three main scales: the street (collective), the neighborhood (community) and the city (social), which can be complemented by the individual or family (residential). In the broader scale ranges, concepts are usually structured by the political division of territory elements or large structures barely noticeable as isolated components when visualized at the observer level.

Assuming the neighborhood as a relatively homogeneous area of territory and the boundaries as large organizers of urban space, for example, there are morphological elements perceptible in the macro view of the city [19]. The Spatial Syntax Theory relates certain characteristics of morphology to movement conditions and identifies possibilities of connection in the urban tissue as structuring items of the evaluation of its quality [5], which is also applicable to other scalar situations.

On the street scale, the ideas of urban vitality are relevant, because the good shape of the city is closely linked to the multiplicity of uses and functions of the private environment and to the ways in which it dialogues with the public space [16]. In addition, the existence of short blocks, basic in the theory of spatial syntax, as well as the high density of people and the frequency of users of different ages are indicators of adequate road form.

Still at street level, there are important attributes, such as widths of the rolling lanes and sidewalks, spatial characteristics of the facades, textures of the paving, amount of vegetation and the visual quality itself. However, while these elements are pertinent to the broader scales of morphology, other optics start from the macro to the micro, aiming at a higher level of detail by identifying properties that fit both the pathway and the lot [17].

It is also important to highlight that it is from the scale of the street that the city is, in fact, perceived [20]. When evaluating how it is understood by its passers-by, there are some important elements in this perceptual process, such as constructive details, walls, floors, colors, textures, urban furniture and vegetation, for example.

Directed to the relationships of the macroscale, that is the path system of a territory, spatial syntax provides two relevant attributes to be evaluated. The first - integration - is the measure that analyzes the distance of a certain stretch of street fruiteaters under analysis. Thus, it is identified of the relative importance of this stretch as a connector element of the road system as a whole [5].

The second - connectivity - refers to the number of pathways that intercept the one of investigative interest [5]. In this context, it is assumed that the greater the number of streets connects the ones under study, higher is its importance.

These two variables- integration and connectivity - are used as a conceptual basis for analyzing the selected territory, as presented below.

III. METHODOLOGICAL PROCEDURES

To achieve the stated objective, the research was divided into four main sections. The first - theoretical foundations - is pertinent to the previous chapter and was focused on the identification of the criteria related to the analysis in the macro-urban scale, mainly linked to spatial syntax. To study issues related to crime, CPTED principles were discussed. The purpose of subsidizing the adopted criteria, the bases of theories and concepts allowed the definition and adjustments of this part of the article, which deals with the techniques and methods employed.

The theories studied were fundamentals to the elaboration of the third section - analytical results, which was subdivided into two parts. In the first - spatialization of crime spots, the sites of criminal occurrences were identified in the study area - CIC neighborhood. So, the information available in its latest version by the electronic site "Onde Fui Roubado" ('Where I Was Stolen - 2012-2018) were used. In this collaborative mapping platform, each user can enter information and location of any offense.

The criminal data were cut to the study area and inserted into a geoprocessing platform, using the qGIS *software* for further analysis in conjunction with spatial syntax. Only the occurrences associated with the public space were selected. Thus, only the spots of thefts and robberies were used in the mapping.

Due to the feasibility of investigations, it is worth mentioning the worldwide trend of using collaborative platforms in research in various fields of science. In addition, official data, usually with restricted access, are often questioned, both because of the inconsistency of the methods of completion and the lack of records of certain offenses by the victims themselves.

The second stage of the analytical results - application of spatial syntax in the study area, aimed to obtain information on the roads of the neighborhood, which were converted, in the same previous *software*, into georeferenced axial axes with the largest possible extension. Using the DepthMax X program, the integration and connectivity information of each vial structure was produced, generating the mapping of the variables.

Finally, in the fourth section - integrated analysis of the results, the levels of integration and connectivity of the neighborhood roads and the location of the crime were discussed in an associated way. This content is addressed in the section of this work aimed at critical discussions of the theme.

IV. ANALYTICAL RESULTS

In the mid-twentieth century, the concept of the CIC neighborhood was motivated by the context of Brazil's strong industrialization process, notably due to the Federal Government's guidelines on decentralization of industrial production of traditional poles. The sharp economic growth of the 1960s and 1970s was another motivator for the ambition of the occupation of the broad national territory [21].

The optimism of the period of the project conception and the first years of implementation did not remain in the following decades. The constant crises of the Brazilian and global economy in the 1980s restrained the process of urbanization of CIC, which, together with the challenge of occupying a wide range of land, generated an expressive contingent of uninhabited spaces, resulting in significant fragmentation of the urban tissue, permeated by several areas of irregular occupation [22].

Thus, the large stock of idle land concentrated in CIC has become important attraction to invasion and spontaneous construction, which positions the region, until today, as the main location of informal settlements of the municipality. The spreading of the occupation resulted in a fragmented tissue, connected by some roads of higher hierarchy, which became the references of circulation and concentration of commercial uses [22].

From a socioeconomic point of view, the neighborhood has become the repository of land in the municipality for popular settlements, aimed at classes with lower incomes, providing manpower for the industries of the region [22]. These conditions determine that the CIC is historically one of the most violent neighborhoods in Curitiba.

Carried out by the methodological procedures exposed in the previous section, the mapping of crime spots in the neighborhood is presented in Fig. 1. It is worth

remembering that, for this research, only the crimes of opportunity are of interest, which tend to concentrate in public spaces [23]. Therefore, 75 occurrences were mapped in the evaluated period (2012-2018), identified 28 thefts and 46 as robberies [24].

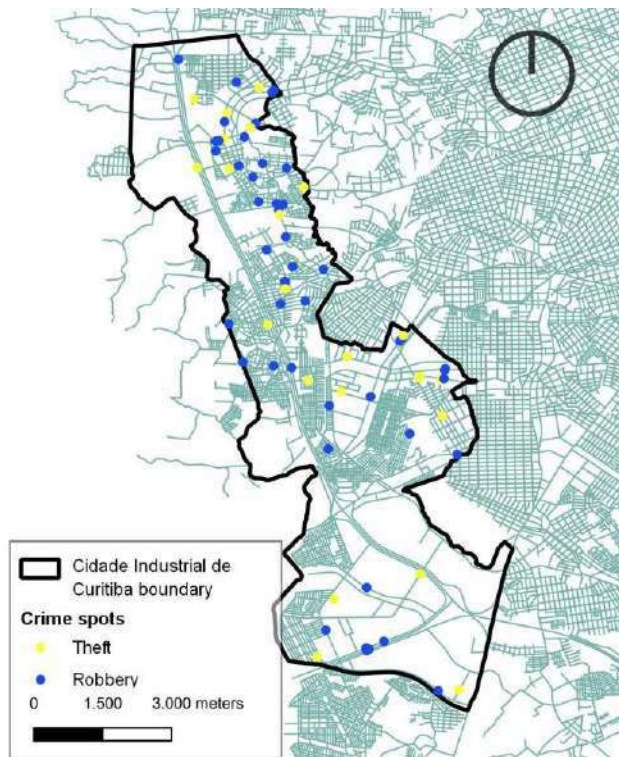


Fig.1: Map of crime spots selected in the study area

Source: Own elaboration based on Onde Fui Roubado (2012-2018).

In a first attempt, the application of spatial syntax was restricted to the CIC boundary. However, it was noted that the road structure at the same time conditions and is conditioned by the surrounding neighborhoods. Thus, the 10 bordering were inserted in the analysis (Table 1).

Table 1: Number of axial axes of pathways per neighborhood in the study area

NEIGHBORHOODS	NUMBER OF AXES
Augusta	243
Campo Comprido	585
Capão Raso	932
CIC	5.009
Fazendinha	534
Novo Mundo	1.161
Orleans	309
Pinheirinho	1.314

Riviera	37
São Miguel	216
Tatuquara	1.726
TOTAL	12.066

Source: Own elaboration based on IPPUC (2020) [25].

After the axial lines of the entire CIC road network and adjacent neighborhoods are drawn, the most important local are highlighted from the two main variables of the spatial analysis [6]: integration (distance from a given axis to all other) and connectivity (number of roads that cross a certain street) were then mapped. These characteristics contain basic indicators of urban vitality, as they relate to the potential for promoting connections.

The results obtained for the first variable were classified into three levels with equal intervals. When analyzed in conjunction with the criminal occurrence, it is perceived the distribution of crime spots between the intermediate and high levels of integration (Table 2 and Fig. 2).

Table 2: Levels of road integration and respective amount of crimes selected in the study area

LEVELS OF INTEGRATION	THEFTS	ROBBERIES	TOTAL
High	17	15	32
Medium	12	31	43
Low	0	0	0
TOTAL	29	46	75

Source: Own elaboration based on Onde Fui Roubado (2012-2018) [24] and IPPUC (2020) [25].

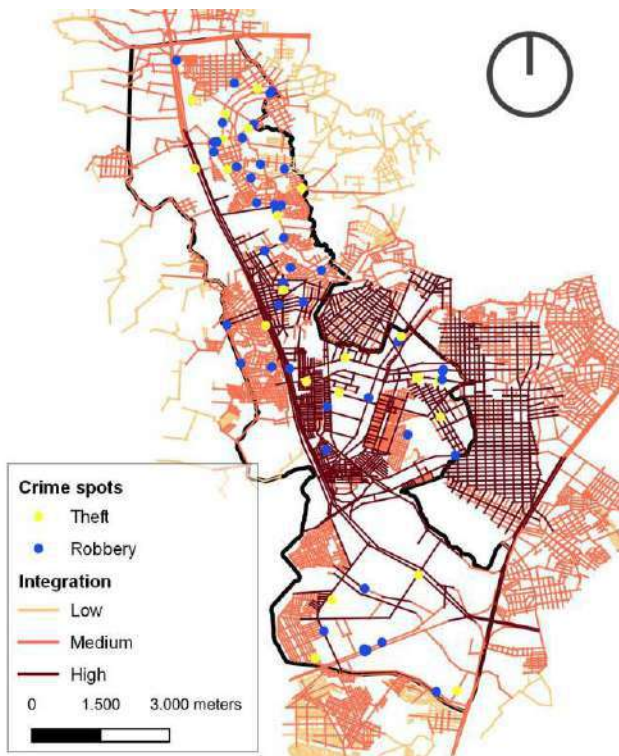


Fig.2: Map of crime spots and levels of road integration in the study area

Source: Own elaboration based on Onde Fui Roubado (2012-2018) [24] and IPPUC (2020) [25].

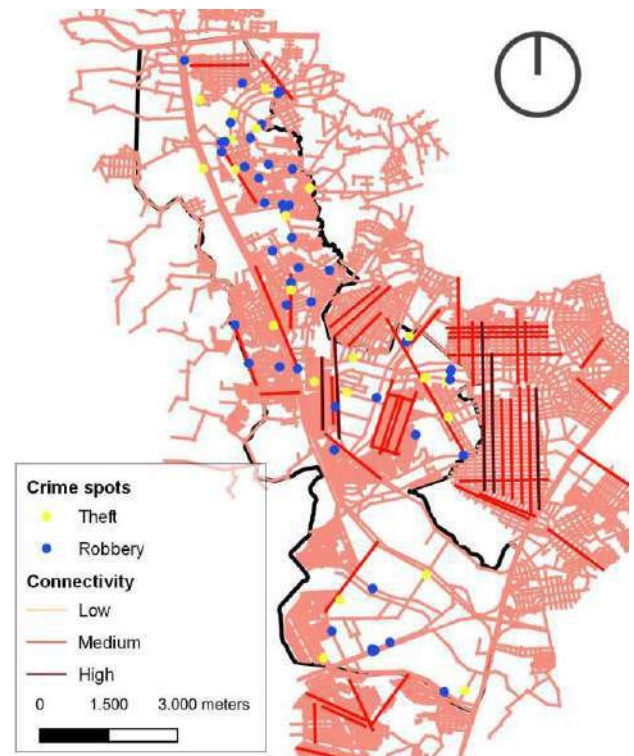


Fig.3: Map of crime spots and levels of road connectivity in the study area

Source: Own elaboration based on Onde Fui Roubado (2012-2018) [24] and IPPUC (2020) [25].

For the connectivity analysis, the variable was also classified into three equal intervals. With results significantly different from those obtained for integration, it is perceived the predominance of criminal occurrences in routes classified at the lower level (Table 3 and Fig. 3).

Table 3: Levels of road connectivity and the number of crimes selected in the study area

LEVELS OF INTEGRATION	THEFTS	ROBBERIES	TOTAL
High	0	0	0
Medium	6	10	16
Low	23	36	59
TOTAL	29	46	75

Source: Own elaboration based on Onde Fui Roubado (2012-2018) [24] and IPPUC (2020) [25].

The results achieved have particularities that deserve special reflections.

V. CRITICAL DISCUSSIONS

It is worth mentioning the predominance of thefts in roads with higher integration and, consequently, with greater potential for vitality, than in those classified in the middle level, in which the prevalence of robberies occurs. The dynamics difference of the two criminal types can explain these results.

According to Brazilian legislation, thefts are understood as subtraction without aggression of some item and often without the perception of the victim and without direct contact between this one and the criminal. In turn, robberies demand violence [26].

Thus, theft tends to be a faster action, ideally occurring in areas with a higher concentration of people, thus with a higher number of potential victims. The criminal use the possibility of his mimetization in the crowd to perpetrate the act. Therefore, it is understandable that in streets with greater integration, therefore with agglomeration of people, this type of crime is more significant.

In the case of robbery, on the other hand, there is interaction of the criminal with the victim. By

intimidation, the aggressor forces the attacked to do something he wants. It is an action that requires more time and exposure of the offender. In a busy place, with a large number of people, there are, tending, less opportunities for the realization of crimes by the 'natural surveillance' of citizens [16]. This fact explains the prevalence of this typology of crime in intermediate classes of road integration, corresponding to more than twice that recorded for the upper stratum.

It is noteworthy that the lower class has no spot of theft or robbery, possibly depending on these streets do not offer opportunities for these crimes, since the flow of people are very low. These are local roads, access to lots and on the periphery of the clipping of the study area, frequented almost exclusively only by residents.

The connectivity variable reveals significantly lower results within the CIC neighborhood compared to adjacent ones. Your historical settlement pattern may explain this result.

Although it is a planned neighborhood, its large extension and the slow process of occupation, often spontaneous, condition that its road network does not have strong regularity. In addition, the northern part of the CIC also has irregular and rugged topographic condition, which makes it difficult to plan orthogonal streets.

In fact, the best results of road connectivity are found outside the boundaries of the study area, in the eastern part, specifically in the neighborhoods Capão Raso and Pinheirinho. Internally to CIC, the only two routes classified at the upper level are the Judge Cid Campelo and Arthur Martins Franco streets (Fig. 4), with 35 and 33 perpendicular connections, respectively. The significant majority of the other ones have less than 10.

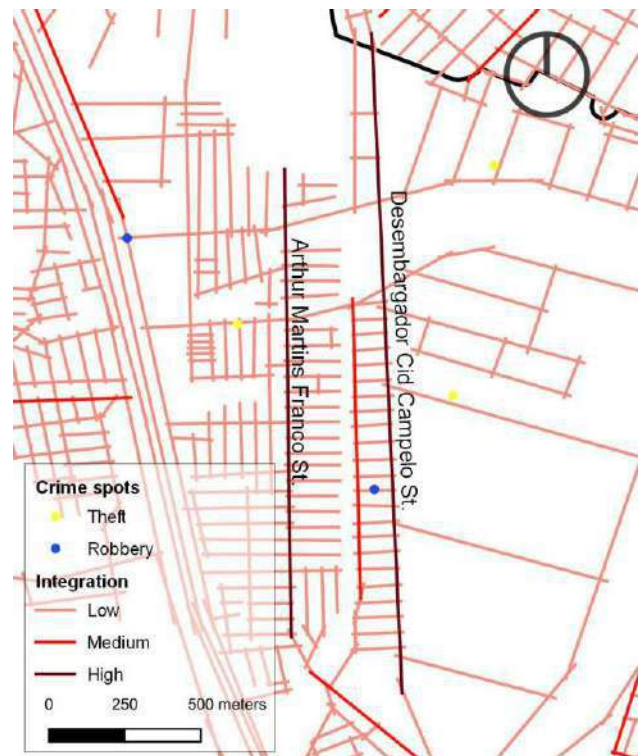


Fig.4: Map of crime points in the vicinity of roads of higher levels of road connectivity in the study area

Source: Own elaboration based on *Onde Fui Roubado (2012-2018)* [24] and *IPPUC (2020)* [25].

However, the specific results for these pathways must be relativized in the face of their contexts of urban insertion. Although they receive many connections from other streets, these are largely made up of short stretches with no exit or no continuity. Therefore, the connection is not relevant to the urbanized tissue, since it is established by very narrow road axes, residential character and local services. In any case, the two road structures in this case do not present crime spots specifically in their extension. The nearest robbery point is one block from Cid Campelo Street.

Finally, it is diagnosed that spatial syntax analysis presents more relationship with crime with integration than with connectivity. The results achieved for the first demonstrate that, in course, routes with lower value for this variable are more susceptible to criminal occurrence. However, it is emphasized that the differentiation for thefts, which happens in ways of greater integration, and robberies, which are recorded in those with lower values assigned to this indicator.

In the case of connectivity, the CIC's occupation pattern makes it difficult to analyze this variable in more detail, since the vast majority of its streets have few intersections with other routes. It is also not possible to

identify more expressive relationships of this variable with crime due to the absence of perceptible patterns in the results achieved.

VI. CONCLUSION

The theoretical foundations discussed allow the understanding of the studied phenomena and, in view of the achievement of the objective of the work, it can be affirmed the adequacy of the methodological procedures adopted.

Faced with the difficulties of obtaining and the credibility of official data on crime, mainly regarding thefts and robberies in public spaces, the use of collaborative platform is timely and efficient. Questions about the reliability of this information can be reduced by applying filters to the spots raised, eliminating those with inconsistency in filling out their attributes.

The analytical results of road integration are clear, with the values obtained for this variable enabling the evaluation in conjunction with crime, including allowing different interpretations for the two criminal modalities. These findings form contributions both to the knowledge of the specific reality of the area of study and to the generic deepening of the thematic context.

For the connectivity variable, however, it is not possible to interpret the range of sufficient results to identify effective relations with crime. Thus, it is recommended that future research be prioritized for studies of alternatives for measuring this particular attribute, including with expansion or reduction of study clippings to assess possible relationships of road connections with criminality.

Spatial syntax proved to be an interesting analytical tool for crime in urban public space. Even though, in this work, only two variables have been used, it is emphasized that the technique provides other topological measures applied to criminal studies, which can be the object of future investigations on the theme.

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The Impact of Social Innovation: Benefits for the Rural Area of Varzedo, Bahia

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Keywords— *Public policy, Social technology, Rural development.*

Abstract— *Innovation is related to the creation of new products, services, or the improvement of existing ones. Social Innovation (SI) concerns an intervention that seeks a new solution to a social problem, creating values for the assisted community, integrating people in the search for a result that satisfies those, directly and indirectly, involved in achieving the generated product, in addition, to establish inter-organizational and personal cooperation between activities and the creation of social innovation. This article aims to identify and analyze the effects of SI developed and directed to the rural population of Varzedo, Bahia. The methodology used was exploratory, descriptive, case study, and field research. Initially, a bibliographic review was carried out on the subject, with legislative and jurisprudential consultation, theses, and articles on specialized websites. Subsequently, visits were made to the rural region of the city, where the local way of life, its actors, and difficulties were witnessed. The results show that the radical and frugal SIs led to sustainable development and social change, generating employment, fixing the man in the countryside, and meeting the aspirations of the assisted population.*

I. INTRODUCTION

Rural development has occurred since the beginning of humanity's experience in social communities, with the change of paradigms, the introduction of new actors with different values, skills, and competencies, in addition to the arrival of progress and innovations, mainly new technologies, resulting in the change of thinking and exploring assets that are available locally [1, 2].

Public policy is an instrument of the State that aims to provide and promote the well-being of the population and may be the result of the articulation of public or private entities with the consent of the public entity. It is usually accompanied by factors, issues, and interest groups and its outcome can be restricted to a specific target group after its implementation [2, 3].

The world and society are undergoing changes arising from the awareness of the problems that are occurring in the world, especially with the introduction of new technologies and climate change, and these factors are influencing the daily lives of people and organizations.

Technological innovation has among its objectives to generate well-being and solve the problems that afflict the world. Its development took place in parallel with the Industrial Revolution when there were great discoveries and inventions to meet the demand of industrial growth [4]. The concept of innovation is related to economic and technological development, relating to products and processes. In the field of social sciences, its study is related to the effects and processes inherent to its application.

Social Innovation (SI) can be interpreted as a relationship of social actors who seek a new effective, efficient, and sustainable solution, capable of meeting a social problem, creating values that are accumulated by society, which differentiates it from routine solutions, where the value created is accumulated by private individuals [1, 2, 5, 6]. Its adoption aims to improve not only the economic logic but also the ability to generate socio-territorial development and improve social capital [1].

The SI is very relevant for the development of rural areas, as there must be integration between the main actors, especially civil society, which must organize itself to make the necessary connections to solve problems and take advantage of the opportunities that are offered. IS requests have increased over time and have been widespread in rural areas. The term innovation generates many questions and understandings and its interpretation depend on the theory used [1, 6].

One of the ways to innovate is through the creation of new products or production processes (radical), or even the improvement of the existing ones (incremental), however, their introduction in the market must be carried out by a company and not by the individual, therefore, the company has relevance in the process. as a gateway to innovation. Another relevant aspect is that innovation does not need to be entirely original, but can be an incremental line, with the ability to improve and improve technologies and products already on the market [1, 7, 8].

Radical innovation requires unconventional thinking, in which the inventor can think “outside the box” or the conventional, requiring a high degree of knowledge, developed skills, with possibilities to open new perspectives and become a vector of innovation. allocation of resources, in addition to playing the role of promoter of change [1,9, 10]. The environments must be suitable to favor creation, with structures open to change, willing to

take calculated risks, and experiment with new ideas. On the other hand, incremental innovation aims to modify what already exists, improving it or making new uses [1, 10]

In the scope of the small rural producer, the SI is perceived when technologies and frugality are verified, where the products or services are simple and the solutions are cheap and functional, contemplating a wide range of individuals who are part of the territory, especially the humblest. and without financial resources, where the results aim to circumvent the complex socioeconomic contexts and solve problems related to the low quality of public services or the absence of public policies aimed at the poorest strata.

The term “frugal innovation” is a new concept that emerged in the markets of India and China, characterized by simplicity and clarity in the use of resources. It is about creative improvisation to develop solutions to serve clients with limited resources and generally to serve emerging low-income markets [11]

Varzedo is a municipality in the state of Bahia and is located close to the most populous and geographically larger cities such as Santo Antônio de Jesus, Castro Alves, Valença, Amargosa, among others [12]. A significant part of its economy is fostered by small rural workers and peasants who are part of family farming, who have scarce financial and technological resources to leverage their production. Thus, due to the advancement of SI on rural properties, situations of engagement, and social mobilization of the community, the municipality believes that it is better observed from the perspective of social technologies.

This work intends to identify and analyze the SIs of the rural area of the city of Varzedo. In this context, the objective of the present work arises, which is justified in the face of the contemporary need for the debate on rural SIs, which fundamentally support this portion of the population, enhancing and valuing knowledge in these locations, providing opportunities for growth, access to goods and services. , preservation of the environment and generation of social peace, elements that come into synergy with the Sustainable Development Goals defended by the UN 2030 Agenda [13].

II. METHODOLOGY

The methodology used was exploratory, descriptive, case study, and field research. The literature review addressed issues related to innovation and its particularities. A bibliographic review was carried out on the subject, legislative and jurisprudential consultation,

analysis of books, articles, dissertations, theses, and materials on specialized and institutional websites through research search tools. Exploratory research was carried out to obtain familiarity with the topics studied, helping to improve ideas, to obtain a better understanding of the various aspects related to innovation. [14, 15].

For data collection, bibliographic research was carried out using scientific articles, theses, dissertations, essays, and specialized websites on the subject and with the help of material already published in scientific events, in magazines, newspapers, books, among others.

The need for visits to places and actors in the region was planned and identified, with possible follow-up by specialist technicians working in the municipality, a stage that was carried out in the second phase, through previously scheduled technical visits and initial contacts to survey the region. on the occurrences of Social Technologies (ST) in rural areas, which would contribute to the achievement of answers about the proposed objectives. This initial data collection served for later verification and comparison of probable elements that characterize possible social innovations in the region.

The third stage consisted of the effective survey of the SIs in the rural area through local visits, study evaluations, verification of the TS and their frugalities, as well as the creation of a photographic archive on the observed innovations.

After the third stage, studies and research were carried out on the region and the points addressed in the mentioned incursions. Thus, further visits were scheduled to provide further observations at the selected sites. In the visit that took place on September 15, 2020, with the support of the current director of Agriculture and Environment of the Municipality of Varzedo - Bahia, Sanitary and Environmental Engineer Diego Barreto de Almeida, the following places were visited: Barragem do Braga, Granja Três Brothers and an experimental model farm of cocoa plantation.

Subsequently, a meeting was held with the architect and urban planner Lorena Lago Santana Bittencourt, who presented other particularities about the city, its population, and the role of rural people. In the next step, a visit was made to a unit of the Avigram company, where it was possible to establish contact and clarify doubts about the operation, strategies, and values of the mentioned company and its management body.

III. THEORETICAL FOUNDATION

3.1 INNOVATION

Innovation can be related to the way a new product is introduced, the entry into a new market, a new production process, or a new source of materials. In the Oslo Manual there is the following definition:

Innovation is more than a new idea or an invention. An innovation requires implementation, either by being put to active use or made available for use by other parties, companies, individuals, or organizations. The economic and social impacts of inventions and ideas depend on the diffusion and absorption of related innovations. Furthermore, innovation is a dynamic and widespread activity that occurs in all sectors of an economy; is not the sole prerogative of the business sector [16].

In the Middle Ages, the term innovation was related to new forms or techniques of developing the most varied activities: artistic, as in the Italian Renaissance of the 15th and 16th centuries; industrial, as in the industrial revolution of England and Germany of the 18th and 19th centuries; or, technoscientific, as in the United States of the 20th century [17].

Innovation is present in society today, in all areas and segments. Many confuse innovation with new ideas, beautiful conceptions, and theories of what to do or how something should be. Usually, the change itself, the construction of the new, is not associated. Innovation is more than the idea, it is an idea applied, executed. Processes, products, society, the world transformed, improved, recreated [17, 18].

The innovation process is associated with the progress and development of nations, playing an important role in their future. The more innovative a nation, the greater its prominence in the world sphere. The ability to create, innovate and generate change is a differential, and countries that have scientific talents and exponents occupy a more privileged position when compared to other countries that do not have this condition. Currently, the most used model to explain this movement is the Triple Helix (Etzkowitz), which works with the synergy between government, industry and universities, in addition to being directed towards the same objective. Some more recent proposals point to the need to contemplate a fourth helix, which would be composed of society itself or people [17, 18].

3.2 SOCIAL INNOVATION - SI

Conventional technology does not always solve the demands required by society, as they seek to maximize profit, while Social Innovation (SI) tends to solve a problem that does not always translate into financial gains.

The SI is a new strand of socioeconomic actions with the ability to change the way of life of a significant portion of the population. In society, this term is still not consolidated and operational, despite being worked on for a long time and several authors have focused on it [1, 8, 18, 19].

Some particularities distinguish social innovation from radical and incremental as can be seen in Table 1.

Table 1 - Distinction between social innovation versus incremental and radical

Business innovation	Radical	Incremental	Social innovation
Market needs	New	Existing	Community needs (and opportunities)
Technological trajectory	Breaking	Consistent	Development trajectory
Knowledge	Transformed	Reinforced	Knowledge and skills
Adoption time	Long	Short	Adoption time
Strategy	Stochastic	Structured	Strategy and planning
Risk	High	Low	(Social) Risk

Source: [1]

Table 1 shows that radical and incremental innovation meets the needs of the market, while social innovation meets the needs of a community and not for profit.

The SI has gained prominence over time, mainly to face social, political, economic, and environmental challenges, becoming a strategy for government officials and for raising awareness among the population. Paradigm changes are taking place, where sustainable production is the most important factor, especially with social changes, their demands, and challenges, which require responses that are not always achieved with the use of traditional ways.

Table 2 shows the different definitions of IS over time.

Table 2 - Definitions of Social Innovation

Source	Definition
Fairweather (1967 apud Horta, 2013)	Social innovation means generating alternative solutions to social problems with minimal disruption of order.
Mumford (2002)	Refers to the generation and implementation of new ideas about

Murray, Caulier-Gracie Mulgan (2010)

social relationships and social organizations to achieve one or more common goals and may involve the creation of new types of social institutions, the formation of new ideas about government, or the development of new social movements.

Social innovations are defined as new ideas (products, services, and models) that simultaneously meet social needs and create new social relationships or collaborations. In other words, they are innovations that are good for society and increase its ability to act.

OECD (2010)

Social innovation implies conceptual, process, or product change, organizational change, and changes in funding, and can deal with new relationships with stakeholders and territories.

Young (2011)

Social innovation is a new mechanism that increases the well-being of individuals who adopt it compared to the status quo.

Bignetti (2011)

Social innovation is defined as the result of knowledge applied to social needs through the participation and cooperation of all the actors involved, generating new and lasting solutions for social groups, communities, or society in general.

Cajaiba-Santana (2014)

They are new practices created from collective, intentional, and purpose-driven actions, designed to bring about social change through the reconfiguration of how social goals are achieved.

CRISIS (2017)

New social, organizational, or institutional arrangements or new products or services that have an explicit social goal, resulting (voluntarily or not) from an individual initiative or a group of individuals, to respond to an aspiration, meet a need, offer a solution to a problem, or seize an opportunity for action to change social relationships, transform a framework or propose new cultural orientations.

Center for Social

It is a new solution to a social problem that is more effective, efficient,

Innovation – Stanford University (FILÉTI, 2019)	sustainable than current solutions and for which the value created is primarily for society rather than private individuals.
<u>Castro-Arce e Vanclay</u> (2020)	Social innovation can be defined as the creation, renewal, or transformation of social relationships in the development of new ways of working together to achieve social goals.

Source: Taken from [20]

Table 2 shows that there is a diversity of definitions, but all of them recognize that they aim at improving the social system.

The SI must spread among the next, to allow many to get involved and enjoy its results. It is known that there is a significant portion of the rural population is unable to carry out their work activities, depending on benefits or state assistance to survive and the SI represent an important tool to change this scenario [1, 8, 18, 19, 21].

There is a multitude of socio-economic problems in rural areas that can be solved through an SI, constituting an opportunity or need that will negatively or positively impact this event. For each problem, there can be a set of solutions to the needs that civil society urges and that generate specific demands, using abundant human capital as an asset, contributing to enhance rural development and, simultaneously, meet the expectations of the people assisted [1, 8, 19]. The emergence of SI aims to solve a specific social problem, bringing sustainable and effectively applicable solutions. In this way, SI establishes itself as an instrument of change, through an innovative and frugal aspect in the life of each individual, community, and/or nation, with values of transparency, sustainability, social responsibility, and environmental protection.

The SI reflected in its various possibilities of technologies, does not impose itself vertically, as there is a need for popular participation in the elaboration and choice of important points, to value local specificities, reflected in their customs, culture, and desires. Some SI practices are reflections of the critical mass, which has the power to induce its will through convincing narratives, resulting in the reconfiguration of social relations. SI social relationships have three configurations: networks (who); attitudes (why); and, governance arrangements (how). When there is a big change in a configuration, its reflection usually affects the others and tends to cause changes, being able to change its configuration with the

designation of new roles and/or new actors in its structure [1, 8, 18, 19].

Network components play key roles, some of which are characterized as innovators, promoters, or followers. Each of them has an attitude according to the degree of the problem, taking into account their values or beliefs and/or motivations, which can influence decision-making, and are influenced by social norms, community history, and formal institutions. Governance arrangements vary according to common interests and new forms of organization, and coordination varies when the heart of the matter is complex and structures are unclear [1, 8, 19, 22]

The application of SI in rural areas has gained prominence in recent decades, mainly because the structures and policies traditionally adopted do not satisfactorily respond to issues such as illiteracy, social inequality, unemployment, crime, poverty, misery, climate issues, education, and economic inequality.

3.3 SOCIAL TECHNOLOGY (ST)

The term technology is derived from the Greek being etymologically composed of two words, the first being technique, derived from *tekhne*, which means "art, technique, craft". The second is *logia*, derived from the word *logos*, which means "study of something". It studies technical and scientific knowledge in several areas of research [4].

Social Technology (ST) promotes several improvements aimed at solving some types of social problems, in its broad fields of action such as education, citizenship, inclusion, accessibility, sustainability, participation, and culture, to promote changes according to with its adaptability to the problem [18, 23, 24]. It is not a product available off the shelf and ready for use, but a dynamic methodology that is adaptable to each reality and field of application, based on popular knowledge and application to local problems to solve needs and pending issues.

ST has some characteristics of its own: it brings news to the localities involved; they represent life improvements and new possibilities for solving existing problems with those involved; and, feeds the emergence of new knowledge, which will effectively bring changes to the existing context. In addition, they do not have a defined temporality, that is, there is no deadline to end, and they bring the possibility of improvement. In essence, they present the willingness to share an economically viable way out for a given point presented, without spatial and temporal stiffening for their emergence and permanence in the face of conflict resolution [19, 25, 26].

The ST must be adapted to smaller scales, with the capacity to release physical, financial, and creative potential, without discrimination between employer and employee, oriented to the internal market, and capable of economically viable small businesses and self-managed enterprises. For its implementation, an institutional culture that is favorable and coherent with the SI is necessary. This culture, instead of criticizing the current model, should prioritize research and the training of human resources, in addition to the solidarity economy and projects led by different social niches [19].

The technology currently used by society is Conventional Technology (CT), described as labor-saving, productivity maximizing, intensive in inputs, with ever-increasing production scales, with coercive controls harmful to productivity, and dependent on environmentally unsustainable machines. In this way, a scenario is established in which production is monopolized by large companies from the most developed countries, not allowing the control of the local producer nor the use of its capacity, configuring itself in an alienating and non-stimulating environment [19].

3.4 FRUGAL INNOVATION

The term frugal innovation first appeared in an article by Zeschky, Widenmayer, and Gassmann (2011). Frugal innovation consists of an innovation that makes the product or service simpler and cheaper, aiming to increase the possibility of acquisition by the poorest strata. Its central objective is to apply extreme restrictions on financial, material and institutional resources in the development of innovations, to achieve a product that has simplicity, limited application, low cost and provides access to the product or service to the greatest possible number of people. Complexity and sophistication are useless if there is no accessibility [11, 27].

There are several studies related to frugal innovation and in Table 3 some are listed.

Table 3 - Definitions of frugal innovation

Author	Definition	Feature
Bhatti (2012)	“It is not simply about reducing costs, but it can also involve increasing buyer affordability through income generation, savings, or alternative payment schemes. Frugal innovation can also mean that the result involves building	- Increased accessibility. - Sustainability

Tiwari e Herstatt (2012)	local entrepreneurship, empowerment and self-reliance or sustainability” (BHATTI, 2012, p. 18). “It seeks to minimize the use of material and financial resources in the entire value chain (development, manufacturing, distribution, consumption, and disposal) to reduce the cost of ownership, meeting or even exceeding certain pre-defined criteria of quality standards. acceptable values” (TIWARI and HERSTATT, 2012, p. 98)	- Accessibility; - Robustness; - Conviviality; - Scalability; - Attractive Value Proposition
Bound e Thorthon (2012)	It is a distinct approach to innovation, which responds to the limitations of financial, material, or institutional resources and transforms these restrictions into advantages. It goes against the mindset that frugal innovation can be equated with creating cheap, low-tech products.	Four features: 1) it implies doing better things, not just cheaper things; 2) extends to services and not just products; 3) refers to remodeling not just the disadvantage; 4) Low cost does not mean low technology.
Zeschky, Winterhalter e Gassmann (2014)	“[...] frugal innovations are not restructured solutions, but products or services developed for very specific applications in environments with limited resources” (ZESCHKY, WINTERHALTER, and GASSMANN,	Technical novelty and market innovation. Criteria: even for less, tailored for less and new for less.

	2014, p. 23).	
Simula, Hossain and Halme (2015)	Innovation that meets the needs of low-income customers typically located in low-income emerging markets	<ul style="list-style-type: none"> - Scarcity of resources; - Simplification; - Environmentally sustainable and lean practices
Weyrauch and Herstatt (2016)	Frugal innovation is characterized by three criteria (both in emerging and developed markets).	<ul style="list-style-type: none"> - Substantial cost reduction; - Focus on basic functionality - optimized performance level

Fonte: [11]

Table 3 shows that the definitions of frugal innovation are related to low cost, targeting the emerging and developing market, with a focus on adapting products to create consumption opportunities for poor customers. It does not aim at a profit as in conventional innovation, those aimed at/by large companies to increase profit. They are related to all types of problems and social needs, including those under the responsibility of public entities - from basic sanitation, education, health, energy to social development - whose results strengthen society.

Universities and public R&D institutions are favorable places for the development of frugal innovation, as their role is to seek economic and cheap solutions that can be marketed at a lower price, in addition to being a factor in reducing inequality.

3.5 PUBLIC POLICIES

There are several understandings of public policy, with one line focused on government and the other approach emphasizing the role of public policy in solving a problem. Public policies are determined by the State to address a particular public problem. These issues are broad and complex, there is no specific beginning and end to be identified, and they still suffer from multiple interconnections and different causes. These are aspects that hardly find a full resolution, and innovation is the way to balance the theme [28, 29]. Talking about public policies is not simply talking about government policies, because they are not merely statist actions, since the participatory mode is required. In addition, the Brazilian Federal Constitution (CF, 1988) is based on the dignity of the human person.

By not bringing the innovation factor to the essence of public policies and, on the other hand, bureaucratizing the path to the realization of new technologies to the extreme, opens the way for the researcher to consider the feasibility and valuation of their efforts. There is a lack of incentive and appreciation for the search for the new, relativizing the risks and supporting research [3]. In Brazil, the human being is the center of attention and their quality of life will reflect whether the successes are greater than the mistakes. To develop the social is to develop the human [30].

When analyzing the context of the small rural producer, it is observed that this public is not adequately covered within the scope of government public policies, not having easily and constantly available lines of credit to finance inputs for production and other investment needs such as machinery and equipment. Despite the little support and little recognition of its importance by society, the work of small rural producers is fundamental for the Brazilian population and provides food support to the national economy [31].

On the other hand, without substantial resources, and therefore far from the most modern technological advances, small farmers replicate the knowledge of their ancestors. In this way, they are only sporadically able to evolve in their ways of treating the crop and its products. Therefore, the innovation observed in this context needs to be valued, as it represents the opportunity to propagate improvements, applying the ideals of preservation and sustainable management [32].

Sometimes the custom replicates delayed, unproductive, polluting, and environmentally aggressive actions, which may present an environmental risk or be environmentally reprehensible. Not using pesticides on a large scale, relativizing the use of transgenics, and preserving the environment, among other aspects, raise the quality of the product and value it in front of customers and consumers, who seek natural and consciously produced products. In addition, SIs can play an important role in reducing resource use, costs involved, crop management, and animal production systems. In this way, the implementation of ST can lead to the choice of alternatives with less environmental impact, whether in the production of resources or the destination of garbage and other waste from production [32, 33].

The growing concern with this aspect of agricultural production in Brazil is undeniable, always trying to combine productivity with the safety and quality of the products offered. The 17 Sustainable Development Goals (SDGs) of the United Nations (UN) are tools that exert a certain pressure to achieve goals related mainly to the environment.

Small producers tend to live with greater respect for the environment, with a greater mentality of sustainability and conscious use of natural resources by using traditional processes of cultivation and food production. The population begins to be aware and value products without pesticides and produced in a sustainable way, which has led a portion of small producers to benefit from these results, using methods that prioritize respect for the environment and reduce or stop aggression to nature.

3.6 CITY OF VARZEDO

Varzedo is a municipality belonging to the state of Bahia, with an area of 226.8 km², an estimated population of 8,734 people in 2021 and a population density of 40.16 inhab/km². In terms of population, its position is as follows: 357th among the 417 municipalities in Bahia and 3153rd among the 5,570 Brazilian municipalities [7, 34]. It is 211 km from Salvador and borders the municipalities of Santo Antônio de Jesus, São Miguel das Matas, Castro Alves, Conceição do Almeida and Elísio Medrado. The municipality has the following indexes: IDHM 0.586; GDP of BRL 37,626.444 thousand; GDP per capita of BRL 11,320.10 [7, 34].

The municipality was created in 1989 after its dismemberment from the municipalities of Santo Antônio de Jesus and Castro Alves, consisting of two districts: Varzedo and Taboleiro Castro. In 1933 it appeared as a district of Santo Antônio de Jesus and called Vargem Grande. In 1943 it became known as Varzedo [7, 34].

In 2019, the average monthly income was two minimum wages, and the proportion of employed persons about the total population was only 7.0%. Thus, if you compare the average monthly income of its inhabitants, Varzedo appears well positioned in 89 among 417 Bahian cities, but if the percentage of employed people is analyzed, its performance plummets, going to position 254 among 417 Bahian cities. In the Brazil analysis, it occupies position 2,034 and position 4,507 out of 5,570 respectively. This condition demonstrates the economic and social fragility of the local population. It is observed that households with a monthly income that circulate up to half the minimum wage per person represent 51% of the total number of households in the municipality [7].

The basis of subsistence of the population of the municipality is family farming, therefore, part of its economy is fostered by small rural workers, who do not have access to the necessary resources to leverage their production [35, 36]. In a complementary and ancillary way, there are assistance benefits from the government and the National Institute of Social Security - INSS, such as pensions, income from the Bolsa Família social program, and more recently emergency aid, aimed at minimizing the

economic effects that the pandemic caused by Covid-19 has brought to a significant portion of the region's residents

Varzedo exemplifies the topic of IS, frugal technologies, and their likely benefits for those involved, presenting himself as a similar sample of the parameters found in small rural cities in Brazil, presenting a favorable scenario for the development of IS [34]. This is a differential that makes life easier for a portion of the population, bringing new possibilities and opening horizons for the application of ST.

3.7 DAM

According to Resolution No. 143/2012, of the National Water Resources Council (CNRH), a reservoir is an “unnatural accumulation of water, liquid substances or a mixture of liquids and solids”. What usually drives the construction of such a structure is the search for the optimization of the available water resource [37].

A dam is a “[] structure in a permanent or temporary course of water for containment or accumulation of liquid substances or mixtures of liquids and solids, comprising the dam and associated structures” [37]. One of the objectives of the dam is to interrupt the flow of a river to form a reservoir, whose stock can be used in the future during the needs of the community [38, 39, 40]. The dams have variable sizes and heights according to their purpose of use. The material for its construction varies, and can be concrete blocks, loose stones, stones in gabion baskets or wood [41].

Small dams, with small volume reservoirs and supplied by run-of-river, most of the time are structures not technically assisted, without operational data records, and usually belonging to the private sphere. Its purpose is to function as a dam, seeking to meet the needs of irrigation and human supply [39, 42].

The climate reality and possible variations in the climate of a region directly affect its water availability and the condition of water storage in small and large reservoirs. Many reservoirs easily lose half of their reserve, which goes back to the conclusion that in the case of small reservoirs, they can only withstand adequately if they operate sustainably [43, 44].

The solutions imposed by the rural communities themselves are most often not based on studies of water availability and deal experimentally with the exploration of water sources and decisions to increase the fulfillment of demands. This is due to the lack of monitoring when analyzing this procedure considering the spatial and temporal variability of the river's water behavior. These

interventions involve a dam for storage and for raising the level and drilling of wells [45].

3.8 BARRET DAM OR MASSAFERRO DAM

In 2012, there was a great drought in the Varzedo region, which led to the construction of the dam in the rural community of Braga, popularly known as the "Massaferro" Dam. It is a structure built by the local population on a water source and which is still responsible for supplying water to the rural areas of Braga, Melado I, and Melado II. The dam is in an elevated region and for this reason, it uses gravity to distribute the water, reaching homes without any type of treatment [45].

It is an enterprise built by the population, without a specific study of capacity and structural basis, having its maintenance, for most of its existence, carried out by the residents of the region. The city hall carried out interventions and inspections on the structure so that it continues to be used by residents and producers in the region, bringing facilities and enabling projects that, without its existence, would be impossible.

The Braga dam was built in 1983 by the Association of Residents of the Braga community, to provide water supply to the communities of Braga, Melado I, and Melado II. Founded by Mr. Angelo Galdino, a member of the Braga community and, at the time, president of the mentioned association. This solution started with a small dam and over the years it was expanded to keep up with the increasing demand for water in the communities, configuring a small dam in stone masonry. The reservoir has an accumulation volume of around 2,814 m³, when it is at its maximum level (Table 1), with a drainage area of 0.5 km² [45].

IV. RESULTS AND DISCUSSION

The SIs identified in the region present solutions for various aspects of society and bring benefits to the assisted community, and in several situations, the results were expressive and will be described below.

4.1 BRAGA DAM OR "MASSAFERRO" DAM

The construction of the dam began in 1983, with the local mobilization of the community to solve the problem of water shortages that affected the residents. The work was done in the form of a joint effort and completed in a few days.

A curiosity about the construction of the dam is that the person who commanded the project was from the community and was unaware of engineering techniques, he only enforced the initial guidelines suggested by his brother. In the initial project, a hydraulic pipeline was

installed that connects the dam to the neighboring communities, serving a significant number of people, equipment that today has been enhanced by the local government.

The Braga Dam could serve 222 residential units in the three communities, with per capita consumption of 0.13 m³/inhab.day, an average of 4.96 people per household, equivalent to 144 m³/day. For irrigation, the estimated consumption for properties with 20 ha was 0.6 L/s/ha. In terms of livestock and animal husbandry, the estimated consumption was 0.05 m³/day for 2,000 heads of cattle and 0.0002 m³/day for 70,000 birds, with a total consumption of 1,036 m³/day [45].

Over time, some politicians in the region thought about expanding the dam to increase the water reserve. They partially dismantled the dam, regularly building another, however, the new structure assembled did not withstand the pressure of the water, partially breaking, depleting the community, and generating a general feeling of apprehension. To solve the problem, the community got together and worked on its repair, again using the "massaferro" alloy and traditional knowledge. In this way, the dam is considered a hybrid, as it has part of the construction in the normal molds and partly maintained with "massaferro", which was the traditional technique used.

The structure of the hydraulic network supplies the communities involved in the Dam project. The supply lines that leave the reservoir of Barragem do Braga, follow through a PVC pipe, which was dimensioned and built by the community, interconnecting with the residences of the locations of Braga (networks 1 and 3), Melado I (network 2), and Melado II (network 3). When there are problems related to supply, such as leakage or clogging, residents gather to carry out maintenance.

During the on-site visit to the Braga Dam, some people were contacted who helped the creator of the structure's construction project. They explained that they used a mixture of 90% clay, 10% cement, and local stones, making the project financially viable and helping to alleviate the serious water problem in the region. The red clay from the Serra da Jibóia was used as a base material, mixing it with the cement using footsteps, which was the traditional way of making the mass for civil construction, until reaching the necessary alloy to be used in the dam construction. Later, they joined this mixture with the stones of the region and assembled the structure of the dam. This mixture was named "massaferro" because of its resistance characteristics. Another important characteristic of the compost created by the mixture is its use in water, as

it does not dissolve easily and, therefore, can be used more widely in the maintenance of the built-up area.

4.2 FARM "BED" CRUSHING MACHINE

During the visit to the farm in the region, significant points of representativeness of TS in operation were detected: equipment for breaking the farm's "bed", chlorine receiver, and heater. Granja Três Irmãos, located in the rural area, specializes in the breeding of poultry for slaughter and directed to the industry Avigran

The poultry litter is the material that is on the floor of the aviary and is intended to serve as a bed, to receive excretions (feces and urine), feathers, skin flakes, and leftover feed from the birds. It is homogeneously cared for, adopting a depth that varies between 8 and 10 cm after compacted. If there is an inadequacy, adverse results will arise and bring problems to the lot that is in the assigned area [46, 47].

When preparing a new batch of birds, the ground is prepared to give comfort to the small animals. With time, the ground is being trampled by birds and keepers, leaving the floor hardened, which harms the creation. Thus, to reduce risks to the health of the animals and increase the productivity of the creation, the "bedding" must be crushed periodically.

The frugal innovation is represented by a rudimentary sewing machine that serves to break the trampled floor of the farms. It uses blades that penetrate the ground and cause a cutting effect.

4.3 CHLORINE RECEPTOR.

Water is an indispensable element for life, in addition to serving for direct human consumption and for raising animals. The healthy use of this resource is of high importance in the production of foods such as those from the poultry industry. Treating water with chlorine is one of the most common ways to regulate this quality [48, 49].

Even though it is fundamental for the survival of animals, sometimes the quantity and especially the quality of water is neglected. Producers are more concerned with feed control than with water. However, between 65% and 75% of the body of birds is represented by water, and this percentage is even higher in the young phase. Water is essential for egg formation, digestion, regulation of body temperature, as well as being an elemental nutrient for survival.

In Brazil, 90% of small rural farmers do not use treated water. In small rural properties, sometimes the water used comes from lakes, rivers, and dams or comes from rain, which is collected and stored in cisterns and wells and used for their consumption, raising animals or for washing and sanitizing places, products, and/or equipment. The risk

of contamination of these supply sources or even reservoirs by pollutants, pathogens, or microorganisms is imminent and can lead to serious problems for human or animal health [46, 50]

]. Preserving water quality requires great care with microorganisms, which proliferate in this environment and are invisible to the naked eye.

To avoid risks of water contamination, the most recommended, due to its efficiency and cost, is to use chlorine, which is a legally approved product, has sanitizing functions, and reaches the necessary efficiency as a disinfectant for water, whether for human or animal consumption [50]. In poultry farming, chlorination rids the water of microbes, controlling, above all, the transmission of Salmonella, H1N1, E. Coli, Coccidiosis, in addition to controlling elements that in excess are harmful to birds such as nitrite, iron, and magnesium [46, 51].

To make an efficient dosage for water disinfection, the use of a chlorinator is necessary. On the farm, a component was developed to measure the chlorine used in the treatment of drinking water by the animals. This frugal innovation brings the possibility of using chlorine tablets to control the quality of the water, which is gradually dissolved, keeping it suitable for consumption by the farm for a longer period.

4.4 FARM HEATER

The first two weeks of the chickens' life are decisive for the success in the creation and the occurrence of errors in this period leads to the failure in the results, mainly about feeding, hydration, handling, and ambient temperature. Chicks destined for cutting are poikilothermic animals in their first stage of life, that is, they cannot maintain the ideal body temperature, being extremely vulnerable to temperature changes, since the main organs of the birds and the immune system are formed and develop in the first seven days of life. Therefore, keeping the environment controlled is essential for the development of birds [46, 52]. Thus, one of the major problems for raising birds for slaughter is controlling the temperature of the environment.

In units lacking technological and financial resources, temperature control becomes the key point for business success. Too much heat or cold can kill animals, leaving smallholders seriously tied to nature's woes. To keep the environment warm in the winter period, some breeders burn wood inside barrels, which somehow control the heat spent on the farm, but do not arrive uniformly. Several burning points are necessary to keep the farm evenly heated, which requires resources to acquire or obtain the wood. Therefore, the issue boils down to distributing the

heat resulting from the burning to the environment evenly in low-temperature periods.

It was at this point that the frugal innovation emerged, which spread to some farms in the region, among them the Três Irmãos Farm. The creation process consisted of the construction of a metallic structure using iron plates and tubes, which, in a completely handmade way, took the form of ovens, where the burning of firewood was better used, saving wood and time. With this technology, better heat distribution is achieved using metallic ducts, which start from a central oven and keep the farm evenly heated, guaranteeing thermal uniformity in a larger space of the farm.

The social innovations identified during the visit carried out in the rural area of the municipality of Varzedo are shown in Table 4 below.

Table 4 - Social Innovations identified in the municipality of Varzedo

Social Innovations	Solution Sought	Results	Current Situation
Braga dam	Provide water for consumption to families in a certain rural region of the city of Varzedo	The objective was achieved and improved, with the creation of several supply lines to other nearby areas.	Following the model created for the Braga Dam, other small structures were set up in nearby regions to supply other locations
Farm "bed" shredder	Provide a loose and aerated soil for the animals	The objective was achieved, because the time of use of the equipment in relation to the traditional way (hand arm) is shorter and brings more efficiency to the handling	Still in full use on several farms
Chlorine	Control the	Substantially	The

regulator dosage of reduced technique farm animal continues to be used, being endorsed and suggested to other producers

chlorine applied to the animals' drinking water, to avoid the spread of diseases and financial losses

It exceeded expectations, as it provided greater comfort to the animals and increased productivity, in addition to reducing the use of wood, as the heat dissipated by the ducts occurs uniformly throughout the space where the animals are raised.

Evenly heat the animal husbandry space

Farm heater

The innovation continues in use and spreads to other farms in the region

Source: Own authorship (2022)

Table 4 summarizes some of the social innovations visited in the municipality of Varzedo and for their achievement, there was no dependence on particular actions, but the mobilization and participation of society, whose actions were fundamental to generate an improvement for the assisted population, being essential the occurrence of social relationships, structured governance aiming at the event and greater empowerment of the community, where they showed their ability to solve problems that affected the place.

V. CONCLUSION

Communities in need of attention from public entities, such as those identified in this study, show that it is possible to regain self-esteem, restructure places and guarantee better well-being only with the use of frugal innovation and Social Innovations (SI). Despite not having financial and technological support, the population of the municipality of Varzedo showed that with collective work it is possible to achieve positive results that will give them comfort and provide a better quality of life.

The literature review on SI leads to the reflection that they are responsible for an efficient future, with less room for misconduct, forming a participatory sphere and feeding the ability of society itself to produce its answers and solutions, which can contribute to the scope of the SDGs. In the specificities of the technologies involved, many are developed by the peasants themselves, who will use them for their well-being and that of the community in which they live.

SI represents an opportunity that arises with the simplicity of objectivity, bringing answers that solve questions that were difficult to solve until then. The objective is to be able to change and improve the local dynamics, based on concepts of humanization and integration.

SI and frugal innovation have the power to transform rural society, generating sustainable development and, consequently, social change, meeting all the aspirations of the actors involved, where each one has a relevant role in decision-making and in the execution of the work to be done.

The social innovations of the municipality of Varzedo make a difference, strengthening the understanding that even without all the necessary support, the creativity and frugality of the rural worker's actions are decisive for the success and improvement of the product and living conditions.

It is concluded that the SI in the rural sphere of the municipality of Varzedo, Bahia, presents, on the one hand, a consolidated dimension and, on the other hand, ample possibilities of expansion of its concept to be used in the resolution of other social problems that afflict its population, mainly rural residents, who lack the institutional support of public entities in all spheres, whether municipal, state and/or federal

Finally, the SI and the frugalities pointed out and related in this work, bring to light all the social characteristics of an innovation, and highlight the potential of the rural worker, demonstrating the need for greater

support from private and public entities through public policies specifically focused on for that segment.

The work was limited to only a few SIs that could be visited, but others can be studied in the future.

The article can be applied in other municipalities, as there is a lack of support from public entities in the rural areas of the municipalities and this condition allows their residents to seek to solve problems in a community way, with the provision of effective and low-cost solutions.

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The role of the health professional in the care of patients with diabetes mellitus and arterial hypertension in primary care – SAH

O papel do profissional da saúde no cuidado do paciente com diabetes mellitus e hipertensão arterial na atenção básica - HAS

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Keywords— Hypertension, Diabetes Mellitus,
Nursing care.

Palavras chaves - Hipertensão. Diabetes
Mellitus. Cuidados de enfermagem.

Abstract— The Family Health Strategy (ESF) has a fundamental role in care and aims to expand, define and consolidate primary health care. The nurse must be part of the ESF team and continuously work on the chronic disease control plan. The aim of this study is to describe the role of nurses in the care of patients with diabetes mellitus and hypertension in primary care. The methodology is a study of narrative literature review with an approach of exploratory, observational, retrospective studies that were searched in the literature 20 articles between 2010 and 2020. Results: In the assessment of the role of nursing cited by nurses' care, predominant nursing related to food and humidity, followed by glycemic control, blood pressure and nursing weight. On the other hand, the nursing process is a technology that allows humanized care in a systematic and dynamic way, with positive results and low cost. It is concluded that the role of the nurse as an educator is essential for both the patient and the family, and they must follow their guidelines in order to understand and realize the importance of the treatment and activities performed to improve the quality of life.

Resumo— A Estratégia Saúde da Família (ESF) tem papel fundamental no

atendimento e tem como objetivo ampliar, definir e consolidar a atenção primária à saúde. O enfermeiro deve integrar a equipe da ESF e atuar continuamente no plano de controle das doenças crônicas. O objetivo deste estudo é descrever o papel do enfermeiro no cuidado do paciente com diabetes mellitus e hipertensão arterial na atenção básica. A metodologia trata-se de um estudo de revisão narrativa de literatura com abordagem de estudos exploratórios, observacionais, retrospectivos que foram buscados em literatura 20 artigos entre 2010 a 2020. Resultados: Na avaliação do papel da enfermagem citada pelos cuidados dos enfermeiros, predomina a enfermagem relacionada à alimentação e umidade, seguida do controle glicêmico, da pressão arterial e do peso da enfermagem. Por outro lado, o processo de enfermagem é uma tecnologia que permite um cuidado humanizado de forma sistemática e dinâmica com resultados positivos e de baixo custo. Conclui-se que o papel do enfermeiro como educador é imprescindível tanto para o paciente quanto familiar, e devem seguir suas orientações de forma a compreender e perceber a importância do tratamento e atividades desempenhadas para o melhoramento da qualidade de vida.

I. INTRODUCTION

The Family Health Strategy (ESF) has a fundamental role in care and aims to expand, define and consolidate primary health care (PHC) in Brazil. The ESF seeks to adapt the directions of the work process in order to develop a series of measures, including health promotion and protection, disease prevention, diagnosis, treatment, rehabilitation, harm reduction and especially health maintenance (BARRETO & SOUZA, 2016).

The nurse must be part of the ESF team and continuously work on the chronic disease control plan. Through the recommendations of implementation methods, in most cases, non-drug treatment can favor the consolidation of comprehensive care and the implementation of health for individuals in the community (TORRES et al., 2014; AZEVEDO & DUQUE, 2017).

In these plans, Hiperdia is defined as a strategy implemented by the Ministry of Health to reorganize care for hypertension and diabetes, with the aim of equipping and encouraging professionals involved in PHC to promote actions aimed at these diseases (FERNANDEZ et al., 2016).

Therefore, the nursing consultation can investigate the risk factors and complications of AH and DM, provide treatment prescriptions and assess their effectiveness. It is believed that nursing care is essential to promote, prevent and restore the health of users who are monitored in Hiperdia. However, many prescriptions can be based on the experience and knowledge of professionals in the health sector (DALY et al., 2014; FERRACCIOLI & ACIOLI, 2017).

Therefore, it is very important to implement the care process in the ESF, in order to organize care and provide assistance to patients with AH and DM to meet their needs (VIEIRA et al., 2017).

The use of the NIC classification in nurses' clinical practice can help in the decision-making process and selection of appropriate nursing interventions. Each NIC intervention lists the activities nurses use to implement the selected intervention. Furthermore, intervention can be understood as any method of treatment based on clinical judgment and nurses' knowledge with the aim of improving the results obtained by the individual (BULECHEK, BUTCHER & DOCHTERMAN, 2016).

It is believed that such studies are significant, as they allow determining the care prescribed by PHC nurses to patients with SAH and DM based on scientific principles, in order to systematically contribute to improving the quality of services.

The aim of this study is to describe the role of nurses in the care of patients with diabetes mellitus and hypertension in primary care.

II. MATERIALS AND METHODS

The present work is a narrative review of the literature carried out through a literature review focused on describing the role of nurses in the care of patients with diabetes mellitus and hypertension in primary care.

The bibliographic research had as a problem question: What is the role of nurses in the care of patients with diabetes mellitus and hypertension in primary care? Articles that sought to explain the role of nurses in the care

of patients with DM and SAH were selected from scientific articles, in Portuguese, English and Spanish, were used to translate the articles into another language the translator available on the website <https://translate.google.com.br/>.

The organization of this review took place between the months of June 2020 to January 2021, thus providing guidance for researchers in relation to the topic addressed, so that they can formulate hypotheses in an attempt to seek resolution of frequent problems related to care provided in previous studies.

For data collection, the following databases were used: National Library of Medicine -PUBMED, Latin American and Caribbean Literature on Health Sciences - LILACS, Virtual Health Library of the Ministry of Health - BVS, Scientific Electronic Library Online - SciELO, Revista Brasileira de Enfermagem – REBEN with the search for key words such as: Nursing, Hospital care, Urgency and Emergency. Twenty articles containing publications between the years 2010 and 2020, which dealt with the chosen topic, were analyzed regarding the topic.

III. LITERATURE REVIEW

The Unified Health System (SUS), implemented since 1988, has undergone changes and innovations in the management, organization and financing of its services, seeking to meet the principles of universality, equity, integrity and sociality. In this case, emphasis was placed on the implementation and expansion of family health strategies at the primary care level. With the objective of promoting the improvement and consolidation of the SUS, electing primary care as the focus of attention and establishing a relationship of solidary responsibility between health professionals and the population, the Ministry of Health formulated the Family Health Plan (PSF) in 1996. The main objective is to follow the biopsychosocial model recommended by the World Health Organization (WHO) and organize a new care practice that can promote the improvement of the quality of life of the Brazilian people (PERREAULT et al., 2016).

The family health program (PSF) in Brazil is composed of at least one medical team. Since its implementation, the team has consisted of a nurse, a doctor, a nursing assistant and four to six community health agents. Each professional is responsible for enriching the control and prevention of hypertension and diabetes mellitus (CARVALHO et al., 2011). The absence of other health professionals on the team is one of the basic problems, especially with regard to recovery from chronic and degenerative diseases. The role of nurses in the PSF also needs further clarification. The Ministry of Health's

specific plan for the PSF expressed sociopolitical interests and priorities, which deserve reflection. The concepts of community, family, gender and race; understanding of the right to health and citizenship; need to be deepened to improve the PSF. Furthermore, according to the principle of universality throughout society, there are not enough positions and teams to serve all people (this leaves recipients, especially those without assistance, frustrated) (RIOS, 2014).

As for the concept of nursing in care practice as a political role and, therefore, a moral role is to treat the patient's happiness as a normative practice in health relationships (whether doctor-patient, nurse-patient, patient physiotherapist etc.), it is said to bring a northern perspective, so that patients understand health and hope to use it as their own health experience. Therefore, it has the characteristic of being democratized in response to the patient's civil society concerns. The supervisor function is usually performed by a nurse trained in biomedical models and automatically reproduces the models used at the secondary and tertiary care levels. Because they have greater responsibility and a leadership role, nurses must take the lead in reflecting on attitudes and guidelines in relation to the ACS so that the PACS achieves its main objective of social transformation (PERREAULT et al., 2016).

In the legal documents that govern the health and occupational systems, the practice expected by nurses in primary care is clearly described, however, in this study, the intention is to approximate the content specified in the legal documents. The exercise of the professional work of nurses between research, nursing and public health policies. Therefore, when nursing achieves the expected results, this can lead to problematization of the practice and its theoretical and ethical assumptions, triggering critical and active debates about its contributions and limitations (BARBIANI, NORA & SCHAAEFER, 2016).

Group activities are aimed at specific pathologies or diseases - such as hypertension, diabetes, asthma, mental health and tobacco (23, 31) - or aimed at specific groups of people, such as pregnant women, women, children, the elderly and members of the extended family, in service (NAUDERER & LIMA, 2010; ROCHA et al., 2010; ROECKER & MARCON, 2011).

Based on this, it is noted the importance of evaluating the role of nursing cited by nurses' care within the PSF, with a focus on food and humidity, followed by glycemic control, blood pressure and nursing weight. These findings are consistent with another Brazilian study that determined the accuracy of nursing interventions for diabetic patients undergoing outpatient treatment. The author highlights that

the most common NIC nursing interventions are nutritional counseling, control of hyperglycemia / hypoglycemia and exercise promotion (SCAIN et al., 2013).

As a strategy to face this reality and maintain the SUS, primary care has been recognized by people and assumes increasing responsibilities for being considered the gateway to the system and the clear position and coordinator of the health care network. The policy is guided by the principles of universality, accessibility, integration, continuity of care, comprehensive care, accountability, humanization, equity and social participation, which are the guiding principles of the new medical model implemented by the SUS. Actions to promote prevention and use of the system should be carried out in a privileged way in the context of primary care, mainly through the Family Health Strategy (ESF), through which regions and regions with greater population coverage can be contemplated. The role of nurses is strategic and essential to ensure their entry into the team and the region through the plan and legal framework of the SUS (BRASIL, 2012).

However, in this type of intervention space, due to the repositioning of the nursing model, the positive aspects of social and professional requirements are complicated, and since the day-to-day it has generated internal professional and ethical, theoretical, methodological and technical problems operational. The demand still reflects the advantages of the biomedical model, which usually provides more care in the hospital environment through technical measures and procedures, treatment and diagnosis (BARBIANI, NORA & SCHAAEFER, 2016).

In primary health care (PHC), the development of health promotion measures in the context of encouraging healthy eating and physical exercise is part of the nursing practice of nurses. The increased consumption of ultra-processed foods and excessive sodium, fat and sugars and other unhealthy foods is directly related to the increased prevalence of SAH and DM. Therefore, when considering the improvement of blood pressure and blood sugar levels, encouraging a change in lifestyle, maintaining healthy eating habits and regular physical exercise are important to reduce the risk and incidence of these diseases (BAJOREK et al., 2017).

In almost all countries, the prevention and control of SAH are of great importance, as the use of new strategies and methods can more accurately identify high-risk groups, in addition to bringing benefits to hypertensive patients and society. However, as it is a chronic disease, the control of SAH requires lifelong monitoring and treatment, including pharmacological and non-

pharmacological measures (REINERS et al., 2012; EGAN, 2013).

The team physicians and nurses must explain to the patient the occurrence of possible adverse reactions, the possibility of possible changes in the treatment methods used and the time to complete the treatment. Provided that specific indications and contraindications are protected, any of the antihypertensive and antihyperglycemic medications on the market can be used for the treatment of hypertension and diabetes mellitus. To reduce the number of patients with hypertension and diabetes, the joint role of community health workers, nurses and technicians is essential to determine the location of patients and the subsequent treatment and monitoring of diabetes (CUTINO, 2014; AMAYA, 2016).

On the other hand, the nursing process is a technology that allows humanized care in a systematic and dynamic way, with positive results and low cost. Allows you to understand, describe and / or explain how the client responds to health problems and important processes, and to determine which areas require nursing intervention (MOURA et al., 2011).

In this case, we highlight the role of nurses in patient care through nursing counseling, which aims to expand the patient's understanding of DM and / or SAH and make them aware of the importance of changing behaviors and attitudes so that they can be in the family live together with more happiness in the social environment. Another function of the nurse is to demand the inspection prescribed by the Ministry of Health. If there are no complications, the medications must be repeated to assess "diabetic feet", control capillary blood glucose and control hypertension. All consultations, except for the examination required for evaluation (CARVALHO, 2012).

Excess weight related to accumulation of mesenteric fat (obesity is called central, visceral, or androgenic) constitutes the greatest risk of atherosclerotic disease. Furthermore, in general, individuals with this type of obesity have dyslipidemia, insulin resistance and systemic arterial hypertension, which are characteristics of the metabolic syndrome. The syndrome is a progressive disease that can increase the total mortality rate by 1.5 times and cardiovascular disease by 2.5 to 3 times confirms the importance of calculating waist circumference, weight and height to assess waist circumference (CARVALHO et al., 2011).

In Brazil and worldwide, systemic arterial hypertension (SAH) is a serious public health problem. It is one of the most important risk factors that lead to the development of cardiovascular, cerebrovascular and renal diseases, leading to at least 40% of deaths from stroke, 25% of deaths from

coronary heart disease and diabetes combined, and 50% of cases of advanced renal failure (RADOVAOVIC et al., 2014).

This is a great challenge that medical professionals and nurses who will face in the daily practice of care for hypertensive and diabetic patients. It is correct to consider the prevalence of non-adherence to treatment an indicator of quality problems in the medical process. In addition, adherence to treatment is essential for the care of hypertensive patients, as professionals can develop clinical and educational interventions to meet the real needs of users and those with difficult adherence (SANTA-HELENA, NEMES & ELUF-NETO, 2010).

Nurses understand the members of the community in which they work, so they can intervene in a simple and interactive way, in addition to offering education and guidance activities on diabetes and SAH for patients and their families, in addition to providing an easy-to-use language, which it will definitely make a difference and help control metabolism and reduce complications (CARVALHO et al., 2011).

In addition, adherence to treatment is essential for the care of hypertensive patients, as the professional can develop clinical and educational interventions to meet the real needs of users that are difficult to adhere to. In order to act effectively, propose and implement actions that meet the real needs of the population, professionals need to know the patient and determine the patients who adhere to the treatment and those who do not adhere to the treatment, and propose the reasons why they do not meet the hypertensive patients in the following treatment (REINERS et al., 2012).

To increase the efficiency of Hiperdia, nurses can use the nursing consultation prescribed by the Federal Professional Council through Resolution No. 358/2009, which stipulates the conditions for the implementation of nursing procedures in a public or private environment, by nurses (COFEN, 2009; SANTANA et al., 2011). Therefore, the nursing consultation can assess the risk factors and complications of AH and DM, as well as nursing prescriptions and assess their effectiveness (DALY et al., 2014; FERRACCIOLI & ACIOLI, 2017).

Regarding the treatment, the nurses' knowledge is of extra importance, as due to the use of artificial insulin, the person with Diabetes Mellitus (DM) can also be called insulin dependent. For DM patients, awareness and continuous treatment are extremely important, as the dose of insulin used varies according to their habits (VANCINI & LIRA, 2011).

The use of artificial insulin is the nurse's responsibility to guide it from storage to use, as it is closely related to the

patient's lifestyle, who must dedicate themselves to physical exercise and to maintain a healthy diet, which is essential for treatment of diabetes. Therefore, the control of these activities and nutrition favors blood glucose control and can reduce the dose of artificial insulin that is essential for the functioning of the carrier organism (VANCINI & LIRA, 2011; VIEIRA, 2016).

For the common problems that DM1 patients and their families may have, the nurse's knowledge plays an extremely important role in providing guidance and explanation. Thus, maintaining a relationship of trust, necessary to improve the quality of life of these people and restore health. Nurses involved in diabetes care must promote the health of these diabetics through plans with new care habits, as treatment adherence and self-care are important considerations (VIDAL et al., 2016).

Therefore, the nursing consultation can assess the risk factors and complications of AH and DM, as well as nursing prescriptions and assess their effectiveness (DALY et al., 2014; FERRACCIOLI & ACIOLI, 2017). It is believed that nursing care is essential to promote, prevent and rehabilitate the health of users who are monitored in Hiperdia. However, many prescriptions can be made based on the experience and knowledge of health professionals, therefore, it is very important to implement the nursing process in the ESF to organize care and provide assistance to patients with hypertension and DM. To meet your needs (VIEIRA et al., 2017).

Therefore, the work strategy for the empowerment of patients with SAH and DM is to encourage the individual to actively participate in the formulation of their care plans during the period of the nursing consultation, emphasizing their responsibility for achieving the desired results. The psychosocial approach adopted by nurses in nursing consultations allows people to identify factors that affect eating habits, lack of motivation to practice physical exercise and factors that do not adhere to medication (DALY et al., 2014). Therefore, considering psychosocial needs is an essential factor to achieve the intended results (CEREZO, JUVE-UDINA & DELGADO, 2016).

The role of nurses in nursing is vital for patients with diabetes and hypertension, from the guidance, monitoring and even acceptance of patient behavior, promotes encouragement and health education so that patients learn to live with patients. Disease (VIEIRA, 2012). Diabetic patient care should aim to prevent complications, assess and monitor risk factors and guide self-care. Ability as a nurse to carry out nursing consultations in accordance with the procedures or technical standards established by the municipal manager, request inspections and copy conventional medicines, formulate health education

strategies and make referrals when necessary (OLIVEIRA & OLIVEIRA, 2010).

IV. FINAL CONSIDERATIONS

Based on the objective of the study, it is concluded that the nurse has a fundamental role in the care of primary care through nursing consultation. The interventions used by nurses are extremely important in the implementation of care and the health education process for patients with diabetes mellitus and arterial hypertension.

Regarding the problem question, the role of the nurse as an educator is essential for both the patient and family member, and they must follow their guidelines in order to understand and realize the importance of the treatment and activities performed to improve the quality of life.

The nursing consultation must be carried out individually and also in a family group, because as an advisor, the nurse must carefully go through all the guidelines on food, medication and also change in the physical and dietary habit, so that the patient/family member sees the importance of the guidelines and strictly follow all the guidelines to improve the patient's life.

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Considerations on the Crisis and Social Responsibility in Brazilian Universities and the Political and Social Situation Science

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Keywords— *University crises, Social Responsibility of the University. Government Funding, Public Educational Policies.*

Abstract— *The article deals with the complex relationship between the State and the University, commenting on the crises related to hegemony, legitimacy and institutional issues. The study in question highlights the most intricate of these crises characterized as institutional, which foreshadows the transformation of the university as an autonomous institution into a university-organization directly linked to the interests of the state since this sets and determines the main contexts of the institutional crisis present in the university of contemporary Brazil. Regarding its methodological outline, the article is characterised as a bibliographical review through a scientific investigation of already published works. It discusses the socio-historical transformations that nowadays can be designated as fruits of globalisation and that have been implicated in the complex transformations that have occurred in higher education. The article concludes by pointing out the need to retake the social, political and cultural meaning of the university by developing knowledge, professional formation and extension activities. It points out the need for a profound revision of the role of the State in relation to education in general, the university in particular and Brazilian society.*

I. INTRODUCTION

There is an expectation on the part of society that the university is a producer of knowledge and a constant trainer of professional staff who act effectively in the demands arising from the social context. However, this requirement with attributes focused on the social responsibility of the university is situated in a complex political and social context.

In this sense, the question is: What is the role of the university in the current context in relation to society's

demands regarding the academy's social responsibility and the actors involved in it in the current social situation?

The debate on university reform, intensified in the last decade, has pointed out contradictions in relation to the principles that sustain the proposals for the University in the 21st century, given that the current intricate social and political conjuncture in the country is notorious.

The debate on university reform, intensified in the last decade, has pointed out contradictions in relation to the principles that sustain the proposals for the University in

the 21st century, given that the current intricate social and political conjuncture in the country is notorious.

In the Brazilian conjuncture, structural transformations should have promptly entailed an agenda encompassing: the revision of the public debt and the tax system; the change of the tax structure, making it progressive, based on wealth rather than on labour income; agrarian reform, accompanied by the financing of small producers and cooperatives; the resumption of industrialisation, in order to improve the economic fabric of the country and reverse its reprimarisation and what some call the "commodities consensus"; the breaking of the communication oligopoly that compromises social discernment and support for the elevation of the Common Market of the South (MERCOSUR) to a more advanced stage than that of a mere common market (Sader, 2016).

The defence of the principles of university autonomy and the null association between pedagogical research and extension are linked to a triangle of contradictory imperative interests. In this sense, understanding that reforms generate the whole political-economic and social movement means placing them in the context in which they were produced. And being so, public education policies, namely for higher education, are placed in the State reform and productive restructuring, which increased in the 1990s. This occurs due to a period of crisis of capitalism that in order to remain hegemonic needed to create overcoming tactics. It is alleged that the crisis would be the result of the inefficiency of the National State in the management of its actions, as it is essential to establish limitations of its interventionist activities in the economy, promote privatization and profitability of its companies, constituting the "neoliberalism" in this scenario.

Neoliberalism is a set of ideas in which the elimination of barriers between markets is exalted, subjecting the economy and social rights to its laws. This requires the creation of strategies that reinforce the free market, such as globalisation, productive restructuring and the third way. These strategies, derived from the globalisation of capital, are materialised by intensifying economic adjustment in all domains and are consolidated in the reduction of public expenditure on social policies. Education is one of the social policies, and it is essential to give it new contours in order to adapt it to the productive sector. This announces a series of measures guided by the principles governing the new configuration of capital.

It is worth emphasising that it is in the restructuring of capital that the crisis of the University is accentuated and, in a contradictory way, the demand to relate its activities to social responsibility. It is in this scenario of crisis and reforms that the training of specific categories of

professionals materialises. Thus, this study has chosen to focus on the analysis of the social responsibility of the University with its social body and society in this complex context.

Thus, one can reflect on how the crises of the university are materialized and especially the crisis of training, here namely teacher training. The examination of the current situation of Brazilian higher education and the teaching work developed constitutes an undeniable challenge. Firstly, Brazilian higher education is quite diversified. This differentiation is not a domestic brand, because the university system, at the international level, has also been undergoing transformations towards a post-secondary system widely diversified, with multiplicity of institutional arrangements, strongly encouraged by international organizations (Mancebo, 2015).

It should be remembered that from the mid-twentieth century, the author Boaventura de Sousa Santos identified in his studies three crises in which the university found itself: the crisis of hegemony, the crisis of legitimacy and the institutional crisis. These crises, in the long and medium term, condition the precariousness of the public university. After ten years, the same author, in 2004, makes an assessment of how these crises were incorporated by the university and points out perspectives, which he called counter-hegemonic globalization, as a response to political and economic determinism. Understanding this panorama requires the characterization of the three crises, establishing a parallel in relation to training, specifically teacher training and founded the framework for discussion of the problem of the social responsibility of the university.

"The factors of the institutional crisis occur in the period of disorganized capitalism (from the end of the sixties to the present) and derive principally from the crisis of the welfare state and the deceleration of industrial productivity in the central countries. The institutional crisis has appeared with greater acuteness in the last twenty years, in part because it reflects both the crisis of hegemony and the crisis of legitimacy. The basic values at stake in the institutional crisis are university autonomy and the specific organizational character of the university. The crisis of the Welfare State is manifested in the progressive deterioration of social policies, housing policy and health and education policies. The State has been rapidly moving from the condition of producer of goods and services (schools, teaching, companies) to that of

buyer of goods and services produced by the private sector and of regulator and evaluator of services transferred to the private initiative". (Filho,2015)

According to Santos (2010), the crisis of hegemony would be the result of the traditional functions of the university assigned throughout the twenty-first century. Thus, it highlights two movements that are articulated in a contradictory way. The production of high culture and the production of average cultural standards. In relation to the production of culture, the university is delegated in the elaboration of exemplary, scientific and humanistic knowledge allied to critical thinking. Such knowledge derives from the need to train elites, a task that the university has been concerned with since the Middle Ages. Already in correspondence with the production of average cultural standards the focus would flourish instrumental knowledge, useful in the training of skilled labour required by capitalist development. The crisis of legitimacy, according to Santos (2010) is based on the contradiction between hierarchy and democratisation. Hierarchy is linked to expertise through restrictions on access and accreditation of skills. Democratisation responds to the demand for equal opportunities for the children of the popular classes.

Finally, the institutional crisis is configured as the fruit of the contradiction between the demand for autonomy and the submission to criteria already defined. Autonomy is exercised through the definition of values and objectives by the university. However, strong pressure has intensified on values and objectives subject to "criteria of efficiency and productivity of a business nature or social responsibility" (Santos, 2010, p.10).

These analyses carried out that made the author project the path of the University. For Santos (2010) these three crises would be interconnected, and could only be confronted with broad action programs generated inside and outside the university, he predicted that focusing on the institutional crisis would result in the false resolution of the other two crises: "[...] A decision to refuse; the crisis of hegemony, due to the growing negative intellectual characterization of the university; the crisis of legitimacy, the growing segmentation of the university system and the growing devaluation of university degrees, in general" (Santos, 2010, p.15).

The following is a brief analysis of two of these dichotomies, given their greater relevance to the object of this work (Santos, 1995).

As for the dichotomy between high culture and popular culture, the author (Santos, 1995) continues by stating that:

"The high culture-popular culture dichotomy constitutes the central core of the modernist ideology. High culture is a subject culture, while popular culture is an object culture, the object of emerging sciences, ethnology, folklore, cultural anthropology, newly introduced sciences in the university. The crisis of this dichotomy results from the emergence of mass culture after the Second World War. This new culture, aspiring to subject-culture and with a logic of production, distribution and consumption distinct from and more dynamic than that of university high culture, began to question the monopoly hitherto exercised by high culture. Unable to transform this new cultural form into an object-culture, the university ceased to be the central producer of subject-culture and in this respect lost its centrality. Faced with the new challenge, during the 1960s the university tried to confront mass culture with the massification of high culture itself, which led to its increasing democratisation, with the consequent explosion of the university population and the expansion of university teaching and research staff. However, the massification of the university did not attenuate the dichotomy, but only displaced it within the university through the dualism it introduced between elite university and mass university, creating a hierarchy between universities and between these and other non-university institutions of higher education. The production of high culture was left to the elite universities and the distribution of high culture to the mass universities. This new reality of the university provoked another tension -the tension between high culture and mass high culture."

In relation to the dichotomy regarding isolation and engagement as already highlighted by Santos Filho (2013), in discussion about the purposes of the university, from the sixties of the last century the call for the practical engagement of universities in solving practical and concrete problems of contemporary society was justified as part of the "social responsibility of the university". The critical aspect of these purposes, besides denouncing the historical isolation of the university and its non-involvement in the solution of social problems, proposes "the mobilization of its institutional autonomy and its

tradition of critical spirit and free and disinterested discussion in the service of the dominated social groups and their interests" Santos, 1995, p. 178 in Filho (2005;n/p)

After some time, Santos, in making an evaluation of the path of research carried out on the crises of the university, confirmed his projection in the sense of saying that the institutional crisis monopolised the other crises.

The institutional crisis constitutes the weakest link in the public university, since "the scientific and pedagogical autonomy of the university is based on financial dependence on the state" (Santos, 2010, p.15).

Faced with such a finding, there are numerous questions that can be targets of multiple answers, since they focus on the sphere of practice and reduce the historical, political and economic conditions of the educational work and the conditions in which teachers are trained. However, Edgar Morin (2007) highlights the contradiction of the university as a place where this knowledge is created and not used.

"The crisis of the University is not, in synthesis, a circumstantial crisis, a mere problem of lack of means, but a more profound crisis, of objectives and goals. Many of the old ideals whose realization was sought through the University continue to be important, but they must be sought by other means. Some, like the rationalization of society and the homogenization of knowledge, were mistaken utopias that must be abandoned. Finally, it would be necessary to give more strength and relevance to some objectives that the University can try to reach, and that until now have not had the necessary emphasis. It is from this revision of perspectives that a new agenda should arise for the University in our midst (...) the ideal of giving people better opportunities to participate in the economic, social and political life of their country is, in itself, unquestionable". (Schwartzman,2013)

In view of what was exposed in the article and since this is nothing new in our society, it is known that Brazil lives a rare moment in which state higher education is criticized in the name of social justice. The state universities are occupied, free of charge, by the children of the middle and upper classes; the others stay in the private universities. (...) The injustice of the public university does not lie in the fact that only the children of the rich enter it - that is social injustice. The injustice of the university lies in the fact that all those who leave it work only for the

rich, due to the structure, the curriculum and the work methods. To form and be an intellectual elite is not a mistake, it is an obligation. What is wrong is to only serve the economic and social elite. Buarque (1994; p.117).

It is necessary that all segments of society reflect together on the directions that should be followed by the Universities in Brazil with proposals that aim to meet in a significant way all intellectual, professional and market demands without mismatches generated by the political hierarchy that ties the university to political and capital interests for funding and autonomy.

II. METHODOLOGY

This is a literature review article. The bibliographical research is inserted mainly in the academic environment and has the purpose of improvement and updating of knowledge, through a scientific investigation of works already published. For Andrade (2010, p. 25): Bibliographic research is a fundamental skill (...), since it constitutes the first step for all academic activities. A laboratory or field research necessarily implies the preliminary bibliographic research. Seminars, panels, debates, critical summaries, monographs do not dispense bibliographical research. It is mandatory in exploratory research, in the delimitation of the theme of a work or research, in the development of the subject, in the citations, in the presentation of the conclusions.

III. DISCUSSION AND RESULTS

The reflections made so far have allowed us to study an approach related to the ways in which the multiple crises end up also reinforcing a tension that is revealed in university education. This decadence is established by the offensive of a neo-liberal State which, through regulatory measures, determines the activities of the university. It is believed that there is still today in the academy an attempt to redesign the social function of the university, to conceive that today it does not respond to the demands of current society. This fact is revealed in the midst of the reduction of public expenditure on public universities and the insignificant expansion of educational establishments whose focus is simply to offer a precarious and mostly technical and utilitarian education.

The search for a paradigmatic change with a solid education that addresses issues of human and social construction is replaced by the offer of a diploma or certificate. In this way, education as a public good becomes commercialised as a simple commodity, a strategy for many for social ascension. It must be emphasized that understanding these questions only as a

political-economic determinism can lead to the distancing of any educational process that advocates an emancipatory formation. By making the contradictions explicit, we profess here the pressing need to respond more consistently to the hegemonic project of capital. To retake the social, political and cultural meaning of the university is to develop activities of knowledge, professional formation and extension, linked to truth, to criticism, to ethics and, especially, to resistance.

This current decadence is established by the offensive of a neo-liberal state which, through regulatory measures, determines the activities of the university, which ends up being immobilised in the face of the interests of the political leaderships in power. The neglect revealed by the reduction of public spending on public universities and the "plastered" expansion of educational establishments is perceptible. In this way, education as a public good becomes commercialised as merchandise. To take back the social, political and cultural meaning of the university is to develop knowledge, professional training and extension activities, linked to truth, criticism, ethics and especially resistance.

IV. CONCLUSION

The relationship between the State and the educational system is complex and polarised. On the one hand, we have a bureaucratized and rigid system, and on the other, a predominance of private educational institutions, which excel in low quality and high costs for their demand. It is evident for all of society that public university education cannot afford not to be financed and supported by the State. In this sense, to find a way out of this labyrinth it is essential to find strategies to abolish the State's authority over educational institutions.

The important thing in formulating a new agenda to address this situation is not the validity of this or that isolated attitude, but the probability of reflecting in a comprehensive, problematized and plural way. In this way, it is imperative to review public educational policies in a neutral way, establishing new formative practices, committed to improving the level of training and increasing human potential, taking into account issues such as citizenship and social justice.

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Hospital admissions of Brazilian older adults due to oral health problems: A trend analysis

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**Keywords— Hospitalization, Older adults,
Oral disease, Oral health, Epidemiology.**

Abstract— *Background. There is a bidirectional relationship between oral health and general health, i.e., poor oral health increases the risk of general health problems and poor general health increases the risk of oral health problems. Objectives. To analyze hospital admissions of older people due to complications of orofacial diseases. Design. Quantitative ecological study. Setting. Public and private hospitals operating within Brazil's Unified Health System. Participants. People aged 60+ years hospitalized due to oral health-related problems from 2008 to 2017. Methods. Prevalence of hospital admissions was estimated based on the number of admissions due to oral diseases in each Brazilian region divided by the number of inhabitants. Joinpoint regression analysis was performed to evaluate the trend of each segment of the variables using the Joinpoint Regression Program software, version 4.6.0.0. Annual percent change (APC), average annual percent change (AAPC) and confidence interval (CI) were calculated at a confidence level of 95%. Results. There was a trend towards the growth in hospital admissions in all Brazilian regions throughout the years. Most hospital admissions were among male older people aged 70-79 years and the main cause of hospitalization was lip, oral cavity and pharynx malignant tumor. The South region presented the highest prevalence of hospital admissions due to oral cancers and the North region exhibited the highest number of hospital admissions due to dental caries and other oral health conditions. Conclusion. The growth in hospital admissions of older adults due to oral health problems suggests failures in the provision of health promotion and disease prevention actions.*

I. INTRODUCTION

Brazil, like many other countries around the world, is aging fast and has experienced an increase in the number and proportion of older people in its population[1,2]. Oral health is an integral and essential part of health care and quality of life and it is crucial for a healthy aging; however, its importance has not been properly acknowledged[3]. Oral diseases are often accepted as an inevitable consequence of life and aging and are thus neglected by people and health care professionals[4].

There is a bidirectional relationship between oral health and general health, i.e., poor oral health increases the risk of general health problems and poor general health increases the risk of oral health problems. Comorbidities like functional and cognitive decline may result in difficulty performing daily oral care[5]. For instance, arthritis can hinder the ability to hold a toothbrush or manipulate dental floss and many older people who use multiple drugs (polypharmacy) tend to have decreased salivary flow, which increases the likelihood of dental caries and periodontal diseases and, consequently, affect speech, chewing, swallowing and social interactions. Furthermore, poor periodontal health has been associated with an increased risk of diabetes and heart diseases[6].

Oral health is defined as the absence of mouth and facial pain, oral and throat cancer, oral infection and sores, periodontal (gum) disease, tooth decay, tooth loss, and other diseases that limit a person's capacity in biting, chewing, smiling or speaking, and that compromises psychosocial well-being[7].

Untreated dental caries is the most prevalent oral disease and the most common chronic disease worldwide. Its overall prevalence rate of 40% places it as a major challenge for public health. Severe periodontitis is the sixth most common disease in the world, with an estimated worldwide prevalence of 5 to 20%, while oral cancer ranks tenth among all types of cancer[4]. The most common oral health problems among older people are root caries and periodontal disease, and both are responsible for the majority of tooth extractions. Although edentulism is considered by many to be a natural aging phenomenon, it may be a result of lack of guidance and oral health care in all age groups[3].

Early stages of dental caries are often without symptoms, but advanced stages can cause pain, infections and abscesses, or even sepsis[7]. Such infection can lead the person to hospitalization or even death. Severe complications from cellulitis can occur due to dental infections and can progress to cavernous sinus thrombosis, mediastinitis, brain abscess, or patient's death[8]. Thus, it is necessary to have access to information about hospital

admissions due to diseases related to oral health problems. Also, regional inequalities should also be taken into consideration as they constitute a risk factor for most oral health problems[4]. In Brazil, the North and Northeast regions have worst social and economic conditions compared with the South and Southeast regions[9].

In view of the considerations outlined above, the present study aimed to analyze older people's hospital admissions due to complication of orofacial diseases over a ten-year period.

II. METHODS

This ecological study analyzed the Brazilian regions from 2008 to 2017. This period corresponded to the data from Brazil's Hospital Information System (*Sistema de Informações Hospitalares – SIH*) and the Health Secretariat which were available in the DATASUS database.

The SIH aims to standardize the process of reporting, consolidation, and sharing of hospital information in Brazil's National Health System, also called the Unified Health System (*Sistema Único de Saúde—SUS*). It is run by the Department of Informatics of SUS – DATASUS.

The data were downloaded directed from the SIH webpage in a comma-separated values file. The Tabnet software was used to tabulate the data and the study variables were: age group (60-69, 70-79, and 80+), gender, year of hospitalization, Brazilian region, and main diagnosis at admission (lip, oral cavity and pharynx malignant tumor, dental caries, disorders of teeth and supporting structures, or other diseases of the oral cavity, salivary glands and jaws) according to the International Classification of Diseases – Tenth Revision (ICD-10)[10]. In Brazil, SIH is a data source of great importance because it discloses data on the epidemiological profile of hospital morbidity[11].

The prevalence of hospital admissions of older people was estimated based on the number of admissions due to oral diseases in each Brazilian region divided by the number of inhabitants. The twenty-six Brazilian states and the Federal District are grouped into five regions, with marked inequality between them, resulting from historical, economic, cultural, social and environmental processes[12]. The population data needed for this estimation were obtained from the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística – IBGE*) on the DATASUS website. The rates were adjusted by age group (60-69, 70-79, 80+), gender and region using the direct method of standardization (FIGURE 1). The data were organized and submitted to descriptive statistical analysis using the Statistical Package for the

Social Sciences (SPSS), version 20.0 (SPSS Co, Chicago, USA). Frequencies and percentages of hospital admissions were calculated for the study variables.

For the analysis of temporal trend reducing potential variability of the historical series, joinpoint regression techniques (by inflection points) were used, thus allowing to assess whether in some points, called joinpoints, there are changes in the observed trend pattern. That way, joinpoint regression analysis was performed to evaluate the trend of each segment of the variables using the Joinpoint Regression Program software, version 4.6.0.0.

The joinpoint regression provides the adjustment of a series of lines, as well as their inflection points on a logarithmic scale through the annual trend test. From the definition of the segments, an annual percent change (APC), average annual percent change (AAPC) and confidence interval (CI) were calculated. This method allows to identify significant changes in some points (joinpoints) in a given trend pattern by estimating whether these values are statistically significant at a confidence level of 95%. The number of inflections used in the analysis was the result of models defined by the program itself, in order to allow the best representation of the trend, with the least number of inflection points. The result made it possible to demonstrate growth (positive APC values), reduction (negative APC values) or maintenance (APC value equal to

zero) of the trend throughout the analyzed historical series. In this way, the APC for each segment is used not only to describe and quantify the trend, but also to assess whether this trend is statistically significant. A trend was considered statistically significant, different from zero, when the p value was less than 0.05[13].

The present study used secondary data publicly available and therefore did not need Institutional Review Board (IRB) approval. However, it should be noted that the study complied with all ethical precepts for scientific research. For this type of study, formal consent is not required.

III. RESULTS

From 2008 to 2017 there were 123,276 hospital admissions of people aged 60+ years due to orofacial diseases. The highest number of cases was found in the Southeast region (n=58,204, f=47.2%) (TABLE 1). The highest mean prevalence was found in the South region (47.9/100,000 older people) and the mean prevalence of hospital admissions in Brazil was 33.6/100,000 older people, with variations across the regions.

There was a higher number of hospital admissions among male older people, especially among men aged 70-79 years (FIGURE 1).

Table 1. Number of hospital admissions of older adults due to oral diseases by year and region. Brazil, 2008 to 2017.

Year	North		Northeast		Southeast		South		Midwest		Total N
	N	%	n	%	N	%	n	%	n	%	
2008	251	7.8	2599	9.6	4663	8.0	2727	10.2	759	9.6	10999
2009	254	7.9	3078	11.3	5209	8.9	2537	9.5	758	9.6	11836
2010	255	8.0	2982	11.0	5527	9.5	2510	9.4	916	11.6	12190
2011	293	9.1	2738	10.1	5252	9.0	2389	8.9	818	10.4	11490
2012	305	9.5	2860	10.5	6192	10.6	2494	9.3	843	10.7	12694
2013	272	8.5	2668	9.8	6168	10.6	2594	9.7	742	9.4	12444
2014	291	9.1	2252	8.3	5851	10.1	2771	10.3	673	8.5	11838
2015	374	11.7	2496	9.2	6365	10.9	2963	11.1	722	9.2	12920
2016	433	13.5	2679	9.8	6299	10.8	2849	10.6	763	9.7	13023
2017	479	14.9	2857	10.5	6678	11.5	2946	11.0	882	11.2	13842

Hospital Information System (SIH/SUS)

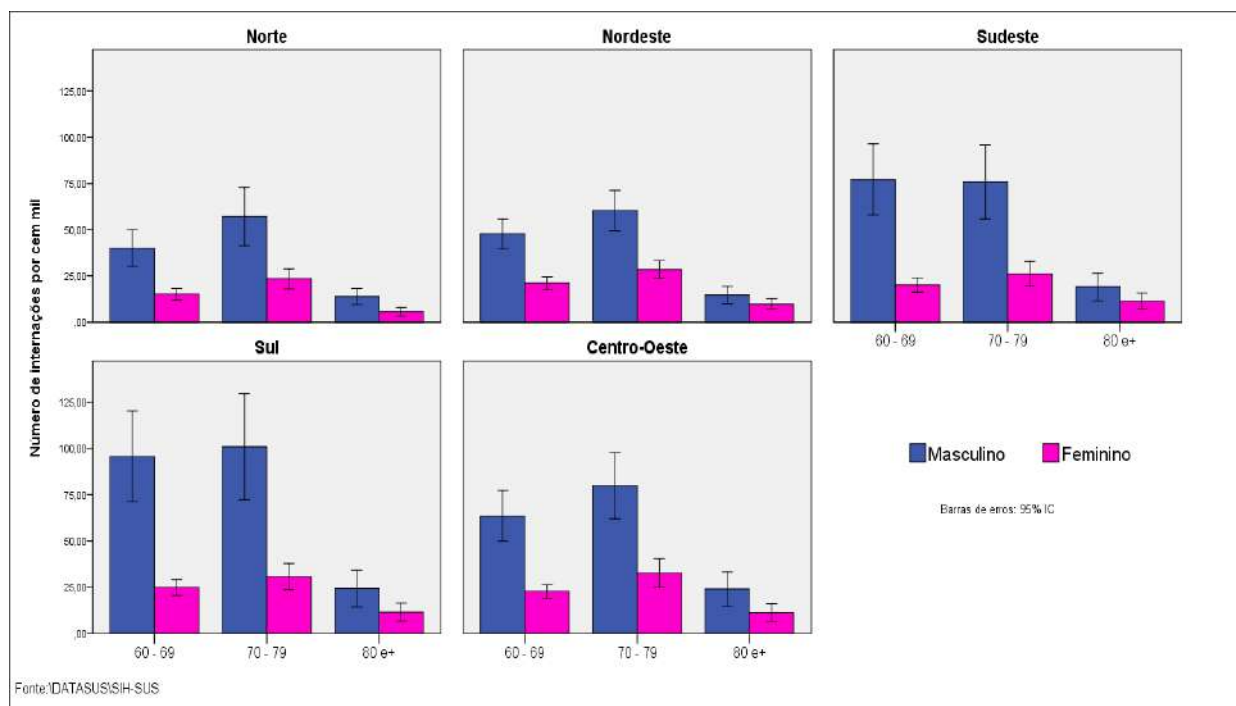


Fig.1 Number of hospital admissions of older adults per one hundred thousand older adults by region, gender and age. Brazil, 2008 to 2017.

Figure 2 displays thematicmaps showing regional difference. It also shows that the main cause of hospital admission was lip, oral cavity and pharynx malignant tumor. The Northregion presented a lower rate of hospital admissions due to cancers and a higher rate of hospital admissions due to other oral diseases, such as dental caries.

In regard to hospital admissions due to diseases related to dental caries and disorders of teeth, oral cavity and salivary glands (TABLE 2), there was a trend towards higher hospital admission rates among people aged 60-69 years and 70-79 years and lower rates among people aged 80+. The rates remained stable from 2014 to 2017 in all the regions and in both genders. The North region presented joinpoints for men aged 60-69 years. The first joinpoint identified was in the period from 2008 to 2012 with a

decreasing APC of -17.92 (95%CI= -36.7; 6.5). The second joinpoint was in the period from 2012 to 2014, with an increasing APC of 143.73. The Northeast region presented joinpoints for men aged 70-79 years, with one joinpoint in the period from 2008 to 2012, with a decreasing APC of -14.41 (95%CI= -29.8, 4.3) and another in the period from 2012 to 2014, with an increasing APC of 94.98. As for the South region, a joinpoint was identified for men aged 70-79 years in the period from 2008 to 2012, with a decreasing APC of -4.54 (95%CI= -18.2; 11.3) and an increasing APC of 67.94 in the period from 2012-2014. In the Southeast region, there was one joinpoint for women aged 60-69 years in the period from 2008 to 2012, with an increasing APC of 1.10 (95%CI= -8.2; 11.3) and a second joinpoint in the period from 2012 to 2014, with an increasing APC of 48.55. The Midwest region did not present joinpoints.

Table 2. Joinpoint analysis of dental caries and disorders of teeth, oral cavity and salivary glands by gender, age and region. Brazil, 2008-2017.

		Men								
Region	Year	Age Group			Age Group			Age Group		
		60-69 yearsold			70-79 yearsold			80+ yearsold		
		APC	CI (95%)	AAPC	APC	CI (95%)	AAPC	APC	CI (95%)	AAPC
North	2008 – 2017		(8.5; 20.6)	14.39		(10.4; 31.9)	20.68		(-67.6; -32.4)	-53.18
Northeast	2008 – 2017		(4.3; 13.9)	8.99		(4.7; 18.5)	11.38		(-64.0; -29.5)	-49.62
Southeast	2008 – 2017		(7.6; 18.5)	12.91		(6.0; 22.1)	13.77		(-63.9; -27.0)	-48.64
South	2008 – 2017		(5.6; 17.6)	11.43		(4.9; 21.7)	13.01		(-62.9; -31.0)	-49.65

Midwest	2008 – 2017	(6.1; 12.0)	9.02	(3.3; 15.3)	9.12	(-67.7; -33.5)	-53.68
Women							
North	2008 – 2017	(7.8; 14.2)	10.96	(12.5; 24.1)	18.15	(-68.3; -27.3)	-51.98
Northeast	2008 – 2017	(-1.5; 6.1)	2.24	(0.2; 8.1)	4.08	(-60.1; -29.7)	-47.03
Southeast	2008 – 2017	(3.1; 13.5)	8.17	(1.0; 11.8)	6.24	(-60.3; -26.4)	-45.98
	2008 – 2011	-16.12	(-20.3; -11.7)	-17.56	(-20.9; -14.1)		
South	2011 – 2014	34.25	-	28.25	(16.3; 41.5)		
	2014 – 2017	-2.39	(-5.8; 1.1)	-5.80	(-10.0; -1.3)		
	2008 – 2017	-	-0.4	(-1.9; 1.6)	-0.1	(-57.1; -31.5)	-45.76
Midwest	2008 – 2017	(-2.8; 6.3)	1.61	(0.6; 15.9)	7.97	(-65.8; -27.1)	-50.08

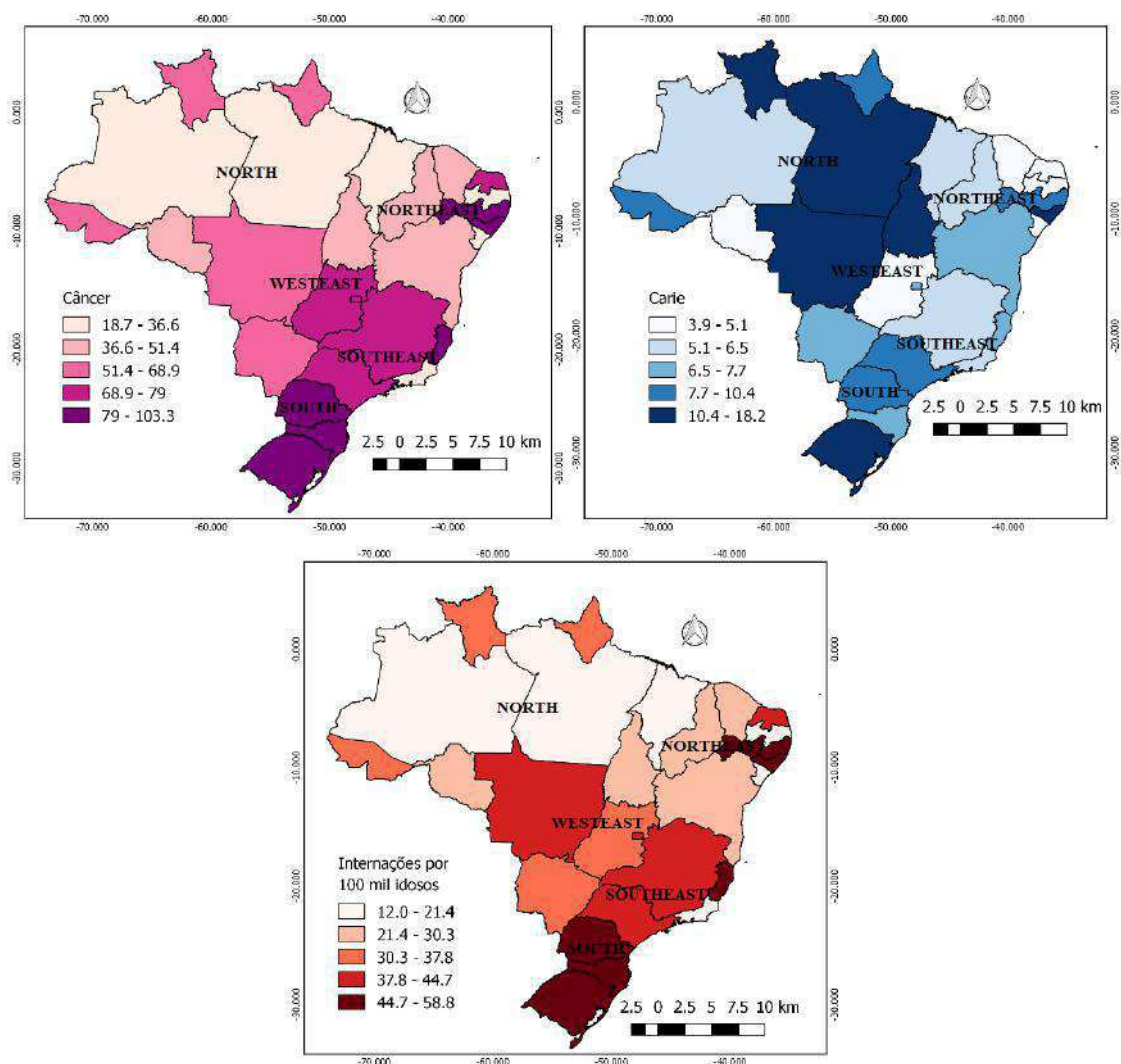


Fig. 2 Thematic maps displaying the distribution of hospital admissions by region. Brazil, 2008-2017.

Regarding hospital admissions due to oral cancers (TABLE 3), there was a trend towards higher rates of admissions among people aged 60-69 years and 70-79 years and lower rates among people aged 80+. The rates remained stable in the period from 2014 to 2017. Only the South

region exhibited changes in the trend pattern – only in women and ages 60-69 years and 70-79 years. As for people aged 60-69 years, we found one joinpoint for in the period from 2008 to 2011, with a decreasing APC of -16.12 (95% CI=-20.3; -11.7) and another jointpoint in the period

from 2011 to 2013, with an increasing APC of 34.25. With regard to people aged 70-79 years, we found one joinpoint in the period from 2008 to 2011, with a decreasing APC of

-17.56 (95%CI= -20.9; -14.1) and another joinpoint in the period from 2011 to 2014, with an increasing APC of 28.25 (95%CI=16.3; 41.5).

Table 3. Joinpoint analysis of oral neoplasms by gender, age and region. Brazil, 2008-2017.

		Male								
Region	Years	Age Group								
		60-69 yearsold			70-79 yearsold			80+older		
		APC	IC (95%)	AAPC	APC	IC (95%)	AAPC	APC	IC (95%)	AAPC
North	2008-2012	-17.92	(-36.7; 6.5)							
	2012-2014	143.73	-							
	2014-2017	23.86	(-2.1; 56.7)							
	2008-2017		-	19.9		(6.6; 34.6)	19.78		(-63.3; -35.7)	-51.43
Northeast	2008-2012				-14.41	(-29.8; 4.3)				
	2012-2014				94.98	-				
	2014-2017				-8.56	(33.0; 24.7)				
	2008-2017		(4.1; 14.2)	9.02	5.1	-			(-60.6; -28.0)	-46.76
Southeast	2008-2017		(6.3; 14.6)	10.37		(7.9; 16.6)	12.19		(-63.3; -27.8)	-48.51
South	2008-2012				-4.54	(-18.2; 11.3)				
	2012-2014				67.94	-				
	2014-2017				-4.52	(-24.6; 20.9)				
	2008-2017		(3; 15.2)	8.89		-	8.2		(-61.0; -32.9)	-48.82
Midwest	2008-2017		(-0.4; 18.8)	8.77		(1.1; 39.3)	18.64		(-66.6; -27.1)	-50.67
		Female								
North	2008-2017		(15.2; 36.2)	25.27		(13.9; 36.7)	24.77		(-66.1; -39.2)	-54.60
Northeast	2008-2017		(-0.8; 8.6)	3.79		(-1.1; 13.1)	5.75		(-56.3; -24.8)	-42.63
Southeast	2008-2017		(3.4; 11.4)	7.35		(2.1; 12.5)	7.18		(-55.7; -26.3)	-42.87
South	2008-2011	1.10	(-8.2; 11.3)							
	2011-2014	48.55	-							
	2014-2017	-0.94	(-12.3; 11.8)							
	2008-2017		-	9.4		(-1.6; 17.9)	7.71		(-55.9; -23.7)	-41.95
Midwest	2008-2017		(1.9; 26.8)	13.68		(-2.9; 17.1)	6.66		(-57.3; -29.5)	-45.13

IV. DISCUSSION

Population aging and its implications for health are a major challenge for public oral health. Hospital admissions are known to lead to older people's worse

quality of life and the present study seeks to provide a more in-depth analysis of the issue by addressing hospital admissions due to oral health problems. This discussion is

important due to the lack of information in this issue in the literature by the scientific community.

Untreated dental caries get worse over time and its sequelae compromise the oral health of the older population. In a study conducted by Nogueira et al., 85.26% of the older adults who were interviewed presented dental complaints, including self-reported pain, missing teeth, spots, difficulty speaking, gingival bleeding, dry mouth, loose teeth, crooked teeth, difficulty swallowing or chewing, discomfort caused by dentures, bad breath and wounds[14].

In Brazil, the data from the latest oral health survey (SBBrazil-2010) show regional differences in all age groups in both big cities and small towns. The North and Northeast regions exhibit the worst epidemiological profiles of periodontal conditions in all age groups compared with the other regions. The number of people aged 65-74 years who did not need dentures was very low, 12.7% in the South region and 2.8% in the North region. Regardless of the low number for all regions, the difference between the South and the North regions is remarkable. The reason may not be so evident, but may be related to social-economic conditions (North region is poorer than the South region)[15], the oral health service offer (lower number of dentists per capita in the North region compare to all other regions) and attitudinal populational differences[16]. In the North, 46.2% of the older adults sought dental care facilities for tooth extraction and 24.9% sought these services for treatment. A contrasting behavior was observed in the South, where 22.9% of the older adults sought dental care facilities for tooth extraction and 38.3% attended these services looking for dental treatment[9].

We found that the Southeast region had the highest absolute number of oral health-related hospitalization. However, when the size of the population in each region was considered, the South region presented the highest prevalence of hospitalizations and the North region presented the lowest prevalence. The hospitalization of people aged 60 years or older for oral health problems was previously highlighted by Freitas et al. who found a total of 2,626,225 hospital admissions were authorized by SUS throughout Brazil in 2013. The researchers calculated morbidity rates for the five geographic regions, and, as in our results, they found the highest rates in the South region. The reason for that may be related to demographic, economical, oral health care infrastructure (including number of dentist per capita), being the South region known for their higher longevity rate, less social economic discrepancy, higher (together with the Southeast region) number of dentist per capita[17,18]. It is known that poor access to dental care often prevents early detection of cancer and hence results in pain, loss of function, disfiguration,

impairment and even death[6]. Corroborating to this line of thinking, Freitas et al. research concluded that the older population outnumbers the general population in the South region and that it features better infrastructure, which may explain the highest number of hospitalizations in this area of the country[19].

Most older adults will experience oral diseases in an advanced stage at some point in life. Therefore, receiving uncoordinated and fragmented care that fails to meet their values and preferences will result, most of the times, in unnecessary hospitalizations, unwanted treatment, adverse drug reactions, and higher health care costs[20].

For many years Brazilian older people have had little access to dental treatments and these treatments were almost always nonconservative. Since 2000, with the inclusion of the oral health team in the Family Health Strategy and the creation of dental specialty centers, the country started to provide more effective oral health programs[21,22]. Nevertheless, research conducted with people aged 65-74 years using decayed, missing and filled teeth (DMFT) index found that the oral health of the older population was still compromised after a period of seven years, as the mean DMFT score remained practically the same (27.8 in 2003 and 27.5 in 2010), with missing teeth being the most prevalent condition[9,23]. As it can be seen, despite the attempts to restructure its Health System in view of the growing demand generated by the growth of the older population, Brazil does not seem prepared to deal with the rapid increase in the number of older adults.

Despite the official guidelines, Brazil's oral health care system still focus on immediacy and acute care rather than health promotion and disease prevention. Primary health care (PHC) is the main level of care for health promotion and disease prevention and care. In Brazil, the PHC is structured through the Family Health Strategy (FHS), which is formed by doctors, nurses, dentists, nurse and oral health auxiliaries and community health agents[24]. Our research, corroborating to other studies, points to the necessity of FHS professionals to develop knowledge and skills to tackle the changes caused by the demographic and epidemiological shift and serve a population that is becoming older[2]. However, in order for this to become a reality, public policies and government will need to be align in this perspective, financing professional formation and the shift of healthcare system focus.

The analysis of gender in our study showed a higher number of hospital admissions among men. A similar finding was reported by Silveira et al., who found that the prevalence of hospital admission was 1.6 times higher in male older adults[25]. This may seem intriguing, as the longevity is higher among women. However, women are

also more likely to seek health care services for health promotion, prevention and care, which may decrease their need to hospitalization[26]. Also, it should be noted that oral cancer is the oral disease responsible for the highest number of hospitalizations among older adults and it is most prevalent among men, with a male-to-female ratio of 2:1[4].

Lip, oral cavity and pharynx malignant tumor was the main cause of hospital admission in our study. According to the International Dental Federation, oral cancer is an important and growing global public health problem, and it remains the leading cause of death from oral disease. Furthermore, oral cancers are highly lethal, incapacitating and disfiguring and occur predominantly as squamous cell carcinomas, which have one of the lowest 5-year survival rates (about 50%)[27]. In all, there were 299,051 cases of lip and oral cavity cancers in 2012 and 145,353 deaths worldwide[27].

Between 80% to 90% of all cancer cases are associated with environmental factors, including drinking and smoking, which can cause mouth, oropharynx and larynx cancer[28]. Research has shown changes in the epidemiology of oral diseases in the older population led by the increased prevalence of oral cancer, which has been associated with drinking and smoking at younger ages. As mentioned earlier, poor access to dental care often prevents early detection of cancer and hence results in pain, loss of function, disfiguration, impairment and even death[6]. However, these effects can be reduced by engaging older adults in health promotion activities that favor social interaction and healthy lifestyles[25]. Our findings suggest potential failures to deliver health promotion and disease prevention actions, which may have contributed to the high number of oral cancer-related hospital admissions.

The present study has some limitations. The SIH data are limited to admissions to public and private hospitals that are authorized by SUS. Therefore, hospital admissions for private medical and hospital care covered by health insurances were not included in the study. Having said that, it is important to know that the vast majority of Brazilian population is SUS dependent for health care attention. Thus, the findings of the present study can contribute to complementary and in-depth studies of oral health.

The complications associated with the oral diseases suggest potential failures to deliver health promotion and disease prevention actions. Thus, it is necessary to elaborate policies for the implementation of actions to improve older adults' quality of life.

Information systems are important for the consolidation of epidemiological data for adequate planning and monitoring of health care actions, as well as public policies that meet the population needs. Moreover, the

methodology used in our study should be highlighted as a strength as it allowed the easy and fast analysis of a large database at a low cost.

V. CONCLUSION

The Information System proved to be an important tool for monitoring the epidemiology of oral health problems, as it helped to detect a significant number of hospital admissions of older people due to oral health problems. The findings showed a trend towards the growth in hospital admissions in all Brazilian regions throughout the years, as well as a difference on regions' hospitalization rate. The complications associated with the poor oral health suggest failures in the provision of health promotion and disease prevention actions. Thus, it is necessary to elaborate effective policies to tackle oral diseases. Such policies may contribute to the implementation of actions to improve older adults' quality of life.

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Prolonged mechanical ventilation patient outcome after discharge from an intensive care unit

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Keywords— Critical Care, Patient Care, Prolonged Mechanical Ventilation.

Abstract— Background: Mechanical ventilation (MV) is one of the pillars of therapy in the Intensive Care Unit (ICU) as many patients require ventilatory support. This study aimed to analyze the outcome of Prolonged Mechanical Ventilation (PMV) patients after discharge from an Intensive Care Unit (ICU). Methods: This is a retrospective cross-sectional study of 142 medical charts of patients admitted to an ICU and a Special Care Unit (SCU) in Brazil from 2012 to 2014. Results: Participants' mean age was 66.5 and the majority were men (58.5%). Outcome in the ICU was correlated with laparotomies before ($p=0.043$) and after ($p=0.049$) admission, sepsis ($p=0.013$), dialysis-requiring acute kidney injury (AKI) ($p<0.001$), and hemodynamic instability ($p=0.003$). Dialysis-requiring AKI ($p=0.012$), non-dialysis-requiring AKI ($p=0.023$) and atelectasis ($p=0.045$) during ICU stay were correlated with death in SCU patients. Only hemodynamic instability ($p=0.002$) and diarrhea ($p=0.045$) were correlated with outcome in the SCU. Additionally, 91 (64.1%) PMV patients in the ICU were discharged to the SCU, 50 (35.2%) died, and one (0.7%) was transferred to another hospital. Furthermore, 15 (16.5%) SCU patients were discharged to the Home Care Program and one (1.1%) was transferred to another hospital. Conclusions: PMV patients exhibited longer hospital stay and higher mortality. Dialysis-requiring AKI and hemodynamic instability were associated with increased risk of death. Only a few PMV patients were successfully discharged or referred to Home Care.

I. INTRODUCTION

Intensive Care Units (ICUs) were created in the United States in the 1950's to provide modern techniques of prolonged mechanical ventilation. In Brazil, the first ICUs were created in the 1970's to provide quality and humanized care to critically ill patients – i.e., patients with impairments in one or more of the main physiological systems and loss of their control who, therefore, required continued care. Because of that, the ICU has been synonymous with severity and mortality [1,2]. Mechanical ventilation (MV) is one of the pillars of therapy in the ICU as many patients require ventilatory support. Is primarily aimed at reducing respiratory discomfort through maintenance of gas exchange, relief of respiratory muscle work and muscular fatigue, and reduction of oxygen consumption, which can facilitate the use of other therapies [3, 4, 5, 6].

Epidemiological studies of ICU patients have found 60% of medical charts indicating acute respiratory failure as the main cause of MV and a high mortality rate (74.5%) in people with advanced age and neurological and lung diseases, with most patients presenting a mean age of 60-76 years and past history of diseases of the circulatory system (56.2%), followed by endocrine, nutritional, and metabolic diseases (27.8%) and neoplasms (18.8%). Furthermore, patients submitted to MV exhibit mortality rates of 45% in the ICU and 47.93% in other hospital settings [4, 7, 8, 9].

Prolonged mechanical ventilation is defined as the need for MV for 21 consecutive days or more for more than 6 hours a day [10, 11]. The main complications arising from the use of MV are decreased cardiac output, acute respiratory alkalosis, elevated intracranial pressure, gastric distension, pneumonia, atelectasis, barotrauma, and bronchopleural fistula [12].

Ventilator-associated pneumonia (VAP) is a common complication in the ICU that is responsible for high mortality and dependence rates, thus prolonging the length of hospital stay and increasing hospital costs [13, 14].

The underlying disease, the length of MV, the etiology of respiratory failure, age, and smoking [6, 15], influences the progress and prognosis of patients submitted to MV.

Therefore, knowing the comorbidities and complications occurring during hospitalization and previous discharge from the ICU and their outcome (progress, death, and discharge) can contribute to a better understanding of the profile of patients submitted to PMV, thus facilitating the planning of actions aimed at early identification of patients. Given that, this study aimed to

assess the progress and outcome of patients submitted to Prolonged Mechanical Ventilation in an Adult Intensive Care Unit and with previous discharge from a Special Care Unit.

II. METHODS

A retrospective and analytical cross-sectional study was carried out at a General Hospital in Northeastern Brazil. The hospital is part of the tertiary care network of the State of Ceará and serves the population covered by Brazil's Unified Health System (*Sistema Único de Saúde – SUS*). The hospital was the first public hospital in the North and Northeast regions to receive a Level 2 Hospital Accreditation from the National Accreditation Organization.

The hospital where the study took place has 336 beds distributed in the medical, surgical and pediatric departments and in the Special Care Unit (SCU) and adult Intensive Care Unit (ICU). It also offers outpatient and home care programs and special and personalized care to patients with chronic diseases, such as Diabetic foot and Stroke [16].

Our study included medical charts of patients admitted to the Adult Intensive Care Unit of the hospital who progressed to Prolonged Mechanical Ventilation from 2012 to 2014 and who continued their treatment in the Special Care Unit (SCU). The SCU receives patients who need continuing care. Information on patients' outcome (progress, death, discharge) over the last three years was provided by the SCU and used in our study.

We used data from the past three years as they were fully consolidated. Three professionals working in the adult ICU (Physician, Nurse and Physical Therapist) previously tested the data collection instrument. The professionals tested the instruments' capacity to organize the data transcribed from the medical charts. Data were collected directly from the medical charts of the patients admitted to the ICU and SCU.

The data collection instrument covered the following information: 1. Identification: chart number, age, gender, origin. 2. Clinical history: diagnosis at admission, comorbidities, life habits, previous surgeries, complications during hospitalization. 3. Treatment and complications and duration of mechanical ventilation, dialysis-requiring acute kidney injury (AKI), non-dialysis-requiring AKI, ventilator-associated pneumonia (VAP), respiratory distress syndrome (RDS), accidental extubation, elective extubation failure, endotracheal reintubation (ETRI), and number of days spent in the ICU/Hospital. 4. Clinical outcome in the ICU (referral to

SCU/death/referral to another hospital) and in the SCU (discharge to home/referral to the Home Care Program – HCP, referral to another hospital, and death). Figure 1

depicts the flow chart of the outcome of the patients analyzed in our study.

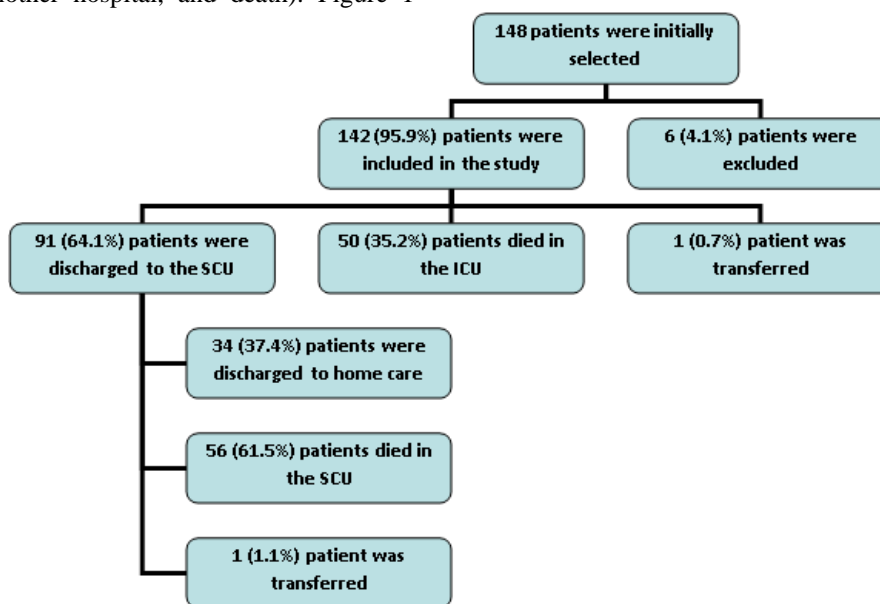


Fig.1 depicts the flow chart of the outcome of the patients analyzed in our study.

The duration of Mechanical Ventilation consisted of the period between Endotracheal Intubation (EI) and withdrawal of the ventilatory support with spontaneous breathing for at least 48 hours after extubation. Prolonged length of stay in the ICU considered in the present study was seven days or more, as defined in the hospital management contract by the Ceará Health Secretariat. Prolonged mechanical ventilation consisted of mechanical ventilation for 21 days or more for more than 6 hours a day [10].

The study included fully completed medical charts of patients who progressed to Prolonged Mechanical Ventilation from 2012 to 2014. Incomplete and illegible medical charts were excluded. In all, six of the 148 medical charts were excluded due to data incompleteness. Thus, the final sample includes 142 medical charts.

The data were organized in tables and graphs using 2013 Microsoft Office Excel® spreadsheets. The data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 20.0 for Windows (SPSS Inc., Chicago, IL, USA).

Quantitative variables were described as means, standard deviations, and absolute and percentage frequencies. A bivariate analysis was performed using the Mann-Whitney test, the Kruskal-Wallis test, and the Spearman's correlation for numerical variables and the Pearson's Chi-square test for categorical variables. All

tests were performed using a statistical significance level of 5%.

The study was approved by the Research Ethics Committee of the University of Fortaleza (UNIFOR) (Approval No. 1.013.436).

III. RESULTS

A total of 142 medical charts were analyzed. The patients' age ranged 17 to 103 years (mean of 66.5 ± 18.7). There was a higher percentage of people under 59 years of age (28.9%). However, longevity was pronounced in the study population as 38 (26.8%) patients were aged 80 years and older. There was a predominance of men (83; 58.5%) compared with women (59; 41.5%) and 82.4% (n=117) of the patients came from other health care facilities.

Table 1 shows the data collected from the medical charts, including clinical diagnosis and comorbidities at admission to the adult ICU and the SCU in the period from 2012 to 2014. Respiratory failure caused by community-acquired pneumonia (PAC) was the main diagnosis at admission (78; 54.9%). The main comorbidities were hypertension (77; 54.2%), heart disease (49; 34.5%), diabetes (46; 32.4%), and neurological sequelae (28; 19.7%).

Only 108 charts contained information on bad habits. Smoking was reported in 58 (53.7%) charts, drinking was described in 47 (43.5%) charts and use of illicit drugs was reported in 3 (2.8%) charts. Acute

Respiratory Failure (ARF) was the main cause of mechanical ventilation in the patients analyzed (128; 90.1%).

Table 1. Clinical diagnosis, comorbidities and cause of mechanical ventilation at admission to the adult ICU and SCU from 2012 to 2014. Fortaleza, Ceará, 2016.

Variables	N	%
Diagnosis at admission		
CAP – Community-acquired pneumonia and respiratory failure	78	54.9
PNA – Pneumonia	54	38.0
Stroke	27	19.0
Sepsis	21	14.9
Renal failure	18	12.7
COPD – Chronic obstructive pulmonar disease	12	8.5
Septic shock	10	7.0
UTI – Urinary tract infection	8	5.6
Laparotomy	8	5.6
AMI – Acute myocardial infarction	7	4.9
Sensory impairment	7	4.9
Pancreatitis	6	4.2
APE – Acute pulmonary edema	6	4.2
CRA – Cardiorespiratory arrest	5	3.5
PE – Pulmonaary embolism	5	3.5
Pulmonary tuberculosis	5	3.5
HIV retrovirus – Human Immunodeficiency Virus	4	2.8
Cardiogenic shock	3	2.1
Comorbidities		
Hypertension	77	54.2
Heart disease	49	34.5
Diabetes	46	32.4
Neurological sequelae	28	19.7
COPD	21	14.8
Obesity	11	7.7
Malnutrition	11	7.7
Cancer	11	7.7
Dialysis-requiring AKI	6	4.2
Non-dialysis-requiring AKI	6	4.2
Liver disease	4	2.8
HIV AIDS	2	1.4
Respiratory failure	2	1.4
Nephropathy	1	0.7
Cause of mechanical ventilation		
ARF- Acure respiratory failure	128	90.1
Surgery	7	4.9
Hemodynamic instability	4	2.8

Unknown	3	2.2
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Source: own construction

In all, 22 (15.5%) patients had undergone some type of surgery before admission to the unit. Surgeries were mainly laparotomy (9; 40.9%) and heart surgeries (3; 13.6%). Similarly, 36 (25.4%) MV patients underwent surgeries after admission to the unit, with laparotomy being the most predominant type of surgery (20; 55.6%).

Table 2 shows the types of complications in the adult ICU. The most common complications in the ICU

were sepsis (64.1%), dialysis-requiring AKI (53.5%) and ventilator-associated pneumonia (35.2%). The most common complications in the SCU were sepsis (30.2), ventilator-associated pneumonia (23.8%) and urinary tract infection (20.6%).

Table 2. Complications in the adult ICU and SCU from 2012 to 2014. Fortaleza, Ceará. 2016.

Complications in the ICU	N	%
Sepsis	91	64.1
Dialysis-requiring AKI	76	53.5
VAP – Ventilator-associated pneumonia	50	35.2
Endotracheal Reintubation	19	13.4
Pleural Effusion	17	12.0
Circulatory Shock	17	12.0
AF – Atrial Fibrillation	17	12.0
Thrombocytopenia	15	10.6
CRA – Cardiorespiratory arrest	14	9.9
Pneumothorax	13	9.1
Bleeding	11	7.7
Non-dialysis-requiring AKI	10	7.0
Atelectasis	10	7.0
Critically illness polyneuropathy	9	6.3
UTI – Urinary tract infection	9	6.3
Stroke	9	6.3
ARDS – Acute Respiratory Distress Syndrome	8	5.6
Accidental extubation	8	5.6
Hemodynamic instability	8	5.6
Hemorrhage	7	4.9
Tracheostomy tube change	7	4.9
Leukopenia	6	4.2
Extubation failure	4	2.8
Edema	3	2.1
Pressure ulcers	3	2.1
Complications in the SCU		
Sepsis	19	30.2
VAP – Ventilator-associated pneumonia	15	23.8
UTI – Urinary tract infection	13	20.6

Hemodynamic instability	13	20.6
CRA – Cardiorespiratory arrest	8	12.7
Septic shock	5	7.9
Diarrhea	5	7.9
Eschar caused by pressure ulcer	3	4.8
Sensory impairment	3	4.8
Bleeding tracheostomy	3	4.8

Source: own construction

Table 3 depicts the mean duration (in hours) of endotracheal intubation, the mean duration (in days) of mechanical ventilation, the mean duration of ICU stay, and the mean duration of hospital stay from 2012 to 2014. The

duration of mechanical ventilation was not significantly correlated with the duration of endotracheal intubation ($p=0.967$).

Table 3. Duration of intubation (in hours), mechanical ventilation (in days), ICU stay (in days) and hospital stay (in days) from 2012 to 2014. Fortaleza, Ceará, 2016.

Variables	n (%)	Mean	Median	Standard error	Mín-Max
Duration of intubation (hours)	134 (94.4)	16.5	15.0	8.0	3 – 65
Duration of MV (days)	141 (99.3)	64.3	48.0	53.9	21 – 401
Duration of ICU stay (days)	142 (100)	37.0	31.5	21.9	2 – 144
Duration of hospital stay (days)	142 (100)	80.2	71.0	59.3	12 – 398

Source: own construction.

Table 4 shows that acute myocardial infarction, sensory deficits, liver disease, non-dialysis-requiring AKI, ventilator-associated pneumonia and cardiorespiratory

arrest were significantly associated ($p<0.05$) with the mean duration of mechanical ventilation.

Table 4. Bivariate analysis of the characteristics of clinical diagnosis at admission, comorbidities and complications in the ICU in relation to the mean duration of MV from 2012 to 2014. Fortaleza, Ceará, 2016.

Variables	Mean duration of MV \pm SD	P value
Acute myocardial infarction		0.014
Yes	96.1 \pm 41.4	
No	62.7 \pm 54.1	
Diagnosis at admission		0.016
Sensory impairment		
Yes	36 \pm 26.0	
No	65.8 \pm 54.6	
Liver disease		0.012
Comorbidity		
Yes	111.5 \pm 31.8	
No	62.9 \pm 53.9	
Complications in the ICU		0.021
Non-dialysis-requiring AKI		
Yes	87.9 \pm 13.7	

No	62.7 ± 4.7	
Ventilator-associated pneumonia		0.014
Yes	70.9 ± 5.6	
No	60.7 ± 6.3	
Cardiorespiratory arrest		0.024
Yes	92.9 ± 15.4	
No	61.2 ± 4.7	

Source: own construction. *p = significance level for Mann-Whitney U test; \bar{x} = mean; sd = standard deviation.

There was a significant association between the outcome in the ICU and laparotomies before ($p=0.043$) and after admission ($p=0.049$). Table 5 shows that 47 of the 56 deaths that occurred as an outcome in the SCU were associated with different pathological complications. The following ICU complications were significantly associated with patient outcome in the ICU (death/discharge): sepsis ($p=0.013$), dialysis-requiring AKI ($p<0.001$), and hemodynamic instability ($p=0.003$).

Some ICU complications were significantly associated with patient outcome (death/discharge) among the patients discharged to the SCU ($n=90$). Dialysis-requiring AKI ($p=0.012$), non-dialysis-requiring AKI ($p=0.023$) and atelectasis ($p=0.045$) were associated with death. As for complications in the SCU, only hemodynamic instability ($p=0.002$) and diarrhea ($p=0.045$) were significantly associated with patient outcome.

Table 5. Analysis of the association of complications in the ICU ($n=141$) and SCU ($n=90$) with patient outcome from 2012 to 2014. Fortaleza, Ceará. 2016.

Place where the complication occurred	Complications	Patient outcome		p value*
		Death	Discharge	
Outcome in the ICU (n=141)				
Adult ICU	Sepsis			0.013
	Yes	39 (42.9)	52 (57.1)	
	No	11 (22.0)	39 (78.0)	
	Dialysis-requiring AKI			<0.001
	Yes	37 (48.7)	39 (51.3)	
	No	13 (20.0)	52 (80.0)	
	Hemodynamic instability			0.003
	Yes	7 (87.5)	1 (12.5)	
No	43 (32.3)	90 (67.7)		
Outcome in the SCU (n=90)				
Adult ICU	Dialysis-requiring AKI			0.012
	Yes	30 (76.9)	9 (23.1)	
	No	26 (51.0)	25 (49)	
	Non-dialysis-requiring AKI			0.023
	Yes	2 (25.0)	6 (75)	
	No	54 (65.9)	28 (34.1)	
	Atelectasis			0.045
Yes	1 (20.0)	4 (80)		

	No	55 (64.7)	30 (35.3)	
	Hemodynamic instability			0.002
	Yes	13 (100)	-	
SCU	No	43 (55.8)	34 (44.2)	
	Diarrhea			0.045
	Yes	1 (20.0)	4 (80)	
	No	55 (64.7)	30 (35.3)	

Source: own construction. * $p < 0.05$ = significance level for the chi-squared test.

The outcomes of the 142 patients who underwent MV in the ICU were as follows: 91 (64.1%) were discharged to the SCU, 50 (35.2%) died, and one patient (0.7%) was transferred to another hospital.

According to information collected from the medical charts, of the 106 (74.6%) patients who died, 50 (35.2%) had been submitted to MV in the ICU and 56 (61.5%) had been discharged to the Special Care Unit (SCU). In all, one (1.1%) ICU patient was transferred to another hospital and 19 (20.9%) SCU patients were discharged from the hospital. In addition, 15 (16.5%) SCU patients were discharged to the Home Care Program and one SCU patient (1.1%) was transferred to another hospital.

IV. DISCUSSION

The present study sought to analyze the profile of patients admitted to an Adult Intensive Care Unit (ICU) and Special Care Unit (SCU) of a large hospital in Brazil. Age was an important variable in our study. There was a higher percentage of people under 59 years of age (28.9%). However, longevity was pronounced in the study population as 38 (26.8%) patients were aged 80 years and older. This finding is in agreement with other studies that have found similar percentages – 25%-31.5% of people aged under 59 years and 20.8%-27.1% of people aged 80 years and over [17, 18].

The predominance of men (58.5%) in our study is corroborated by other authors who found that more men are admitted to the ICU [19]. Additionally, the number of men admitted to ICU in different countries is considerably higher than that of women [20].

Respiratory failure caused by community-acquired pneumonia (PAC) was the main diagnosis at admission (54.9%). These findings are similar to those found in Taiwan, where heart and lung diseases were found in 50% of the patients submitted to PMV and hypertension, Diabetes and neurological sequelae were the most prevalent comorbidities [21].

Guidelines of the Brazilian Society of Pulmonology and Phthisiology mention that community-acquired pneumonia is the acute infectious disease with the greatest social and medical impact on morbidity and costs related to treatment. They also mention that diseases of the respiratory system are the fifth leading cause of death in Brazil, with pneumonia being the second most frequent. There is an upward trend in hospital mortality rate that points to several hypotheses, such as the hospitalization of more severe cases of pneumonia and the aging of the population [22].

Researchers have pointed out that the different clinical manifestations and degrees of severity of pneumonia are challenges in emergency care centers [23]. Therefore, early diagnosis and classification of patients based on severity criteria are key to the treatment in a hospital setting. Furthermore, the need for admission to an intensive care unit (ICU) should be carefully assessed.

The information collected from the medical charts revealed high rates of comorbidities such as hypertension (54.2%), heart disease (34.5%), diabetes (32.4%) and neurological sequelae (19.7%). It should be noted that 56 deaths were associated with different pathological complications shown in Table 5.

Information on patient characteristics and outcome in patients requiring mechanical ventilation (MV) is critical for better use of resources and clinical decision making in the ICU. A study of 505 patients on MV in India found that 76.4% of the participants presented comorbidities and that primary causes of MV were sepsis and neurological, cardiac, renal and respiratory diseases. Furthermore, the study found that hypertension and diabetes were the most common comorbidities [24]. Similarly, prolonged postoperative mechanical ventilation was required by 10-20% of cardiac surgery subjects, who constitute a specific group that represents most of the postoperative mortality, which is associated with multiple organ failure and sepsis [25].

The neurological sequelae (19.7%) observed at admission in our study should be highlighted. Researchers have drawn attention to the effect of neuromuscular dysfunctions on the outcome of MV, which are risk factors for difficult weaning. In their study, 33% of the patients with polyneuropathy failed weaning trials and finally died [26].

Attention should be paid to the high rate of smokers (53.7%) found in our research. Smoking is the leading cause of preventable death (World Health Organization [27]). Thus, it should be noted that the main cause of mechanical ventilation was Acute Respiratory Failure (90.1%), which may have been caused by tobacco use.

In addition to being a major cause of mechanical ventilation, Acute Respiratory Failure can lead to several complications and increase the risk of morbidity and mortality in critically ill patients. MV patients with lung diseases have a significantly higher mortality rate than those without lung diseases [28].

A total of 15.5% of the patients in our study had undergone some type of prior surgery before admission to the ICU. Laparotomy was the most common type of surgery (40.9%). After admission to the adult ICU, 25.4% of these patients underwent new surgeries, with laparotomy being, again, the most common type of surgery (55.6%). These findings agree with a study that found that 63.1% of the patients analyzed had undergone laparotomy [29]. Other researchers have emphasized that the rate of complications following emergency laparotomies is greater in comparison with elective laparotomies, and that the most common problems are pain, postoperative fever, wound infection, nausea and vomiting in the postoperative period [30].

It should be noted that prior surgery (laparotomy) before and after admission to the ICU was significantly associated with patient outcome (death or discharge). Of the patients who died, 66.7% had undergone previous laparotomy ($p=0.043$) and 55% had undergone laparotomy during hospitalization in the adult ICU ($p=0.049$).

Sepsis (64.1%), dialysis-requiring AKI (53.5%) and ventilator-associated pneumonia (35.2%) were the most common complications in the adult ICU in the present study. Complications of sepsis are a cause of great concern, as they are the main causes of death in the ICU and one of the leading causes of death in general in the United States of America [31].

Researchers have investigated the association of comorbidities and colonization status with outcomes in patients requiring prolonged mechanical ventilation using comorbidity burden documented from pre-admission data.

The outcomes studied included transfer back to acute care facilities, stay, and ventilator weaning status. Within 60 days, 58.6% of the patients were transferred back to an acute care facility. The most common reason for transfer was infection/sepsis (37%) [32].

Pneumonia is one of the main nosocomial infections in the ICU and ventilator-associated pneumonia is the most common infection in hospitalized patients with an incidence rate ranging 9%-68% depending on the diagnostic method used and the population studied [33]. Because of that, many measures have been successfully implemented to prevent ventilator-associated pneumonia. One of these measures was the creation of protocols within the ICU that should be used in a multidisciplinary manner and audited by the Hospital Infection Control Services [34].

The use of specific strategies focused on the prevention of nosocomial infections in addition to standard precautions should be based on specific transmission in critically ill patients. The most common infections in these patients are ventilator-associated pneumonia, catheter-related bloodstream infection, and urinary tract infection. Therefore, it is necessary to periodically drain and discard any condensate that accumulates in the tubes of a mechanical ventilator [35].

A total of 74.6% of the patients who were hospitalized in the years analyzed in our study died. Other researchers also found a 74.6% mortality rate, thus supporting the findings of our study [7]. It should be noted that the percentage of people over 60 years of age and the severity of the patients hospitalized in the units where the present study took place might have significantly influenced such rate.

Acute myocardial infarction, sensory impairment, non-dialysis-requiring AKI, ventilator-associated pneumonia and cardiorespiratory arrest were statistically associated ($p<0.05$) with the duration of mechanical ventilation. These findings draw attention to the population aging. In the older population, AKI considerably enhances the effects of ICU hospitalization, thus reducing the chances of weaning and often leading to death. In addition, multiple comorbidities such as diabetes, heart disease and pre-existing kidney injury are associated with the development of prolonged mechanical ventilation [21].

In our study, the analysis of the association of complications in the adult ICU, comorbidities and complications outside the ICU with outcome in the SCU revealed that only AKI ($p=0.012$) and hemodynamic instability ($p=0.002$) were significantly associated with the outcome in the SCU. Patients with kidney injury who

require PMV have a very poor prognosis. In the ICU, the combination of mechanical ventilation and renal replacement therapy was found to be associated with prolonged hospital stay, high cost of care and poor outcome. In addition, none of the patients with severe renal impairment survived one year after discharge [36].

Sepsis, dialysis-requiring AKI and hemodynamic instability were associated with the outcome (death/discharge) in our study. A recent study found that severe sepsis/septic shock, acute respiratory distress syndrome (ARDS), atelectasis and infection with drug-resistant pathogens were mostly common in the ventilator-associated pneumonia group [37].

Another study that assessed AKI outcome found that 22.5% of patients presented renal function recovery, 5.6% of patients remained on dialysis after 30 day, and 71.9% of patients died. In addition, age and focus abdominal sepsis were identified as risk factors for death and urine output and negative fluid balance were identified as protective factors [38].

ORIGINAL ARTICLE

Assessment of risk factors responsible for difficult weaning from mechanical ventilation in adults

ORIGINAL ARTICLE

Assessment of risk factors responsible for difficult weaning from mechanical ventilation in adu

The small sample size is a limitation of the present study. However, it should be noted that the sample size was affected by the number of medical charts excluded from the research due to missing or inaccurate information. Given that, we emphasize the importance of completing medical charts with accurate clinical and hospital information as they can be used in research. Furthermore, it should be noted that as the present study analyzed patients from only one hospital, its findings cannot be extrapolated. However, the hospital where the research took place is a large reference hospital and, therefore, the same results may be found in other places. Our study is expected to draw attention to the magnitude of the problem and contribute to the planning of preventive and rehabilitation measures targeted at patients in hospital settings.

V. CONCLUSION

Patients who remained under prolonged mechanical ventilation exhibited longer hospital stay and higher mortality. Complications such as dialysis-requiring AKI and hemodynamic instability were significantly associated with increased risk of death in MV patients.

Only a small percentage of the patients submitted to Prolonged Mechanical Ventilation were successfully discharged or referred to Home Care.

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Effect of Tillage and Irrigation Method to Sesame (*Sesamum Indicum L.*) Production in Dryland and Wetland

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Keywords — *Tillage models, irrigation, dryland, wetland areas. Sesame, production.*

Abstract— *The productivity of an agricultural commodity is influenced by culture technology such as tillage and water supply. This research aimed to determine the influence of tillage and water supply on the growth and yield of sesame. This experiment used the factorial randomized block design, with three replications. The First factor was the tillage method which consists of three levels, i.e.; no-tillage, minimum tillage, and full tillage. The second factor was irrigation method, i.e., provision of flush water, provision of water through the ditch and the provision of surface waterways. The result showed that the combination of tillage treatment and the provision of water and a variable number of pods on a trial production on dry land, while on trial in wetland areas only the variable weight of 1000 seeds. As there is a difference in the growth of real variables only on trial in wetland areas due to tillage treatments at all ages observation and the results analysis of the experimental on dryland and wetland that water is the determinant of production.*

I. INTRODUCTION

Sesame (*Sesamum indicum L.*) is the commodity from people plantation supporting various industries that produce edible oil with low saturated fat [1][2]. Its oil contents reach 47-52%. Sesame and its derivative product have high nutrient, for example, sesame oil which is well known as the king of vegetable oil with anti-oxidant that other vegetable oils didn't have [3] [4].

Sesame cultivation in Indonesia is mostly cultivated in a limited range and is still a low domestic production[5], but it has a very important role in the development of agro-industries and value-added products [6], on the contrary, United States can produce between 900 – 2240 kg/ha that classified as high productivity. The poor mastery of cultivation technology causes low production per unit area. It is also stated that less proper technical culture procedure will obviously lower production and conversely with

technology appliance able to increase productivity up to 34% [7]. Until now, most of our farmer still made mistake in applying sesame cultivation technical culture, including tillage, irrigation, fertilization, planting method and obscure variety usage, these causes small production per unit area [8] and loss of harvest [9]. Indonesia has land potential that suitable for developing this commodity, registered approximately 70.41 million hectares (58%) of 122.05 million hectares sub-optimal land is suitable for farm development and more than 49.3 million ha and still not being used optimally [10].

Related to that matter, the most important thing is how to apply technical culture correctly, especially tillage and irrigation in dryland/moor development and wetland. Dryland situated in higher area that is cultivated without water inundation as usually does in common land[11]. On the other hand, wetland is a field with rain as its primary

water source, so that it will produce in rainy season, while in dry season most of that area will be neglected and left drained because inaccessible water source, and lots of other limitations [12].

Tillage in plant cultivation has a purpose of preparing good plant growth media for the sake of plant growth continuance. There are three tillage models; they are without tillage, minimum tillage and full tillage (reversal and levelling). Whereas procedure of irrigation divided into three methods, they are; surface irrigation, beneath surface irrigation, gush and drops [13]. Furthermore, the purpose of irrigation is to fulfil water need of plant growth in adequate quantity and need period. If the quantity is excessive (indicated by surface appearance) often inflict aeration stress, but if the quantity is lacking, often inflict drought stress.

Sesame plant is a plant that has so many taproots and fibrous roots. Explained that sesame plant has two forms of roots, spread and lengthwise strongly, in which with that sesame root plant can survive in the lack of water condition, compared to another type of plants. So that by doing tillage properly combine with good irrigation, can increase sesame plant productivity, whether on dryland or in wetland.

The purpose of this research was to determine the interaction of soil treatment effect and water supply to the growth and production of sesame plant in dryland and wetland. Specifically, it was to determine the best treatment combination for its effect on the production of sesame plants.

II. MATERIAL AND METHOD

This field research was conducted in April – September 2016, in dryland and wetland of Sugiharas village, Saradan district, Madiun resident and also in dryland and wetland of Banjarejo Taman Madiun district. Indry season I (MKI) used factorial randomized block design and repeated three times. The first factor was tillage procedure with three levels, they were without tillage (P1), minimum tillage (P2), and full tillage (P3), and the second factor was the procedure of irrigation with three levels, they were sprinkling (A1), trenches (A2) and surface (A3).

Land preparation was done by land opening, crop residue cleaning and doing tillage for about two weeks before cultivation. Terraces made with waterways as its barrier were also useful for drainage refinement that in accordance with the needed terrace measurement. Before cultivation and simultaneously with second tillage, ground leveling, manure fertilization or compost with dose of 1 ton/ha. Cultivation was in accordance with treatment,

sliced, by 20 cm x 40 cm interval with 3 – 4 seeds each hole, meanwhile plants that spread in the plot were 4 grams per terrace.

Cultivation including NPK fertilization (150 kg N given at the age of 15 and 25 HST, 50 kg P were given when planting and 50 kg K were given simultaneously with second N fertilization), irrigation in accordance with need, weed control by weeding manually also pest and disease control when it was required.

Variables observation involved; (1) plant height, (2) branch quantity, and (3) branch quantity. While the production of variables; (4) Number of pods, (5) 1000 seeds weight, and (6) production. The observation was conducted at the end of vegetative growth and harvest. Data were analyzed by Duncan test 0.05% and continued with the correlation between treatments.

III. RESULTS AND DISCUSSION

Statistical analysis results showed that interaction between tillage treatment and irrigation method on the number of pods (Table 1).

It can be seen from Table 1 that the combined treatment of soil treatment and irrigation on the number of pods of cultivation, the highest value was obtained by combination of P3A3 treatment (full tillage and in the whole surface) of 104 Pods, but not significantly different from P3A2, P2A3, P3A2, and P2A2. However, it differs significantly from P3A1, meaning that minimum tillage and full soil processing are not significantly different as long as the given irrigation is provided on a ditch or surface. Although sesame does not need water.

Table 1: The average value of the observation of a combination of tillage and irrigation on the number of pods

Treatment	Pod Quantity			
	Dryland		Wetland	
P1A1	83.67	ab	122,33	a
P2A1	70.33	ab	126,33	a
P3A1	62.00	a	117,00	a
P1A2	75.67	ab	129,00	ab
P2A2	88.00	bc	115,67	a
P3A2	104.00	c	127,00	a
P1A3	81.33	abc	132,00	ab
P2A3	100.00	c	125,33	a
P3A3	104.00	c	141,33	b

Note: Numbers accompanied by same letters show there are no any significant different at 0.05 % degree (Duncan Test).

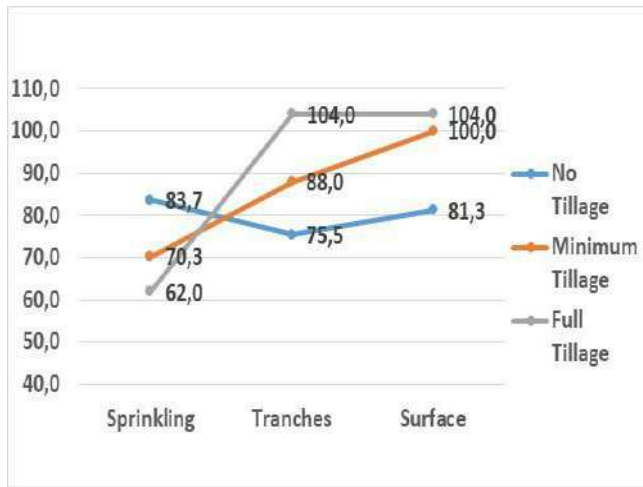


Fig. 1: Interaction curve of combination between tillage treatment (P) and irrigation (A) toward pod quantity variable on wetland

Similarly, what happens to the parameters of production per hectare, indicates the interaction between the combination of treatment of soil treatment and irrigation. The average value of the observed effect of the combined treatment of soil treatment and irrigation on the production of sesame is presented in Table 2.

Table 2: The average value of the observation of a combination of tillage and irrigation on the production

Treatment	Production (Ton/Ha)	
	Dryland	Wetland
P1A1	0.76 a	1.19 a
P2A1	0.68 a	1.35 ab
P3A1	0.65 a	1.34 ab
P1A2	0.70 a	1.28 ab
P2A2	0.86 ab	1.21 a
P3A2	1.10 bc	1.56 ab
P1A3	0.76 a	1.31 ab
P2A3	1.06 bc	1.42 ab
P3A3	1.18 c	1.72 b

Note: Numbers that accompanied by same letters show there are no any significant difference at 0.05 % degree (Duncan Test)

It can be seen in Table 2 that on dryland indicates interaction where the combined treatment of full soil

treatment and irrigation of the surface giving the highest value of production reached 1.18 T / Ha but not significantly different from P3A2 and P2A3. On wetland does not show any interaction where including influence of each treatment also did not show any real difference. It is suspected that paddy land after rice generally has a good condition for the growth of sesame plants [8].

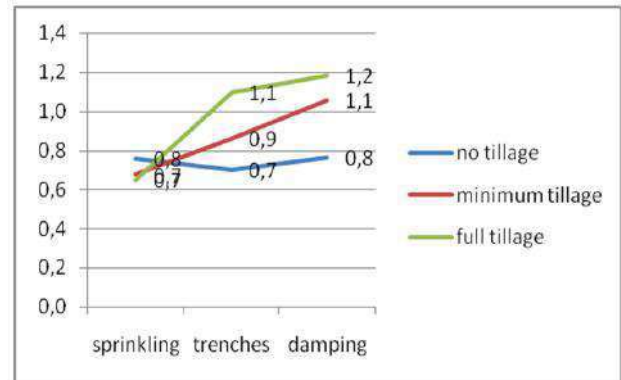


Fig. 2 Interaction curve of combination between tillage treatments (P) and irrigation (A) toward production variable on dryland

Interaction also occurs at the variable weight of 1000 seeds in wetland experiment (Table 3).

As seen in Table 1 experiment in field show combination of fully treatment tillage and irrigation with surface method that prove give high result of pod but it didn't show significant difference with another several treatment combinations except in flush irrigation method which shows significant difference. While in production variable shows that full tillage treatment combination with surface method irrigation give the highest production average up to 1.18 Ton/ha though it is not much different between combination of full tillage and gutter irrigation method and minimum tillage and surface irrigation method.

Table 3: Average Value of Influence 1000 Seeds Weight Combination on Rice Field

Treatment	1000 seeds weight (gr)	
	Dryland	Wetland
P1A1	2,65 a	2.70 a
P2A1	2,69 ab	2.71 a
P3A1	2,68 ab	2.68 a
P1A2	2,65 a	2.71 a
P2A2	2,69 ab	2.72 ab
P3A2	2,69 ab	2.72 ab
P1A3	2,72 ab	2.71 ab

P2A3	2,75	b	2.72	ab
P3A3	2,71	ab	2.77	b

Note: Numbers that accompanied by same letters show there are no any significant difference at 0.05 % degree (Duncan Test)

The interaction variable analysis result of pod quantity and production in field experiment shows that good cultivation demand more of irrigation (Fig. 1 and 2) in which interaction pattern relatively similar to full tillage which more responsive towards water so that gutter irrigation method and surface method have unreal result. On the other hand, without tillage procedure doesn't support plant growth so it has lowest result.

Analysis result in wetland experiment shows that there is only real interaction on 1000 seeds weight variable (Table 2). As seen on table 2, combination between full tillage treatment and surface irrigation method are different significantly with treatment combination of without tillage with all of irrigation method that used in this experiment, but doesn't significantly different from combination of minimum tillage treatment or full tillage treatment with gutter irrigation method. Average value of 1000 seeds weight (g) is 2.77 grams. As for interaction pattern on 1000 seeds weight variable (Fig. 3)

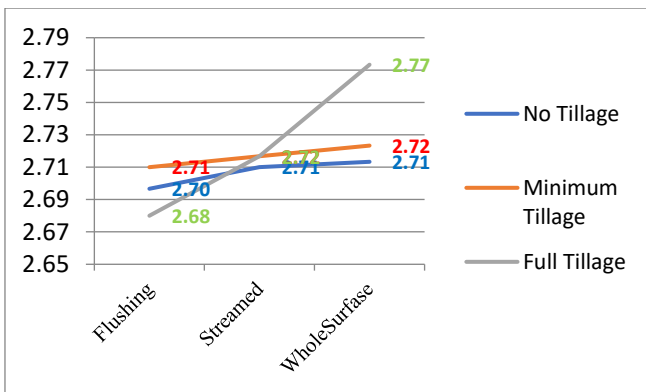


Fig. 3 Interaction curve of combination between tillage treatment (P) and irrigation method (A) seed weight variable on wetland experiment.

indicate that there is interaction on full tillage treatment that show significant respond toward irrigation method, while without tillage treatment and minimum tillage treatment show same respond toward irrigation method so that doesn't show any interaction.

Next, the analysis result on influence of treatment separately toward plant height variable shows that on field experiment indicate significant difference only on treatment tillage influence on all observation age while irrigation method didn't show any difference (Table 4).

Table 4: average value of tillage treatment and irrigation method influence toward plant height variable (cm) in various age of observation on wetland experiment.

Treatment	Plant height in various age of observation			
	45	60	75	90
P1	71.78a	79.89a	88.56	104.56a
			96.22	
P2	81.22b	88.44ab	97.44	112.22ab
			97.44	
P3	81.56b	89.78b	90.67	113.44b
			90.67	
A1	75.67a	83.78a	95.22	111.22a
			95.22	
A2	78.44a	86.56a	96.33	112.33a
			96.33	
A3	80.44	87.78a	96.33	330.22a
			96.33	

Note: Numbers that accompanied by same letters show there are no any significant difference at 0.05% degree (Duncan Test)

As seen in Table 4, full tillage treatment gives the highest variable average value up to 113.44 cm on 90 days old after planting. Although it is not different significantly from minimum tillage treatment on all observation age, while without tillage treatment has the lowest average value. Although it is not different significantly with minimum tillage treatment.

In contrast, experiment on field, the influence of separately treatment, irrigation method precisely indicate significant difference on seed quantity per pod's variable and weight of 1000 seeds (Table 5).

Table 5: average value of observation results separate treatment influence toward seed quantity per pod and 1000 seeds (g) variables on field experiment.

Treatment	Seed Quantity/Pod	1000 Seeds Weight (gr)
P1	132.56	2.67
P2	131.00	2.68
P3	131.44	2.69
A1	132.89	2.67
A2	128.33	2.67
A3	133.78	2.70

Note: Numbers that accompanied by same letter show there are no significant difference at 0.05 % degree (Duncan Test)

As seen in (Table 5) surface irrigation method show significant difference with flush irrigation method whether on seed quantity per pod variable or 100 seeds weight variable. The average value of quantity seed per pod is 133.78 when use surface irrigation method and the lowest value is 128.33 when use gutter irrigation method.

Analysis result towards production variable on wetland experiment indicates that there is no interaction. only indicated that there is influence on tillage (Table 6).

Table 6: Average Value Observation Result Of Separate Treatment Influence Toward Production Variable On Wetland

Treatment	Production (Ton/Ha)
P1	1.26 a
P2	1.33 b
P3	1.54 b
A1	1.29 a
A2	1.35 a
A3	1.48 a

Note: Numbers that accompanied by same letters show there aren't any significant difference at 0.05 % degree (Duncan Test)

As seen at Table 6, influence of full tillage treatment gives highest total production up to 1.5 Ton/ha. but didn't significantly different from minimum tillage treatment, while the lowest production achieved by influence of without tillage treatment that 1.26 Ton/ha.

Analysis result towards production variable on field and wetland as shown in Fig. 4 indicates that in wetland, tillage has more significant difference, while field experiment shows that tillage has more significant influence and on field experiment shows that tillage and irrigation method give similar influence.

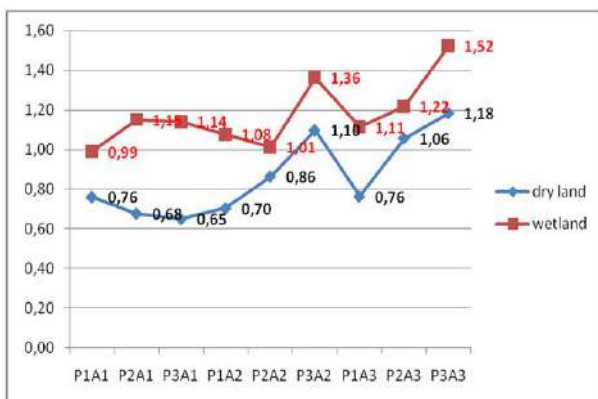


Fig. 4 Production variable between dryland and wetland

A. Discussion

Analysis result shows that combination between tillage treatments and irrigation methods indicate the significant interaction between the number of pods variable and production on field experiment. It is expected because field soil's characteristic is very influenced by tillage and water availability. Whereas, full tillage is strongly corresponded with water availability compared to without tillage treatment. As the research conducted on the growth of sweet corn has positive correlation between the depths of tillage with the availability of water in the land[13]. Dryland has lower fertility rate and low organic substance so that resistance towards water availability is low. Meanwhile, tillage had strong influence toward growth and plant production because tillage can control weed. Destroy soil's chunk so formation of planting medium that suitable for seeding and nursery. Also, ease the root growth through soil tilling on surface layer and beneath surface at the same time form aeration throughout minimum tillage, but organic substance and fertilization should be balance [14]. Experiment shows that without tillage treatment can increase usage of available water. Result and water productivity from all plant give contribution in reducing plant water stress' risk on dry land farming [15].

Analysis result shows the combination between tillage treatment and irrigation method indicates the significant interaction on 1000 seeds weight variable on the wetland experiment. It is because wetland, generally sesame plant, is planted in the second planting season after paddy so soil still in good condition for sesame growth and production although without tillage. Also, rooting is able to growth well and soil is able to keep enough water. However, interaction pattern is more dominated by irrigation method, so that it is also an influence on the seed-forming process. As stated that seed forming or filling is strongly influenced by soil's water availability, for example paddy that encounter drought will yield less weight of rice [6]. The difference on irrigation method doesn't significantly influence growth variety, result variety, and rice component result. The height of rice harvest is more related to rice quantity per tassel and 1000 fascicles compared with tassel component per cluster [16]. Also, sesame plant has many and strong adventitious roots type that able to penetrate soil. It is supported with regular irrigation that will give significant influence toward result [17].

The analysis result of the plant height variable on wetland experiment didn't show any interaction, but separate tillage treatment indicates significant difference (Table 4). It is assumed that tillage influence gives high

respond toward water availability. It means that soil with good tillage can reserve and provide enough water for plant compare to without tillage or minimum tillage soil. The proper usage of plant type and population in the marginal area included dryland will determine nutrition efficiency; plant height is used as an indicator [18]. The sufficient water in the field of routing means that providing plant nutrition substance because it can be absorbed by the plant in solution form and solution availability which is circulated within the plant will have positive correlation with photosynthesis process that produces carbohydrate for plant growth.

The analysis result of tillage influence and irrigation toward production variable separately indicates that there is a significant difference in the variable of seed quantity per pod and 1000 seeds weight (Table 5). This occurred on field experiment. In which treatment that significantly influence is the availability of water treatment. It probably because field need more water to support plant growth, so surface irrigation method give significant influence compared with flush or gutter irrigation method. However, plant's irrigation should be in adequate quantity and adequate period. water use on different media shows different effects on plant growth [19]. If water quantity is excessive (surface occurring as the indicator) often inflict aeration stress, while if the water is deficient often inflict drought stress [20]. On the other hand, experiment of separated treatment influence in field shows tillage give significant influence (Table 5). It probably because experiment in wetland is second planting season after paddy, so the influence of irrigation make growing space distinct better while water availability in soil still adequate for sesame growth. that's why irrigation method didn't influence significantly because sesame classified as drought resist plant or need a little amount of water [21].

The analysis result of influence tillage treatment and irrigation method on the field and rice field mainly production variable (Fig. 4) shows that rice field has adequate water availability. Tillage has more significant influence. It is possibly related to texture or physical of soil where wetland was planted before, so the soil condition still very supportive. Meanwhile, on field experiment, Tillage treatment didn't significantly influence. It can be assumed that area is usually planted only on the earlier rainy season so that quantity of detention water level is strongly influenced plant growth. It is stated that irrigation frequency treatment has significant influence toward result. Result component, plant height, and branch quantity, by increasing duration between irrigation frequency and result.

IV. CONCLUSIONS

Application of tillage and irrigation combination for sesame plant cultivation on the field give significant influence especially toward number of pods and production variables, as well as on wetland experiment although only 1000 seeds weight variable that important.

From Separate treatment, it can be concluded that research on the field is more influenced by water availability where surface irrigation method proved to be better. While experiment on wetland is influenced dominantly by tillage treatment where full tillage treatment proved to be better.

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What do Primary Education teachers think about creativity? Case study

Qué piensan las maestras de Educación Primaria acerca de la creatividad? Estudio de casos

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Keywords— *creativity, divergent thinking,
interview, organization and school didactics.*

Palabras clave— *creatividad, pensamiento
divergente, entrevista, organización y
didáctica escolar.*

Abstract— *Author Ken Robinson talks about how schools kill creativity by producing uncreative students and factory-like classrooms. Creativity should be developed over time, however, it drops drastically in the last years of Primary. To solve this conflict, techniques or ideas are proposed so that students have critical and divergent thinking in their day to day life, although the question would be whether teachers are prepared and, more importantly, what perception they have regarding creativity. That is why the present work exposes a series of interviews with Primary Education teachers and what results are extracted from this experience.*

Resumen— *El autor Ken Robinson habla de cómo las escuelas matan la creatividad formando a alumnos poco creativos, y aulas que parecen fábricas. La creatividad se debería ir desarrollando con el tiempo, en cambio, baja drásticamente en los últimos años de Primaria. Para solucionar este conflicto se proponen técnicas o ideas para que los alumnos tengan un pensamiento crítico y divergente en su día a día si bien la duda sería si los docentes están preparados y, más importante si cabe, qué percepción tienen con respecto a la creatividad. Es por ello que el presente trabajo expone una serie de entrevistas a maestras de Educación Primaria y qué resultados se extraen de esta experiencia.*

I. INTRODUCCIÓN

El sistema educativo desde que se conoce ha transmitido sus conocimientos de manera magistral, es decir, la batuta la lleva el maestro y el alumno simplemente se dedica a escuchar la lección, tomar apuntes y memorizar. La escuela que anteriormente dio resultados ahora se ve obsoleta por los cambios que se están produciendo en la sociedad, y por lo tanto este tipo de docencia magistral ya no tendría cabida en la actualidad. Una clase donde se imparte una docencia en la cual los alumnos reciben la información de forma pasiva,

la redactan en un examen finalmente no saben usarla en su día a día, es la consecuencia de que no exista un aprendizaje significativo. Lo que es evidente es que esta realidad la podemos transformar, y enseñar a los alumnos a pensar de forma crítica, lógica, centrada en su propio descubrimiento, es desarrollar sus habilidades personales y sociales... Este tipo de enseñanza es posible teniendo en cuenta que todos somos personas creativas, y que desarrollar esta capacidad es la manera que tenemos para revertir la situación actual y fomentar la enseñanza significativa. Cabe añadir que todos los implicados en el

contexto educativo tienen que poner su granito de arena, es decir, el centro tiene que proporcionar materiales que fomenten la creatividad, el docente tiene que alentar al alumno a dar su opinión, a dejar un tiempo prudente para que piense y razone, y los padres en las casas tienen que seguir el ritmo que se lleva en las aulas. El pensamiento divergente y convergente de Gardner debería ser un pilar fundamental que todos y todas las docentes deberían conocer y saber cómo introducirlo en las escuelas y como desarrollarlo.

Para averiguar esta situación, se ha realizado un estudio de casos basado en tres entrevistas a maestras de Educación Primaria las cuales se exponen a continuación:

II. MAESTRA ENTREVISTADA A

1. ¿Qué piensas acerca de la creatividad?

Pienso que la creatividad es una capacidad que tenemos todos los seres humanos en mayor o menor medida. Según tengo entendido son varios los autores los que aseguran que la creatividad va disminuyendo con los años. Es en los primeros años de la Primaria donde parece que esta capacidad está más desarrollada, ¿O no vemos a los niños inventar miles de historias?

2. ¿Piensas que su aplicación en el aula es importante?

Considero que es muy importante este aspecto, y siguiendo un poco con lo anteriormente dicho, si no queremos que los niños pierdan su creatividad en la vida adulta los docentes deben fomentar esta capacidad. Es complicado introducirla dentro del aula ya que considero que el curriculum es bastante cerrado, pero se pueden transformar pequeñas cosas para que se consiga un mayor fomento de la creatividad.

3- ¿Has sido formado/a sobre los aspectos relacionados con la creatividad en cuanto a marco teórico y usos en el aula?

Me he informado y he realizado algunos cursos sobre este tema. Ken Robinson me ha inspirado mucho para intentar abordar este tema en el aula, ya que considero que es fundamental para el desarrollo del alumnado que un profesor sea también creativo dentro del aula.

4. Atendiendo a tus experiencias previas en el sistema educativo, ¿has percibido un proceso de enseñanza aprendizaje orientado en el trabajo de la creatividad?

En ningún momento considero que dentro del aula se fomenta la creatividad. Intentaré explicarme mejor poniendo algunos ejemplos. En algunas ocasiones como maestros, y por comodidad, le decimos a nuestros alumnos con puntos y comas cómo tienen que realizar los ejercicios, por ejemplo: en la libreta cuando los alumnos

tienen que copiar los enunciados y realizar la tarea, nosotros como maestros, decidimos que todos lo hagan iguales con los mismos colores y no damos la oportunidad de que creen su propio trabajo.

Por otro lado considero que confundimos las diferentes metodologías (que no sea la tradicional) con hacer cosas creativas. Bajo mi punto de vista, hacer una metodología basada en el ABP absolutamente guiada no es fomentar la creatividad, es simplemente cambiar de metodología.

5. Atendiendo nuevamente a experiencias previas, ¿piensas que la evaluación era adecuada para atender a posibles respuestas creativas?

La evaluación tal y como la entendemos no. También considero que evaluar un proceso creativo es bastante complejo, ya que es bastante subjetivo y la evaluación educativa es más objetiva, por lo que se crea un conflicto de intereses. Considero que un proceso creativo es más importante el resultado final y que tenga verdadera utilidad, relacionándose en bastante medida con el pensamiento divergente, en cambio, la evaluación educativa se centra más en el proceso y si el resultado no es válido para las demás áreas no importa.

6. ¿Y el sistema educativo actual? ¿Piensas que aborda adecuadamente el trabajo de la creatividad?

En absoluto, Ken Robinson habla de que las escuelas “matan la creatividad”. Ví en un video suyo una especie de experimento que hacía con un clip, venía a decir lo siguiente: Él preguntó a una gran número de niños “¿qué harían con un clip?” el 98% contestó más de 200 respuestas creo recordar, en cambio, conforme iba preguntando a un grupo mayor la cantidad de respuestas disminuyen en gran medida. Creo que este ejemplo define claramente mi manera de ver la escuela en lo relacionado a la creatividad.

7. ¿Tienes constancia de algunas lagunas de atención a la diversidad que puedan aparecer en caso de no abordar la creatividad de manera correcta en el aula?

En estos momentos no, pero considero que dentro de la atención a la diversidad que ofrecemos dentro del aula la creatividad y fomentar el mundo interior de los alumnos es fundamental.

8. ¿Conoces cómo abordar la creatividad en tu aula?

Abordar la creatividad dentro del aula es complicado, pero como docentes, debemos empezar a dejar de pensar en la escuela como la entendíamos antes, es decir, como un método recto de que los niños aprendan todos de la misma manera, ¿acaso no existe la diversidad? no todos aprenden de la misma manera ¿por qué agrupamos a los alumnos por edades, y no por intereses o por capacidad cognitiva?. Debemos empezar a cambiar pequeñas cosas para hacer

que los alumnos sean creativos y como consecuencia críticos con el mundo que les rodea

9. ¿Conoces cómo atender a niños con altas capacidades creativas?

No tengo los conocimientos suficientes para atender a estos alumnos, pero lo que sí tengo claro es que cuando a un alumno por ejemplo se le da bien la música y mal las matemáticas no debemos castigarlo con un refuerzo excesivo de aquello que no domina, sino con un refuerzo positivo fomentando aquello que sí le gusta hacer

10. ¿Podrías indicar las funciones que puede tener un profesor en el aula cuando se enfrenta al trabajo de la creatividad?

En primer lugar considero que un profesor sin iniciativa, sin creatividad, sin ilusión... no puede afrontar el trabajo creativo que implica un aula de Primaria. Para ello debe tener aptitudes más que suficientes para fomentar esta capacidad, por ejemplo, teniendo en cuenta las nuevas tecnologías, informándose sobre temas de actualidad...

III. MAESTRA ENTREVISTADA B:

1. ¿Qué piensas acerca de la creatividad?

La creatividad es un proceso a través del cual se crea o se construye algo nuevo ya sea objeto, ideas o simplemente fantasías, en el cual tiene un papel fundamental la imaginación. Este concepto puede desarrollarse y potenciarse en todos los seres humanos, mientras que los hábitos de los individuos no se vean coartados ya que supondría una mayor dificultad crear representaciones novedosas.

2. ¿Piensas que su aplicación en el aula es importante?

En mi opinión, la aplicación de la creatividad en el aula tiene una gran relevancia. El alumnado debe tener situaciones en las que se aborde y potencie este concepto, para que, de esta manera, la imaginación y la libertad del alumnado juegue un papel fundamental, puedan desarrollar sus actitudes y pensamientos originales, descubran y creen con libertad en el proceso de enseñanza-aprendizaje.

3. ¿Has sido formado/a sobre los aspectos relacionados con la creatividad en cuanto a marco teórico y usos en el aula?

Considero que no he tenido una enseñanza en profundidad de este concepto. A lo largo del Grado de Educación Primaria, he aprendido diversas ideas sobre la creatividad, pero desde una perspectiva mecanizada ya que no he dejado de ser de una forma memorística y no desde la práctica. Sí que es cierto, que en algunas asignaturas concretas como Escritura Creativa o Juegos cooperativos he tenido la oportunidad de llevar a la práctica y desarrollar diversas actividades de este concepto.

4. Atendiendo a tus experiencias previas en el sistema educativo, ¿has percibido un proceso de enseñanza aprendizaje orientado en el trabajo de la creatividad?

Considero que en mi trayectoria educativa la creatividad ha sido escasa. Por tanto, a lo largo de todos mis años como estudiante he comprobado cómo determinadas metodologías y recursos hacen que la imaginación se coarte y desaparezca, consiguiendo así anular la creatividad. De este modo, se repiten numerosas veces las frases “no se dibujar”, “no se me ocurre nada”, que no es más que el resultado de un sistema educativo mecanizado y sistemático en el cual no hay lugar a la imaginación y a la creatividad.

5. Atendiendo nuevamente a experiencias previas, ¿piensas que la evaluación era adecuada para atender a posibles respuestas creativas?

No considero que la evaluación sea adecuada con respecto a la creatividad ya que en el sistema educativo se busca una calificación final, un simple número que evalúe si se ha aprendido memorísticamente una serie de contenidos. Por tanto, se deja a un lado las experiencias creativas, el desarrollo de la imaginación y de este concepto.

6. ¿Y el sistema educativo actual? ¿Piensas que aborda adecuadamente el trabajo de la creatividad?

Pienso que la creatividad no se debe abordar en una hora o momento concreto de la semana dentro de, por ejemplo, una unidad didáctica. Aunque, actualmente, se desarrollan prácticas más innovadoras relacionadas con la creatividad, pienso que no se aborda adecuadamente, ya que considero que se debe trabajar y potenciar de manera global y no simplemente una hora concreta en el aula.

7. ¿Tienes constancia de algunas lagunas de atención a la diversidad que puedan aparecer en caso de no abordar la creatividad de manera correcta en el aula?

No tengo constancia de esto, ya que, a lo largo de mi trayectoria estudiantil del Grado de Educación Primaria considero que la enseñanza que he recibido respecto a la atención a la diversidad ha sido muy escasa y, desde mi punto de vista, pienso que como docente es necesario tener más conocimientos al respecto. Por tanto, aunque no me conste si existen lagunas de atención a la diversidad, sí considero que las haya en el aula de forma general como he explicado en la pregunta anterior.

8. ¿Conoces cómo abordar la creatividad en tu aula?

Personalmente, pienso que la creatividad debe abordarse desde la libertad y confianza con el alumnado. El aula debe ser un lugar en el que el alumnado sienta que puede desarrollar sus ideas propias y pueda expresarse, siendo

partícipes de su proceso de enseñanza-aprendizaje y no simplemente un mero espectador.

9. ¿Conoces cómo atender a niños con altas capacidades creativas?

No conozco cómo atender al alumnado con altas capacidades ya que, como he explicado anteriormente, no he recibido ningún tipo de enseñanza sobre esto durante el Grado de Educación Primaria.

10. ¿Podrías indicar las funciones que puede tener un profesor en el aula cuando se enfrenta al trabajo de la creatividad?

Como he mencionado anteriormente, pienso que la creatividad debe ser trabajada de forma global y permanente y no en un momento concreto dentro de una programación. Para llevar a cabo el trabajo de la creatividad, el docente debe desarrollar metodologías y recursos que potencien y desarrollen este concepto y evitar métodos y actitudes que la coarten. En el clima en el que se desarrolle la creatividad juega un papel importante la libertad y, a su vez, la tolerancia por parte del docente, respetando ideas, pensamientos y cuestiones del alumnado, hacerles ver el valor que tienen sus ideas y fomentando el aprendizaje espontáneo. Por tanto, considero que el docente debe de ser flexible e innovador, dejando lugar a la toma de decisiones por parte del alumnado y a sus propias iniciativas.

IV. MAESTRA ENTREVISTADA C

1. ¿Qué piensas acerca de la creatividad?

Mi pensamiento acerca de este término es, que se trata de una capacidad que poseen los seres humanos que se debe reforzar y trabajar a lo largo de la vida. La creatividad es un talento que permite responder de maneras diferentes a un mismo suceso, problema, ejercicio, situación... Es por ello que considero que la creatividad no es algo innato, sino más bien una habilidad que puede verse fortalecida si se ejercita a menudo.

1. ¿Piensas que su aplicación en el aula es importante?

Indudablemente. Considero que los docentes deben dejar espacio en el aula a los pensamientos de los alumnos, así como dotar a los mismos de estrategias que despierten el entusiasmo por crear y ser partícipes del proceso de enseñanza-aprendizaje. Para ello pienso que es importante permitir a los alumnos fallar, equivocarse y no temer al error como sucede asiduamente. Los alumnos deben sentirse seguros en el aula, así como desenvolverse en ella libremente y no sentir vergüenza a la hora de expresar sus ideas, o llevar a cabo sus actos, porque, desde mi punto de

vista, en esos pequeños detalles comienza la coartación de su creatividad.

1. ¿Has sido formado/a sobre los aspectos relacionados con la creatividad en cuanto a marco teórico y usos en el aula?

Sí, a lo largo del Grado en Educación Primaria he conocido algunas nociones sobre el término, sobretodo en asignaturas como Psicología de la Educación y Psicología del Desarrollo. Asimismo, he visto algunos vídeos de Ken Robison y las escuelas en Finlandia, proyectados por varios docentes de otras asignaturas.

1. Atendiendo a tus experiencias previas en el sistema educativo, ¿has percibido un proceso de enseñanza aprendizaje orientado en el trabajo de la creatividad?

No, desafortunadamente creo que mi generación ha recibido una enseñanza absolutamente tradicional caracterizada por clases magistrales, en las cuales el recurso protagonista del aula ha sido principalmente el libro de texto. En mis experiencias previas como alumna del sistema educativo español, he podido observar que en la mayoría de ocasiones nuestro aprendizaje ha sido muy mecanizado y repetitivo, y nuestra preocupación ha sido exclusivamente la calificación a obtener. De esta manera, no existe una motivación intrínseca por aprender, y es por ello que muchas veces contemplamos el sistema educativo con connotaciones negativas.

1. Atendiendo nuevamente a experiencias previas, ¿piensas que la evaluación era adecuada para atender a posibles respuestas creativas?

Como he comentado anteriormente, nuestro aprendizaje ha ido encaminado únicamente a obtener buenas calificaciones, descuidando por tanto el proceso de aprender. Por ello, y atendiendo a mis experiencias previas, no considero que los sistemas de evaluación fueran los adecuados para favorecer la creatividad.

¿Y el sistema educativo actual? ¿Piensas que aborda adecuadamente el trabajo de la creatividad?

Respecto al actual sistema educativo considero que se han dado grandes pasos y con ellos, se ha conseguido avanzar hacia una escuela más creativa. Sin embargo, creo que siguen siendo insuficientes y esto se debe a la herencia de todos y cada uno de los aspectos del sistema educativo de años anteriores. Es por ello que, no creo que se aborde de manera correcta la creatividad en las actuales escuelas.

1. ¿Tienes constancia de algunas lagunas de atención a la diversidad que puedan aparecer en caso de no abordar la creatividad de manera correcta en el aula?

Aunque no me conste, ni haya vivido alguna situación en primera persona al respecto, sí creo que puedan haber lagunas con la diversidad en las aulas. Si no se aborda la creatividad de manera correcta, la totalidad de los alumnos son susceptibles de ver su proceso creativo estancado. De esta manera, si un alumno que no presenta dificultades específicas puede verse afectado por una mala docencia o falta de estímulos necesarios para desarrollar la creatividad, otro alumno que sí las tiene también y con mayor motivo.

1. ¿Conoces cómo abordar la creatividad en tu aula?

Considero que se debe hacer desde una perspectiva en la que prime la libertad de expresión así como de actuación, como he dicho anteriormente, dejando un amplio espacio a los pensamientos de los alumnos y ejercitarlos mediante debates, asambleas, autoevaluaciones y actividades en las que los alumnos puedan manifestar sus sensaciones.

1. ¿Conoces cómo atender a niños con altas capacidades creativas?

No, puesto que no he recibido ningún tipo de enseñanza en ese aspecto, aunque conozca ciertos aspectos acerca del concepto, no sé cómo se lleva a la práctica con niños de altas capacidades.

1. ¿Podrías indicar las funciones que puede tener un profesor en el aula cuando se enfrenta al trabajo de la creatividad?

Mi experiencia como estudiante me lleva a pensar que la creatividad en el aula se debe estimular a cada momento, consciente e inconscientemente debe trabajarse a lo largo de toda la jornada escolar. Para ello, considero que es importante abordarla mediante debates en clase, en los que se deje paso a las opiniones de los alumnos mayoritariamente, dejarlos pensar en voz alta, que se expresen libremente... También creo que se deben evitar comparaciones por parte del docente, evidenciando que todas las opiniones son válidas e incluso pueden tener relación. Por otra parte, los retos, problemas o desafíos son una buena herramienta para fomentar la creatividad, así como las actividades o tareas de respuesta libre. Y por último, considero fundamental desarrollar hábitos como leer, ver películas e incluso fomentar las salidas y excursiones, ya que me parece que todas ellas son experiencias que enriquecen el conocimiento y este mismo aviva la creatividad.

V. RESULTADOS Y CONCLUSIONES

Con relación a la primera cuestión de la entrevista, toda la muestra relacionaba —directamente— la creatividad con una capacidad humana. Una de las entrevistadas (A), asegura que hay una degeneración de dicha capacidad, la

cual, a su vez, puede ser entrenada, atendiendo a la información obtenida de la entrevistada C. A su vez, B, establece una relación inversamente proporcional entre la capacidad de creatividad y la posibilidad de encontrarse limitado —socialmente—

Ante la segunda cuestión, la entrevistada A, hace referencia a un aspecto que ya recogía C en la anterior respuesta, la creatividad puede —debe— ser trabajada. En este sentido, asegura que hay limitaciones claras atendiendo al currículo vigente.

La entrevistada B, hace ver la gran importancia de la creatividad en el aula, asegurando que se debe propiciar en el alumnado a través de diversas dinámicas, compartiendo ideas con C quien, además, añade la trascendental importancia que se ve reflejada en el clima tranquilo, relajado y cordial del aula (no existiendo por tanto limitantes en la participación de los alumnos).

Con respecto a la pregunta 3, las entrevistadas B y C coinciden en la formación de nociones principales acerca de la creatividad durante su Grado de Educación Primaria. A su vez, la entrevistada B puntualiza una escasa formación, sin profundidad, de este concepto en dicha formación, lo que es directamente proporcional a la respuesta de la entrevistada A, ya que asegura que la formación que ha recibido ha sido por interés y curiosidad propia.

En relación a la pregunta 4, la entrevistada C asegura que su proceso de enseñanza-aprendizaje no ha estado orientado en el trabajo de la creatividad, lo que se relaciona con la respuesta de la entrevistada B en la pregunta 3. A su vez, la entrevistada A coincide en no haber tenido una enseñanza creativa, a lo que añade el concepto erróneo de creatividad que aplican diversos docentes en el aula. Por lo tanto, las tres entrevistadas confirman no haber percibido procesos creativos según sus experiencias previas.

En cuanto a la pregunta 5, las entrevistadas A, B y C coinciden en que la evaluación no es adecuada para atender a posibles respuestas creativas, puntualizando las entrevistadas B y C que el sistema educativo es mecanizado y repetitivo. La entrevistada B, asegura que el sistema educativo evalúa procesos memorísticos simplemente lo que coincide con la respuesta de la entrevistada C en la pregunta 4. A su vez, la entrevistada A añade las limitaciones existentes sobre esta cuestión, puesto que asegura que el proceso de evaluar procesos creativos es muy complejo.

Siguiendo con la pregunta 6, entrevistadas A, B y C coinciden en que el actual sistema educativo no aborda de forma satisfactoria la creatividad, a pesar de lograr avances con metodologías más innovadoras, tal y como afirman las

entrevistadas B y C, estos avances siguen siendo insuficientes para ellas. Asimismo, la entrevistada A, no solo afirma que no se trabaja adecuadamente, sino que subraya el titular de Ken Robinson, señalando que las escuelas matan la creatividad.

Haciendo referencia a la pregunta 7, ninguna de las entrevistadas afirma tener constancia sobre las lagunas que puedan surgir en cuanto a la atención a la diversidad en caso de no abordar la creatividad de manera correcta. En este caso, la entrevistada B puntualiza que no la tiene por la escasa formación recibida, la entrevistada C señala que a pesar de no tener constancia, considera que sí pueden surgir lagunas, mientras que A pone de manifiesto la importancia de atender adecuadamente a la diversidad para evitar que se propicie esta situación.

A propósito de la pregunta número 8, las respuestas de las entrevistadas B y C son muy similares, coincidiendo ambas en que lo primordial para desarrollar aulas creativas es dejar espacio a la libertad de los alumnos, tanto a la hora de actuar como de expresarse. La entrevistada A por su parte, propone algunos cambios como la agrupación en las aulas atendiendo a intereses u otros aspectos diferentes a la edad, tal y como se viene haciendo tradicionalmente.

Seguidamente, con respecto a la pregunta 9, las tres entrevistadas coinciden en no tener conocimientos para atender al alumnado con altas capacidades creativas. A su vez, la entrevistada A añade que se debería aplicar un refuerzo positivo en el alumnado que desarrolle de manera eficaz aquellas asignaturas que les gustan, y no un castigo por aquellas otras áreas que no dominen de la misma manera.

Por último, en cuanto a las funciones del docente cuando se enfrenta al trabajo de la creatividad, entrevistadas B y C hacen hincapié en que este mismo lo debe hacer permanentemente y no como algo pasajero o puntual, de manera que la creatividad sea abordada globalmente. La entrevistada A además hace referencia a la ilusión, y por tanto, la vocación que deben poseer todos los docentes a la hora de desarrollar esta capacidad en los menores.

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Quality of Pumpkin Fruits in Different Soil Managements

Qualidade dos Frutos de Abóbora em diferentes manejos do solo

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Keywords— *Post-harvest, degraded
areas, growth.*

Abstract— *To mitigate the effects of conventional agriculture, aiming at the sustainability of the ecosystem, it is necessary to use techniques that preserve the environment, reconciling food production with the reduction of environmental impacts in a sustainable way. In this sense, carrying out the cultivation keeping the native forest can be an alternative for maintaining sustainability in agricultural systems. Therefore, the objective of this work was to evaluate the postharvest quality of three pumpkin varieties (*Cucurbita moschata*) submitted to different soil management, aiming to obtain subsidies for the establishment of a promising management of this vegetable under field conditions. The study was carried out in an area located in the municipality of Acarape, Ceará, where two cultivation systems and three pumpkin cultivars were used, distributed in a*

Palavras-chave— Pós-colheita, áreas degradadas, crescimento.

split-plot scheme. Longitudinal (DL), transversal (DT), internal cavity (DCI), pulp firmness (FP), peel (CE) and pulp (EP) thicknesses were evaluated. The environmental factor influenced the longitudinal diameter and firmness of the pulp. Furthermore, higher values of pulp firmness were observed in pumpkin cultivars when cultivated in both cultivation environments. On the other hand, the moranga and jacarezinho cultivars presented the lowest values. In relation to the longitudinal diameter of the fruits, the sergipana cultivar was larger when cultivated in conventional and alley environments, respectively. On the other hand, cultivars moranga and Jacarezinho presented the lowest values in both cultivation environments. It is verified that for the diameter of the inner cavity of the fruits, the Sergipe cultivar obtained lower values when cultivated in the environment in alleys. When comparing the two cultivation environments, when verifying the fruits of pumpkins cultivated in the conventional environment, the color of the fruits suffered a greater oxidation of vitamins and beta-carotenes, with darker pulp colors in relation to the alley environment, interfering in all three. color luminosity parameters (L^*), chromaticity (C^*) and hue angle (H°). Given the above, it is necessary to adopt conservation practices for agriculture in order to reduce the harmful effects on the environment. For this, it is recommended to grow pumpkin in an alley environment for greater protection of the environment and the soil.

Resumo— Para mitigar os efeitos da agricultura convencional, visando à sustentabilidade do ecossistema, é necessária a utilização de técnicas que preservem o meio ambiente, conciliando a produção de alimentos com a redução dos impactos ambientais de forma sustentável. Nesse sentido, a realização de cultivos mantendo a mata nativa pode ser uma alternativa para a manutenção da sustentabilidade em sistemas agrícolas. Portanto, objetivou-se com este trabalho, avaliar a qualidade pós-colheita de três variedades de abóbora (*Cucurbita moschata*) submetidas a diferentes manejos de solo, com vistas à obtenção de subsídios para estabelecimento de um manejo promissor dessa hortaliça em condições de campo. O estudo foi realizado em uma área localizada no município de Acarape, Ceará, onde utilizou-se dois sistemas de cultivo e três cultivares de abóbora, distribuídas em um delineamento de parcelas subdivididas. Foram avaliados os diâmetros longitudinais (DL), transversal (DT), da cavidade interna (DCI), a firmeza da polpa (FP), a espessura da casca (EC) e da polpa (EP) e a coloração. O fator ambiente influenciou o diâmetro longitudinal e a firmeza da polpa. Além disso, maiores valores de firmeza da polpa foram observados nas cultivares moranga quando cultivada nos dois ambientes de cultivo. Por outro lado, as cultivares moranga e jacarezinho foram as que obtiveram menores valores. No que diz respeito ao diâmetro longitudinal dos frutos a cultivar sergipana apresentou maiores, quando cultivada no ambiente convencional e de aleias, respectivamente. Por outro lado, as cultivares moranga e jacarezinho foram as que obtiveram menores valores nos dois ambientes de cultivo. Verifica-se que para o diâmetro da cavidade interna dos frutos, a cultivar sergipana obteve menores valores quando cultivada no ambiente em aleias. Quando comparado os dois ambientes de cultivo, ao verificar os frutos de abóboras cultivadas no ambiente convencional, a coloração dos frutos sofreu uma maior oxidação de vitaminas e betacarotenos, apresentando cores de polpa mais escuras em relação ao ambiente de

aleias, interferindo nos três parâmetros de cores luminosidade (L^), cromaticidade (C^*) e ângulo Hue (H°). Diante do exposto, é necessária a adoção de práticas conservacionistas pela agricultura com o intuito de diminuir os efeitos deletérios ao meio ambiente, para isso recomenda-se o cultivo de abóbora em ambiente de aleias para uma maior proteção do meio ambiente e do solo.*

I. INTRODUÇÃO

Com o crescimento da população mundial, a demanda por novas áreas para agricultura e pecuária também está aumentando, levando a uma maior quantidade de áreas desmatadas¹. Uma das principais consequências dessas perturbações é a fragmentação de ecossistemas naturais, levando a alterações tanto nos fatores abióticos, quanto nos bióticos. Um dos maiores desafios desde séculos passados, à conservação da biodiversidade, vem tomando ênfase no cenário mundial dos últimos anos. Projetos sustentáveis e agroecológicos vêm sendo desenvolvidos a fim de reduzir os impactos deletérios do manejo inadequado dos ecossistemas naturais².

Dentre os ecossistemas naturais, cerca de 40% do globo terrestre está ocupado pelas florestas tropicais e subtropicais, entre as quais 42% são compreendidas pelas florestas secas, onde se inclui a Caatinga. O domínio do bioma Caatinga abrange cerca de 800 mil Km², correspondendo aproximadamente a 54% da região Nordeste e 11% do território brasileiro³. Apenas nas últimas três décadas é que este bioma vem sendo estudado de forma mais aprofundada, constatando-se sua relevância a partir do conhecimento da sua alta biodiversidade além de suas potencialidades⁴.

A exploração do bioma Caatinga teve início com o processo de colonização do Brasil, inicialmente como consequência da pecuária bovina, associada às práticas agrícolas rudimentares, como por exemplo, a prática das queimadas⁵. O resultado dessa exploração, que se intensifica nos dias de hoje, vem provocando impactos ambientais de grande magnitude, cujas consequências exigem intervenção imediata no sentido de amenizar os problemas daí decorrentes⁶.

Atualmente, existe uma necessidade de minimizar os impactos ambientais sendo necessária a adoção de práticas agrícolas seguindo os princípios da agricultura sustentável, com base agroecológica. Além disso, as práticas sustentáveis reduzem o efeito negativo sobre o ambiente, ocasionando o mínimo de impacto aos recursos naturais. Esse sistema de cultivo também diminui a utilização de insumos químicos, sendo este, um dos fatores contaminantes do ecossistema. Levando em consideração esses atributos, a agroecologia e seus sistemas de cultivo

preconizam a conservação dos recursos naturais como o aumento na biodiversidade⁷.

Em virtude da não conservação do ecossistema em função da agricultura convencional. Uma das alternativas que vem sendo bastante utilizada são os sistemas agroflorestais. Esses sistemas visam à utilização dos recursos naturais de forma mais sustentável, pois mantêm a diversidade de espécies cultivadas em harmonia com a vegetação nativa, preservando a biodiversidade local. Vale ressaltar que a forma de cultivo agroecológico quando comparado ao modelo convencional, possui uma maior eficiência na conservação dos solos, promovem a diminuição nos riscos de erosões e atuam na manutenção da matéria orgânica⁸.

No que diz respeito à qualidade dos frutos, as exigências dos consumidores e a procura de frutos de boa qualidade e livres de doenças vêm aumentando a cada ano. A qualidade destes é atribuída ao seu tamanho, forma e cor da casca, cujos fatores, associados à composição físico-química da polpa, oferecem aos frutos e aos produtos deles obtidos melhor qualidade sensorial e nutricional, responsáveis por sua aceitação definitiva no mercado⁹. A manutenção dessas características que conferem ao fruto uma boa qualidade depende do conhecimento da estrutura, da fisiologia e das transformações metabólicas (mudanças físicas, físico-químicas, fisiológicas e bioquímicas) que ocorrem no ciclo vital da planta¹⁰.

Uma forma de buscar a sustentabilidade agrícola é a realização do cultivo de hortaliças associado à mata nativa, podendo as espécies de cucurbitáceas serem utilizadas nesta prática. O gênero cucurbita é representado por várias espécies cultivadas destacando-se, entre elas, o jerimum (*Cucurbita maxima*), o qual é nativo das Américas e sua importância, relaciona-se, principalmente, ao valor alimentício e versatilidade culinária dos frutos.

Nesse sentido objetivou-se com este trabalho avaliar a qualidade dos frutos de abóbora (*Cucurbita moschata*) submetida a diferentes manejos de solo. Tais objetivos são com vistas à obtenção de subsídios para estabelecimento de um manejo promissor dessa hortaliça em condições de campo.

II. METODOLOGIA

O experimento foi realizado em uma área localizada no município de Acarape, Maciço de Baturité - CE, a uma latitude de 04°13'27"S, longitude de 38°42'30"W e altitude média variando de 70 a 100 m. O clima do local é classificado como Bsh, ou seja, semiárido quente, caracterizado por escassez de chuvas e grande irregularidade em sua distribuição¹¹.

2.1 Delineamento experimental e tratamentos

Foram utilizados dois sistemas de cultivo e três cultivares de abóbora, distribuídas em delineamento de parcelas subdivididas e inteiramente casualizadas. As parcelas foram compostas por dois sistemas de cultivos: cultivo convencional (cultivo da abóbora na ausência de espécies arbóreas) e cultivo em aleias (cultivo da abóbora em associação com plantas arbóreas nativas). As subparcelas foram formadas pelas cultivares jacarezinho, moranga e sergipana.

Cada sistema foi implantado em uma área de 50 x 24 m, e foi definido o espaçamento entre as linhas de árvores de 10 m, ficando cinco linhas de árvores por sistema. As cultivares de abóbora foram semeadas em espaçamento de 2,5 x 0,5 m, com quatro linhas de plantio com oito metros de comprimento cada uma. Cada tratamento foi composto de quatro repetições e foram considerados nas avaliações os quatro metros centrais das duas linhas do meio de cada subparcela.

2.2 Levantamento florístico

Antes de iniciar o experimento foram coletados, com o auxílio de tesoura de poda e podão, ramos vegetativos e/ou reprodutivos com 30 cm de comprimento, das espécies arbóreas arbustivas pertencentes à cada uma das áreas que foram usadas no estudo. Esta coleta botânica foi realizada conforme o modelo preconizado¹². Com esse material botânico foi montado exsicatas (amostra de planta seca e prensada numa estufa, fixada em uma cartolina de tamanho padrão acompanhada de uma etiqueta contendo informações sobre o vegetal e o local de coleta, para fins de estudo botânico), segundo a técnica usual¹³. O material botânico foi depositado no herbário Prisco Bezerra para sua devida identificação, onde se mantém depositado para possíveis estudos sob o código EAC 62604.

2.3 Escolha da área, montagem e condução do experimento

Inicialmente foram separadas na área vegetada da propriedade duas áreas próximas com medidas de 50 x

24m cada, tomando-se o cuidado de nas duas áreas existirem as mesmas características de solo e vegetação. Após escolhida as duas áreas de cultivo, optou-se por fazer a retirada da vegetação da área menos densa. Nesta área foi realizado o plantio das plantas de abóbora de modo convencional, enquanto na outra área manteve-se as plantas nativas para o cultivo em aleias. Nesta última foi realizado um desmatamento planejado que consiste na permanência de todas as árvores presentes no espaçamento de 7,5 metros, a fim de associar o cultivo da abóbora com as espécies nativas da área de estudo.

2.4 Produção de mudas e plantio

As mudas de abóbora (*Cucurbita* spp) foram produzidas em bandejas de isopor tendo como substrato uma mistura de esterco bovino e bagaço de coco (1:1). As mudas dispostas nas bandejas foram armazenadas em uma estufa improvisada, feita de uma armação de ferro e coberta com plástico, a fim de criar um microclima agradável para propiciar um melhor enraizamento. Aos 15 dias após a semeadura, quando as mudas apresentarem uma folha definitiva, foi realizado o transplante das mudas para o campo. A reposição hídrica foi feita por regas manuais, à medida que houve a necessidade, com 10-30% da capacidade de retenção do substrato.

2.5 Sistema de Irrigação

Para irrigação das áreas 1 e 2 foi utilizada água proveniente de um açude localizado na propriedade onde foi realizado o experimento. O sistema de irrigação utilizado foi por gotejamento. Durante o experimento a água foi conduzida da fonte até as plantas, por meio de tubos, eliminando as perdas por condução e minimizando as perdas por percolação. Outra redução das perdas d'água ocorre em função da não existência de dispositivo na extremidade dos microtubos para dissipação da água e pressão, o que contribuiria para o processo de evaporação¹⁴. O sistema de irrigação foi composto pelos seguintes componentes uma moto bomba de três cv, tubulação de pvc azul de 50 milímetros, registro de 50 milímetros, chula e adaptador de fita de 20 milímetros, fita de bulbo molhado de 30x30 centímetros e vazão de 1,5 L h⁻¹.

2.6 Tratos culturais

Os tratos culturais realizados são aqueles indicados para o cultivo da abóbora na região Nordeste¹⁵. Durante a condução do experimento foi realizada a aplicação de extratos naturais no controle de pragas da cultura da abóbora, na qual, foram observadas a presença de pulgões, lagartas e formigas. Os extratos utilizados foram¹⁶: extrato de alho, óleo mineral e detergente neutro, e extrato de castanha de caju mais álcool 70% na proporção de 1:10¹⁷.

Para determinação da massa seca da parte aérea (MSPA) e Caule (MSC), os órgãos vegetais separados foram colocados em estufa com circulação forçada de ar, a 65°C até massa constante. Os dados foram expressos em gramas. Após a coleta da parte aérea das plantas, as raízes foram retiradas, lavadas, identificadas, e colocadas para secar em estufa, com circulação forçada de ar, a 65°C até massa constante para determinação da massa seca da raiz (MSR).

2.7 Qualidade dos frutos

Aos 105 dias de plantio os frutos foram coletados em campo, no período da manhã, e acondicionados em sacos identificados, para serem transportados para o Laboratório de Fisiologia e Tecnologia Pós-Colheita, da Embrapa Agroindústria Tropical, em Fortaleza, CE, onde foram feitas as avaliações de qualidade.

Ao chegar no laboratório os frutos foram pesados e abertos para as demais determinações. Inicialmente, procedeu-se as determinações físicas nos frutos: diâmetros longitudinal (DL), transversal (DT), da cavidade interna (DCI), a espessura da casca (EC), da polpa (EP), com o auxílio de um paquímetro digital solar Caliper.

2.8 Coloração e Firmeza

Após as determinações físicas, os frutos foram utilizados para a determinação da coloração. Para isso, foi utilizado o calorímetro da marca minolta CR-410 (Figura 1A), com iluminação D65, realizando-se as leituras de L (luminosidade), a*, b*, sendo estes transformados em C* (Cromaticidade), utilizando a fórmula $(C = \sqrt{a^{*2} + b^{*2}})$ e h° (ângulo de cor) pela fórmula $h^{\circ} = tg^{-1} * b^{*} / a^{*}$. Nesse espaço de cores o L* indica luminosidade, o C* indica o “croma” e o H° é um ângulo de tonalidade. O valor de croma C* é 0° no centro e aumenta conforme a

distância deste. O ângulo de tonalidade H° inicia-se no eixo +a* e é dado em graus; 0° seria +a* (vermelho), 90° seria +b* (amarelo), 180° seria - a (verde) e 270° seria -b* (azul)¹⁸.

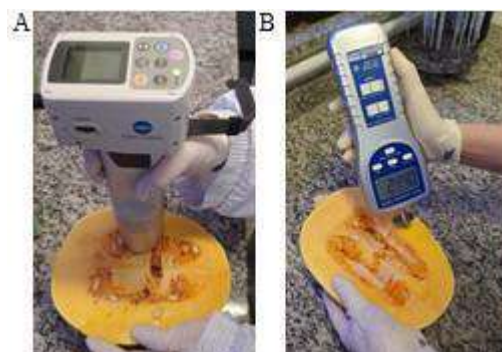


Fig. 1: Determinação da coloração (A) e firmeza (B) em frutos de abóbora utilizando o Calorímetro Minolta CR-410, e o Penetrômetro PTR-300 2021.

Após a determinação da coloração, a firmeza da polpa foi realizada em ambos os lados na região equatorial do fruto, com o auxílio do penetrômetro digital modelo PTR-300 com uma ponteira de 6 mm, sendo os dados expressos em Newton (N) (Figura 1B).

2.9 Análise estatística

Os dados obtidos foram submetidos à análise de variância pelo teste F ao nível de 5% de probabilidade através do software “ASSISTAT 7.5 BETA” e a análise de regressão para os dados em que ocorreram efeitos significativos¹⁹.

III. RESULTADOS E DISCUSSÃO

3.1 Dados biométricos dos Frutos

Tabela 1: Análise de variância do quadrado médio para as determinações da análise dos frutos de cultivares de abóbora (sergipana, jacarezinho e moranga) quando avaliado as seguintes variáveis: diâmetro longitudinal (DL), diâmetro transversal (DT), diâmetro da cavidade interna (DCI), firmeza da polpa (FP) em Nilton, espessura da casca (EC) e espessura da polpa (EP), Acarape - CE, 2021.

Fonte de Variação	de	Quadrado Médio						
		GL	DL (mm)	DT (mm)	DCI (mm)	FP (N)	EC (mm)	EP (mm)
Blocos	3		4,0308 ^{ns}	0,8024 ^{ns}	0,9222 ^{ns}	12,9850 *	0,9150 ^{ns}	0,4205 ^{ns}
Ambiente (A)	1		669,8706**	0,2606 ^{ns}	0,2011 ^{ns}	706,8537 **	0,0060 ^{ns}	4,9334 ^{ns}
Resíduo (a)	3		12,93197	687,47578	110,47399	3,26418	0,19344	17,76024
Parcelas	7		8857,92207	3896,39494	659,27679	2444,24344	1,11245	163,30317
Cultivares (B)	2		417,7266**	0,9536 ^{ns}	3,2251 ^{ns}	22,8670 **	2,8831 ^{ns}	10,5544 **

Interação AxB	2	106,1992**	0,3879 ^{ns}	4,2117 *	42,9872 **	1.4467 ^{ns}	0,6454 ^{ns}
Resíduo (b)	12	26,73916	305,69606	40,58405	11,59265	0,26676	12,97771
Total	23	37197.46056	8384,90447	1749,91276	4110,20623	6,62352	609,73123
CV (A)	-	3,11	18,90	14,63	4,84	42,19	14,32
CV (C)	-	4,47	12,60	8,87	9,13	49,54	12,24

** significativo ao nível de 1% de probabilidade ($p < .01$); * significativo ao nível de 5% de probabilidade ($.01 \geq p < .05$); ^{ns} não significativo ($p \geq .05$).

Observa-se na Tabela 1 que o fator ambiente influenciou no diâmetro longitudinal e firmeza da polpa, enquanto que o fator cultivar, além das duas variáveis citadas, também influenciou significativamente a espessura da polpa. Quando se observa a interação entre os fatores, não houve diferença significativa no diâmetro transversal, na espessura da casca e da polpa (Tabela 1).

No que diz respeito ao diâmetro longitudinal dos frutos observa-se na Figura 2A, que a cultivar sergipana

apresentou maiores valores desta variável, obtendo médias de 198,77 mm e 116,57 mm, quando cultivada no ambiente convencional e de aleias, respectivamente. Por outro lado, as cultivares moranga e jacarezinho foram as que obtiveram menores valores nos dois ambientes de cultivo. Comparando o diâmetro longitudinal dos frutos do sistema convencional com os de aleias, verificou-se uma maior redução na cultivar sergipana, valor esse equivalente a 59,65% (Figura 2A).

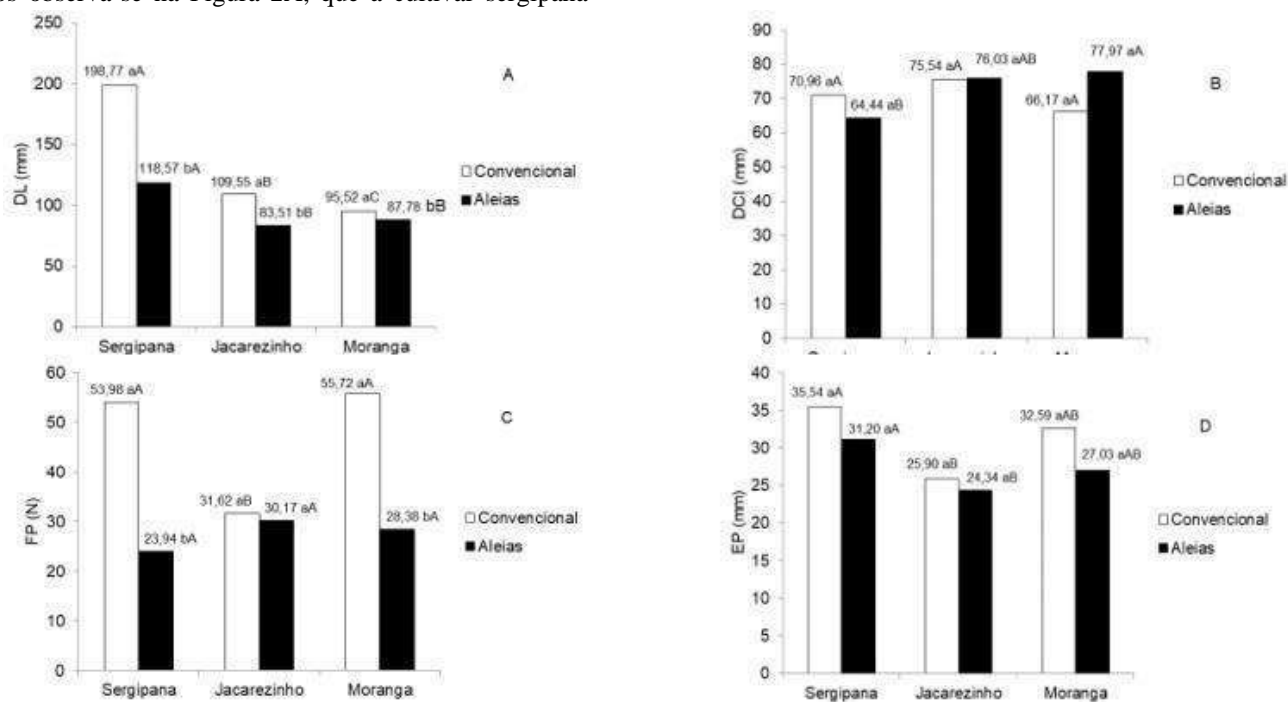


Fig. 2. Valores das interações entre as médias encontradas para as variáveis: diâmetro longitudinal – DL (A), diâmetro da cavidade interna – DCI (B), firmeza da polpa FP – (C) e espessura da polpa – EP (D), em frutos de abóbora das cultivares (sergipana moranga e jacarezinho) em dois ambientes (convencional e aleias), Acarape – CE, 2021.

As medias seguidas pela mesma letra minúsculas para as cultivares de abóbora e maiúsculas nas linhas para os diferentes ambientes de cultivo não diferem estatisticamente entre si. Foi aplicado o teste de Tukey ao nível de 5% de probabilidade.

Verifica-se que para o diâmetro da cavidade interna dos frutos Figura 2B, a cultivar sergipana obteve menores

valores quando cultivada no ambiente em aleias, com uma média de 64,44 mm. Por outro lado, quando se comparou

cada cultivar estudada nos dois ambientes, verificou-se que não houve diferença significativa.

Para a firmeza da polpa Figura 2C as cultivares sergipana e moranga, ambas do ambiente convencional, foram as que obtiveram maiores valores, apresentado médias de 53,98 N e de 55,72 N, respectivamente. Por outro lado, a cultivar sergipana foi a que obteve menor valor, com média de 23,94 N no ambiente com aleias (Figura 2C). Ao comparar cada cultivar estudada nos dois ambientes, verificou-se que a maior diferença foi observada nos frutos da moranga (50,93%), seguida pelos da sergipana (44,34%).

Quando avaliado a espessura da polpa dos frutos Figura 2D a cultivar jacarezinho apresentou menores valores nos dois ambientes de cultivo (convencional e aleias), com médias de 25,90 mm e 24,34 mm, respectivamente. Por outro lado, quando se comparou cada cultivar estudada nos dois ambientes, verificou-se que não houve diferença significativa.

Trabalhando com duas cultivar de abóbora (Taqueira e Leite)²⁰ consorciadas com leguminosas arbóreas em sistemas de aleias e duas doses de biofertilizante (0 e 1,5 L/cova) em São Luís – MA, obteve uma média de 194 mm quando avaliada a cultivar “leite” no tratamento controle, com média de 194 mm, valor esse, semelhantes os encontrados no presente estudo na cultivar sergipana no ambiente de aleias, com média de 198,77 mm (Figura 2A).

Por outro lado, ao trabalhar com a cultivar de abóbora Tetsukabuto Chikara no sistema de cultivo orgânico e convencional em Curitiba – PR²¹, obteve maiores resultados para firmeza da polpa no sistema de cultivo orgânico, com uma média de 71 N. Entretanto, quando observado o sistema convencional obteve menores resultados, com média de 55 N, resultados esses, semelhantes aos que foram encontrados no presente trabalho nos ambientes de cultivo convencional e de aleias, nas cultivares sergipana e moranga, com medias de 53,98 N e 55,72 N, respectivamente (Figura 2C).

Além disso, foi verificado²⁰ que a cultivar “leite” não sofreu influência entre os tratamentos quando avaliada a espessura da polpa, tendo uma média de 23 mm, sendo que, a média encontrada foi semelhante às obtidas pela cultivar jacarezinho que obteve menores valores entre os ambientes e cultivarem estudadas no presente trabalho, com médias de 25,90 mm e 24,34 mm, respectivamente (Figura 2D).

3.2 Dados de coloração

Tabela 2: Análise de variância do quadrado médio obtido pela análise colorimétrica para as determinações da polpa crua dos frutos de cultivares de abóbora (sergipana, jacarezinho e moranga) quando avaliado as seguintes variáveis: luminosidade (L*), cromaticidade (C*) e ângulo de tonalidade (H°), Acarape – CE, 2021.

Fonte de Variação	Quadrado Médio			
	GL	L*	C*	H*
Blocos	3	1,0080 ^{ns}	0,4707 ^{ns}	1,7001 ^{ns}
Ambiente (A)	1	7,9129 ^{ns}	5,2361 ^{ns}	7,6590 ^{ns}
Resíduo (a)	3	13,92256	16,53681	18,89904
Parcelas	7	194,03870	159,54884	297,83627
Cultivares (B)	2	5,6822 *	20,7790 **	4,8630 *
Interação A x B	2	5,3407 *	4,3354 *	7,9788 **
Resíduo (b)	12	14,01034	11,74979	30,92942
Total	23	671,03138	890,72302	1463,36593
CV (A)	-	5,14	8,28	5,79
CV (C)	-	5,16	6,98	7,41

** significativo ao nível de 1% de probabilidade (p < .01). * Significativo ao nível de 5% de probabilidade (.01 =< p < .05). ^{ns} não significativo (p >= .05).

Seguindo o parâmetro da escala de tonalidade de 0 a 100, sendo que zero representa a cor preta e 100 a cor branca, verifica-se que na variável luminosidade (L*) os menores valores observados foram de 66,24 e 72,43, nos frutos da cultivar sergipana e jacarezinho respectivamente, ambas do sistema convencional, tendo uma tendência de ir para cores mais escuras (Figura 3A).

Essa interação entre os diferentes ambientes de cultivo e cultivares pode ter ocorrido pela diferença dos microclimas originados na área experimental. Por conta da permanência de árvores no cultivo de aleias, a temperatura é menor em comparação ao cultivo convencional. A temperatura é um dos fatores que ocasionam a oxidação e perda de vitaminas²², carotenoides e mudança na coloração da polpa dos frutos. Além disso, as abóboras do cultivo convencional tenderam para cores mais escuras. Portanto, sofrendo uma maior oxidação em relação ao ambiente de

aleias, interferindo nos três parâmetros de cores luminosidade (L*), cromaticidade (C*) e ângulo Hue (H°).

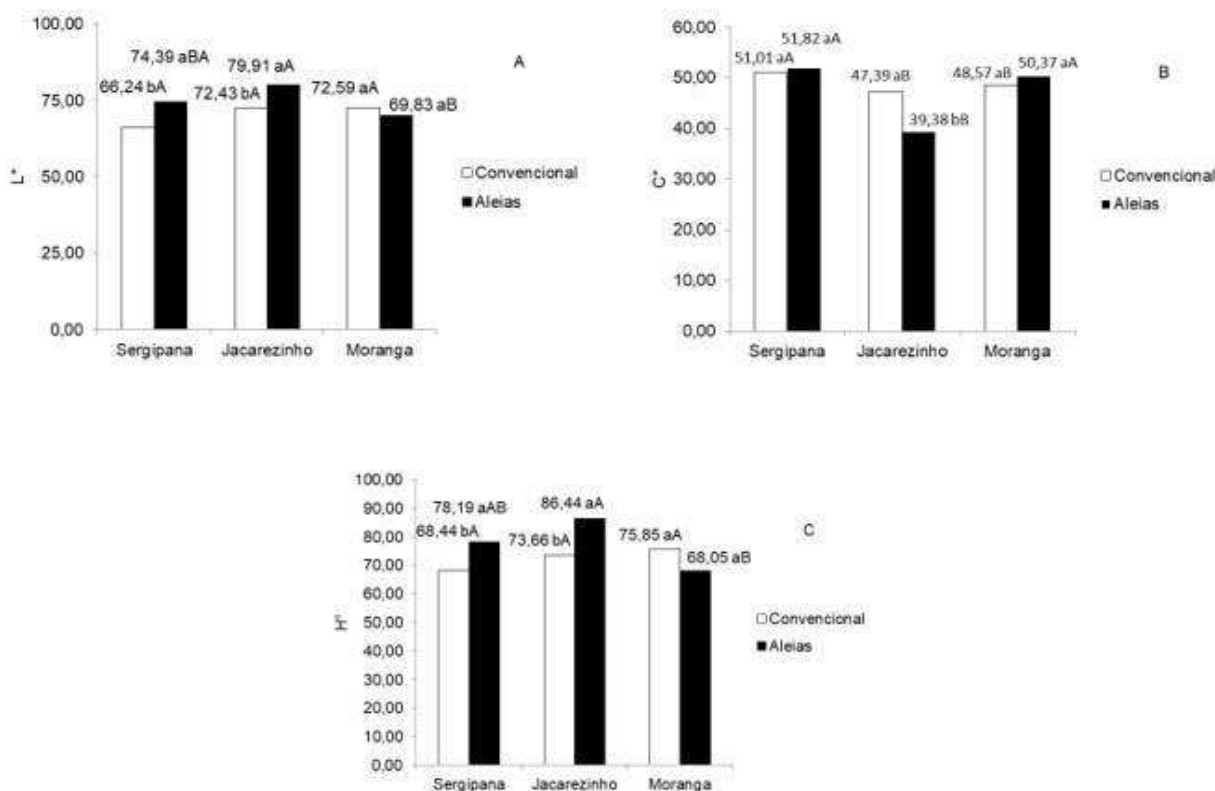


Fig.3. Valores das interações entre as médias obtidas pela análise colorimétrica para as determinações da polpa crua dos frutos de cultivares de abóbora (sergipana, jacarezinho e moranga) quando avaliado as seguintes variáveis: luminosidade (L*), cromaticidade (C*) e ângulo Hue (H°), Acarape – CE, 2021.

As médias seguidas pela mesma letra minúsculas para as cultivares de abóbora e maiúsculas nas linhas para os diferentes ambientes de cultivo não diferem estatisticamente entre si. Foi aplicado o teste de Tukey ao nível de 5% de probabilidade.

Ao avaliar a cromaticidade (C*), observa-se na figura 3B que a cultivar jacarezinho obteve menores valores nos dois ambientes de cultivo, com médias de 47,39 e 39,38 nas plantas cultivadas no sistema convencional e de aleias, respectivamente, tendo uma tendência de polpa mais escura. Com resposta semelhante à observada nas plantas da cultivar jacarezinho, os frutos de moranga no cultivo convencional, tiveram média de 48,57.

Analisando a Figura 3C que mostra a variável ângulo Hue (H°) representando a cor real dos frutos, as cultivares sergipana e jacarezinho no sistema convencional e a moranga no sistema em aleias apresentaram os menores valores, com média de 68,44°, 73,66° e 68,05°, respectivamente, tendo dessa forma, uma tendência a ser menos amarela.

Para o L* luminosidade valores semelhantes foram obtidos quando²² quando trabalharam com a polpa de abóbora obtendo valores de L* que variaram entre 62,33 (crua) e 46,88 (seca a 60°C), indicando maior tendência a

escurecimento (redução do valor de L*) quanto maior a temperatura de secagem.

IV. CONCLUSÃO

Foi possível observar que o fator ambiente influenciou no diâmetro longitudinal e na firmeza da polpa dos frutos, não afetando as outras variáveis biométricas avaliadas nos frutos.

Quanto ao diâmetro da cavidade interna dos frutos, verificou-se que a cultivar jacarezinho obteve menores valores quando comparada as outras cultivares.

Quando comparado os dois ambientes de cultivo, ao verificar os frutos de abóboras cultivadas no ambiente convencional, a coloração dos frutos sofreu uma maior oxidação de vitaminas e betacarotenos, apresentando cores de polpa mais escuras em relação ao ambiente de aleias, interferindo nos três parâmetros de cores luminosidade (L*), cromaticidade (C*) e ângulo Hue (H°).

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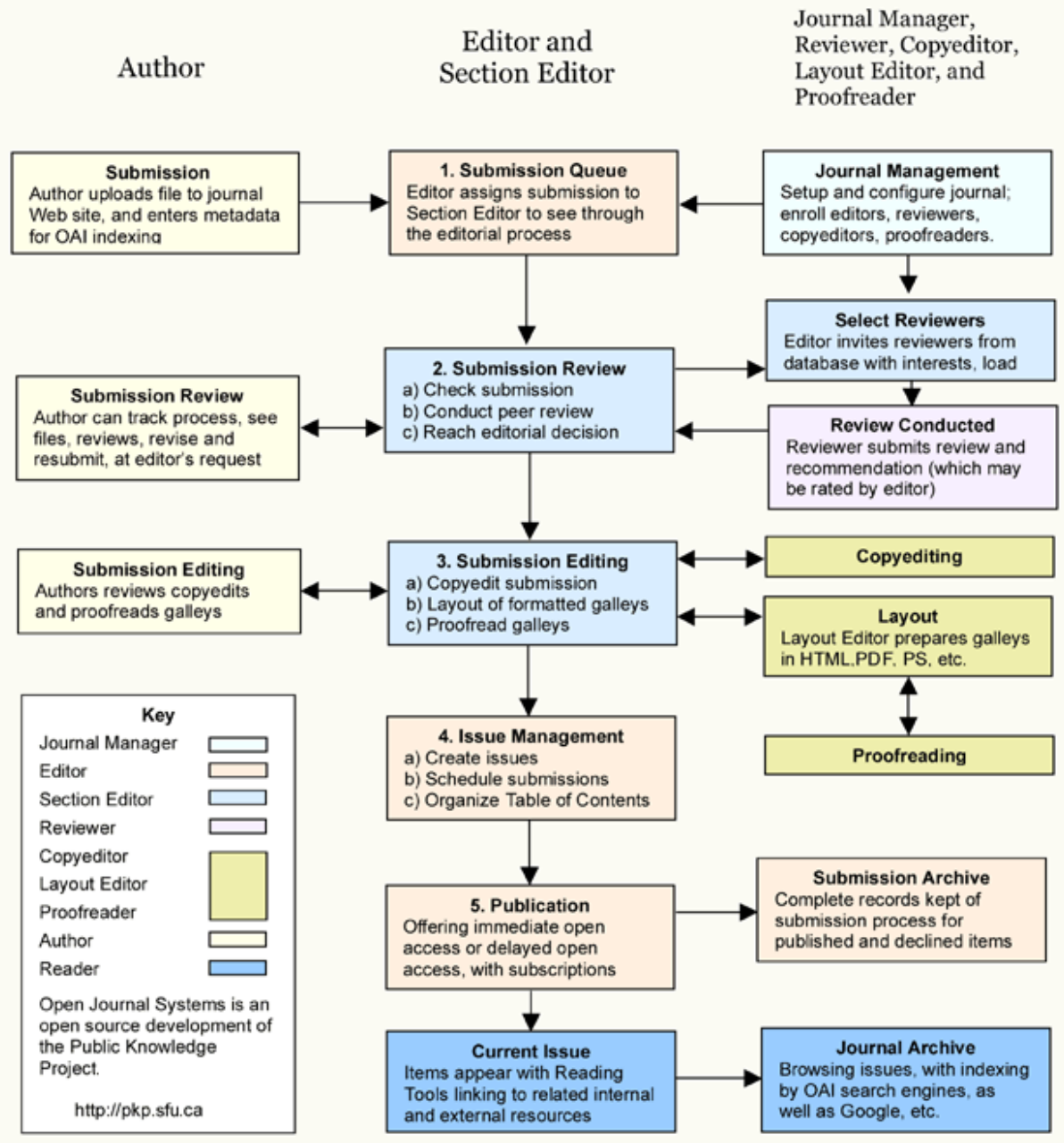
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