

ISSN: 2349-6495(P) | 2456-1908 (O)



# International Journal of Advanced Engineering Research and Science

(IJAERS)

An Open Access Peer-Reviewed International Journal



Journal DOI: [10.22161/ijaers](https://doi.org/10.22161/ijaers)

Issue DOI: [10.22161/ijaers.81](https://doi.org/10.22161/ijaers.81)

AI PUBLICATIONS

Vol.- 8 | Issue - 1 | Jan 2021  
[editor@ijaers.com](mailto:editor@ijaers.com) | <http://www.ijaers.com/>

# International Journal of Advanced Engineering Research and Science

(ISSN: 2349-6495(P)| 2456-1908(O))

DOI: 10.22161/ijaers

Vol-8, Issue-1

Jan, 2021

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Publisher

*AI Publication*

Email: [editor.ijaers@gmail.com](mailto:editor.ijaers@gmail.com); [editor@ijaers.com](mailto:editor@ijaers.com)

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# FOREWORD

I am pleased to put into the hands of readers Volume-8; Issue-1: 2021 (Jan, 2021) of “**International Journal of Advanced Engineering Research and Science (IJAERS) (ISSN: 2349-6495(P) | 2456-1908(O)**”, an international journal which publishes peer-reviewed quality research papers on a wide variety of topics related to Science, Technology, Management and Humanities. Looking to the keen interest shown by the authors and readers, the editorial board has decided to release print issue also, but this decision the journal issue will be available in various library also in print and online version. This will motivate authors for quick publication of their research papers. Even with these changes our objective remains the same, that is, to encourage young researchers and academicians to think innovatively and share their research findings with others for the betterment of mankind. This journal has DOI (Digital Object Identifier) also, this will improve citation of research papers. Now journal has also been indexed in **Qualis (Interdisciplinary Area) (Brazilian system for the evaluation of periodicals, maintained by CAPES)**.

I thank all the authors of the research papers for contributing their scholarly articles. Despite many challenges, the entire editorial board has worked tirelessly and helped me to bring out this issue of the journal well in time. They all deserve my heartfelt thanks.

Finally, I hope the readers will make good use of this valuable research material and continue to contribute their research finding for publication in this journal. Constructive comments and suggestions from our readers are welcome for further improvement of the quality and usefulness of the journal.

With warm regards.

**Dr. Swapnesh Taterh**

Editor-in-Chief

Feb, 2021

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Received: 08 Nov 2020;

Received in revised form:

06 Dec 2020;

Accepted: 15 Dec 2020;

Available online: 04 Jan 2021

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**Keywords**— *Avena sativa*  
L., fertilizing, Rust.

**Abstract**— Among the diseases that manifest in the cultivation of oats (*Avena sativa*), leaf rust, caused by *Puccinia coronata* f. sp. *avenae*, has been shown to be the most destructive, being responsible for the decrease in quality and grain yield. Nutritional balance can contribute to plant resistance to disease. In order to evaluate the effect of different doses of calcium and sulfur on leaf rust severity and on the productivity of the IPR Afrodite white oat cultivar, an experiment was installed in the municipality of Ponta Grossa-PR. The experimental design used was randomized blocks, with 5 treatments and 4 repetitions. The treatments consisted of different doses of SE-SUPER fertilizer (CaO 31% + S 13.50%) applied at sowing: T1 (control, 0Kg.ha<sup>-1</sup>), T2 (50Kg.ha<sup>-1</sup>), T3 (100kg.ha<sup>-1</sup>), T4 (150kg.ha<sup>-1</sup>) and T5 (200kg.ha<sup>-1</sup>). The assessments of leaf rust incidence and severity are carried out weekly from the first symptoms, by quantifying the proportion of the affected host tissue. From the first assessment, weekly assessments were carried out, making it possible to calculate the area under the disease progress curve (AUDPG). For the determination of productivity, the yield in kg of grains / ha was calculated, based on the harvested experimental area. There was a difference between treatments for the severity of rust in the six evaluations performed. All doses were equivalent in reducing the AUDPG of the disease, but the treatments with 150 and 200 kg.ha<sup>-1</sup> of SE SUPER, presented the highest percentages of reduction, 47.21 and 48.00%, respectively. There was no difference in the productivity obtained. Other management strategies must be associated with fertilization with calcium and sulfur to control rust. Other management strategies should be associated with fertilization with calcium and sulfur, contributing to the rational use of pesticides and reducing pollution.

## I. INTRODUCTION

Among the diseases that manifest in the culture of white oats (*Avena sativa* L.), leaf rust, caused by *Puccinia coronata* f. sp. *avenae* Fraser & Led., has been shown to be the most destructive, being responsible for the decrease in grain quality and yield, having caused severe epidemics in all regions of the world where this cereal is grown [18].

The damage caused to the leaves, especially to the flag leaf, causing the reduction of photosynthesis, interferes in the redistribution of the products resulting from this process from the leaves to the grain in formation. This results in withered grains, with little or no commercial and nutritional value [20].

The characteristics linked to the yield most affected by the occurrence of the disease are the average weight of

panicles and the weight of 1,000 seeds [3]. Grain yield and quality can decrease by more than 30%, reaching 50% in susceptible cultivars, depending on the level of disease incidence [20] [14].

Spraying with fungicides is the main rust control measure, however, mineral nutrition can contribute to reducing the intensity of the disease [15]. That is, mineral nutrition favors the increase in the thickness of the wax layer of the middle lamella, and the production of phenolic compounds, among other factors that increase the resistance of plants to diseases [10]. The deficiency of the nutrients needed to synthesize chemical compounds and physical barriers, around the point of infection, can result in host susceptibility [15].

Zambolim, Pereira, Cintra [22], consider that, in cases of fungal diseases, the protection promoted by balanced mineral nutrition results in the formation of an efficient physical barrier, with inhibition of hyphae penetration or better control of the cytoplasmic membrane permeability. This prevents the release of sugars and amino acids into the intercellular spaces and constitutes a chemical barrier, with the production or formation of phenolic compounds.

Among the essential mineral nutrients, calcium (Ca) is of great importance in plant defense responses to phytopathogens [12]. Ca can affect the incidence or severity of plant diseases in two ways. First, because it contributes to the stability of biomembranes; thus, under low Ca contents, there is an increase in the efflux of low molecular weight compounds, such as sugars, from the cell cytoplasm to the apoplast, favoring phytopathogens [15]. In addition to this function, Ca plays a critical role in cell division and development, in the structure of the cell wall and in the formation of the middle lamella [12] [10].

Many phytopathogenic fungi and bacteria invade the tissues, producing extracellular pectinolytic enzymes, such as polygalacturonase [9], which dissolves the middle lamella of host plants. The activity of this enzyme is drastically inhibited by the presence of calcium [12] [15].

Sulfur (S) also plays an important role in the plant's defense mechanism against pests and diseases. S is a lipophilic element, it can act through the cell wall of fungi, destabilizing the redox reaction of the pathogen metabolism [22]. These authors affirm that the product is considered to be in contact, eliminating and / or eradicating the structures of fungi on the surface of plants and also participates in the formation of amino acids and proteins, in the process of photosynthesis and in the defense mechanisms of the plant.

Healthy plants contain a wide variety of secondary metabolites, many of which contain S in their structure. These compounds are present either in their biologically

active form or stored as inactive precursors, which are converted by the active form by the action of enzymes in response to the attack of the pathogen or pest. Little is known about how it works [21] [8].

Knowing the effects of these mineral nutrients on the rust intensity of white oats can help to develop management strategies and, consequently, reduce the applications of pesticides, the production cost and the environmental impact. Within this context, the aim of the present work was to evaluate different doses of organic fertilizer (based on calcium and sulfur) in the culture of white oats and their interference in leaf rust severity and productivity, in the region of Campos Gerais, Paraná.

## II. MATERIAL AND METHODS

The experiment was carried out in the educational and experimental area of Unicesumar, Campus Ponta Grossa, located at 25 ° 13' latitude and 50 ° 03' longitude, and 900 m altitude. The climate in this place is humid subtropical, classified as Cfb, according to Köppen. The average annual rainfall is approximately 1550 mm. The cultivar used will be IPR Afrodite, the seeds were donated by the Instituto Agronômico do Paraná (IAPAR). Soil analysis was performed before the experiment was implemented, obtaining: pH in water 5.6, P (Mehlich 1): 5.11 mg.dm<sup>-3</sup>, K: 60 mg.dm<sup>-3</sup>, S (phosphate monocalcium in acetic acid): 5.8 mg.dm<sup>-3</sup>, Ca: 2.9 cmolc.dm<sup>-3</sup>, Mg: 1.0 cmolc.dm<sup>-3</sup>, effective CTC (t): 5.5 cmolc.dm<sup>-3</sup>, MO: 1.8 dag.kg<sup>-1</sup>.

The experimental design was a randomized block with 5 treatments and four replications, making a total of 20 plots, each plot having five 3m lines, spaced 0.2 m apart. The treatments consisted of the application of different doses of the SE SUPER fertilizer (CaO 31% + S 13.50%) applied at sowing (together with the basic fertilization), T1 (control, 0 Kg ha<sup>-1</sup> SE SUPER); T2 (50 kg ha<sup>-1</sup> SE SUPER), T3 (100 kg ha<sup>-1</sup> SE SUPER), T4 (150 kg ha<sup>-1</sup> SE SUPER) and T5 (200 kg ha<sup>-1</sup> SE SUPER). The SE SUPER fertilizer was supplied (donated) by the company Polli Fertilizantes Especiais, which has the IBD certificate, used in organic agriculture.

The sowing was in the winter of 2020. The planting system with mechanical seeding was adopted. Sowing took place on June 24, 2020, using the density of 100 kg ha<sup>-1</sup> of seeds, with an average viability of 80%. The basic fertilization was standard, using 30 kg ha<sup>-1</sup> of N and 60 kg ha<sup>-1</sup> of P<sub>2</sub>O<sub>5</sub>. The crop emerged on July 3, and the standard cover fertilization (40 kg of N / ha) was carried out on July 13.

The experiment was under natural inoculation of the disease (leaf rust). The assessments of leaf rust incidence

and severity were performed weekly during the culture cycle from the first symptoms, by quantifying the proportion of the affected host's tissue. The leaves of 10 plants chosen at random on the two central lines of each plot were evaluated with the aid of a diagrammatic scale [17]. From the first assessment, weekly assessments were carried out, making it possible to calculate the area under the disease progress curve (AUDPG).

$$\text{AUDPG} = \sum_{i=1}^n [(Y_{i+1} + Y_i) \times 0,5] [T_{i+1} - T_i]$$

Where  $Y_i$  = percentage of leaf area affected by rust in the  $i$ -th observation,  $T_i$  = time (in days) at the time of the  $i$ -th observation and  $n$  = total number of observations [19].

The harvest was done manually on October 24, 2020, by collecting four rows of two meters. For the determination of productivity, the yield in kg of grains / ha was calculated, based on the harvested experimental area. The statistical analysis of the data will be done through the free program Sasmi agri. The data of the area under the disease progress curve (AUDPG), will be subjected to analysis of variance (ANOVA), and the discrimination between treatments will be done by the Tukey test at the 5% probability level.

### III. RESULTS AND DISCUSSION

Six evaluations of *P. coronata* f. sp. *avenae*, at 31, 38, 49, 56, 64 and 71 days after the emergency (DAE). The lowest severity (0.32%) of the disease occurred at 31 DAE, and the highest (29.20%) at 71 DAE (Table 1).

Table 1- Severity (%) of rust (*Puccinia coronata* F.sp. *avenae*, at 31 DAE, 38 DAE, 49 DAE, 56 DAE, 64 DAE and 71 DAE, 85 DAE and Area below the disease progress curve (AUDPG), in the different treatments performed on white oats, cultivate IPR Aphrodite, Ponta Grossa / PR, 2020 harvest.

Treatment	31 DAE	38 DAE	49 DAE	56 DAE	64 DAE	71 DAE	AUDPG
Witness	0,65 a	13,50 a	14,00 a	13,85 a	21, 20 a	29,20 a	670,91 a
50 kg.ha <sup>-1</sup>	0,40 ab	11,50 b	11,50 ab	6,45 b	14,35 b	22,95 b	453,46 b
100 kg.ha <sup>-1</sup>	0,40 ab	5,87 c	9,25 ab	7,55 b	13,40 b	20,70 b	367,10 b
150 kg.ha <sup>-1</sup>	0,35 ab	5,12 c	8,25 ab	7,25 b	14,15 b	20,60 b	354,20 b
200 kg.ha <sup>-1</sup>	0,32 b	4,37 c	5,50 b	7,00 b	14,35 b	19,95 b	348,83 b
C.V. (%)	32,57	23,11	29,11	29,88	19,83	12,69	12,51

\* Averages followed by the same lowercase letter in the column do not differ by Tukey's test at 5% significance; Original data. DAE = days after emergency; C.V. = coefficient of variation.

Although the doses of calcium and sulfur reduced the disease's severity and AUDPG (Table 1), there was no statistical difference between treatments for the obtained productivity. The lowest productivity obtained was in the

control (1304.69 Kg.ha<sup>-1</sup>) and the highest (1546.86 Kg.ha<sup>-1</sup>) in the treatment with 200Kg.ha<sup>-1</sup> of SE SUPER (Table 2).

There was a difference between treatments in the six evaluations performed. The highest percentages of reduction in disease severity were observed in treatments with 150 and 200 kg. ha<sup>-1</sup> of SE SUPER (Table 1).

Matzen et al. [13], worked with *Bacillus amyloliquefaciens* (ex-*subtilis*) strain QST 713, to control powdery mildew in oats, and were successful in reducing the severity of the disease only at the beginning of the epidemic. Gabardo et al. [9], worked with alternative products (leaf fertilizers) to control Asian rust (*Phakopsora pachyrhizi* Syd. & P. Syd.), Obtaining a reduction in the severity of the disease only when there was low pressure of the inoculum.

There was a difference for the AUDPG, between treatments (Table 1). AUDPG is a useful quantitative summary of disease intensity over time, for comparison over the years, locations or management tactics [11]. All doses were equivalent in reducing the AUDPG of the disease, but the treatments with 150 and 200 kg. ha<sup>-1</sup> of SE SUPER, presented the highest percentages of reduction, 47.21 and 48.00%, respectively.

Diseases caused by pathogenic fungi are one of the main factors that reduce the productivity and quality of grains in the production of crops [17]. The damage caused to the leaves by rust, especially the flag leaf, causes the reduction of photosynthesis, interferes in the redistribution of the products resulting from this process from the leaves to the grain in formation. This results in withered grains, with little or no commercial and nutritional value [20].

The yields obtained are below the average productivity of Paraná, which reached 1,889 kg.ha<sup>-1</sup> in the 2020 harvest [6]. The difference between the treatment (200 Kg.ha<sup>-1</sup> of SE SUPER), which obtained the highest productivity average and the state average was 342.14 Kg.ha<sup>-1</sup>, we emphasize that in the present experiment there were no other strategies for disease management, in addition to fertilization with calcium and sulfur (Table 2).

The importance of culture has been growing exponentially in Brazil, and the planted area went from 106.1 thousand ha<sup>-1</sup> in 2007 to 291.5 thousand ha<sup>-1</sup> in 2017, an increase of 174% [4]. For 2019, the planted area

is approximately 372,500 ha<sup>-1</sup>, corresponding to an increase of more than 80,000 ha<sup>-1</sup> compared to 2017, the regions with the largest production of white oats in Brazil are Mato Grosso do Sul, Paraná and Rio Grande do Sul respectively. For 2019 the production was 836.3 thousand tons [5].

The increase in cultivation areas proves that, in fact, culture has its place in the consumer market and importance for producing states. However, there are limiting factors for the expansion of culture in Brazil, such as the occurrence of rust.

Table 2 - Productivity (Kg ha<sup>-1</sup>) as a function of the treatments carried out on white oats, cultivar IPR Aphrodite. Ponta Grossa / PR, 2020 harvest.

Treatment	Productivity (Kg há)
Witness	1304,69 a*
50 kg.ha <sup>-1</sup>	1346,36 a
100 kg.ha <sup>-1</sup>	1424,48 a
150 kg.ha <sup>-1</sup>	1488,02 a
200 kg.ha <sup>-1</sup>	1546,86 a
C.V. (%)	20,46

\* Averages followed by the same lowercase letter in the column do not differ by Tukey's test at 5% significance; Original data; C.V. = coefficient of variation.

Another important issue for the management of the disease is that the use of resistant cultivars is considered the most effective and economical control method for grain rust [16]. However, resistance is not durable for long periods when used in large areas. This is because the rust, being obligatory parasites, co-evolved with their hosts as components of a system very influenced by ecological conditions, that is, any change in the predominant population of the host, results in subsequent changes in the population of the pathogen, so that the balance is restored [1].

Future experiments are necessary, combining, in addition to fertilization with calcium and sulfur, other forms of disease control. Collaborating for the rational use of inputs by farmers in the region, providing alternatives for disease control in white oat crops.

#### IV. CONCLUSION

There was a difference between treatments for the severity of rust in the six evaluations performed.

There was a difference for the area under the disease progress curve, all treatments differed from the control.

There was no difference in the productivity obtained. Other management strategies must be associated with fertilization with calcium and sulfur to control rust.

#### ACKNOWLEDGEMENTS

To Unicesumar, for the opportunity to carry out the present work.

To Flavia Sayuri Arakawa and the coordinator of the Agronomy course Maicon Ramon Bueno, for the pro activity in solving doubts and for the confidence in carrying out the work.

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# Modeling an experiment to measure the speed of gravity in short distances using vibrating masses: Frequency optimization

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Received: 08 Nov 2020;

Received in revised form:

06 Dec 2020;

Accepted: 15 Dec 2020;

Available online: 04 Jan 2021

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**Keywords**—*Frequency optimization, Vibrating masses, Speed of gravity*

**Abstract**— *In order to investigate the behavior of gravitational signals while travelling through a medium an experiment was designed, aimed at measuring the speed of these signals over short distances. The experiment contains 2 sapphire vibrating devices that emit a signal and one sapphire device that behave as a detector, which are suspended in vacuum and cooled down to 4.2 K. The amplitude of the detecting device is measured by an ultralow, phase-noise microwave signal that uses resonance in the whispering gallery modes. Since sapphire has a quite high mechanical Q, the detection band is expected to be small, thus reducing the detection sensitivity. A new shape for the detecting device is presented in this work, yielding a detection band of several hundred Hertz. With the aid of a Finite Element Program the normal mode frequencies of the detector are determined assuming the detector as a spring-mass system. The results show that the detection is achievable then the best operational frequency is determined.*

## I. INTRODUCTION

The GRAVITON group is a Brazilian research group dedicated to the study of gravity, whose gravitational waves consist of its main area of interest. The announcement of the first direct detection of gravitational waves happened in 2016 (Abbot et al., 2016). The first attempts to directly detect gravitational waves date from the early 1960's, using resonant-mass gravitational wave detectors (Aguira, 2011).

GRAVITON's efforts for the direct detection of gravitational waves (GW) are concentrated on

SCHENBERG detector, whose main detection mass consists of a sphere with 0.65m in diameter, made of solid Cu6%Al alloy. Six transducers are connected to the sphere's surface in a semi-dodecahedron distribution. These mechanically amplify the motion and excite a membrane in a resonant cavity where microwaves signal is pumped. As these microwaves leave the cavity, they carry a sideband signal that contains information on the GW's amplitude. The direction of the incoming GW can also be found from the



analysis of the signals from the six transducers (Magalhaes, 1997A; Magalhaes, 1995; Magalhaes, 1997B).

Some of the research carried out in the GRAVITON group is presented in the references (Frajuca, 2002; Frajuca, 2004; Frajuca, Bortoli & Magalhaes, 2005; Frajuca, Bortoli & Magalhaes, 2006; Frajuca, 2008; Frajuca & Bortoli, 2006; Andrade, 2004; Ribeiro, 2004; Bortoli, 2010; Bortoli, 2016; Bortoli, 2019; Bortoli, 2020; Aguar, 2002) and the detector schematics is displayed in Fig. 1.

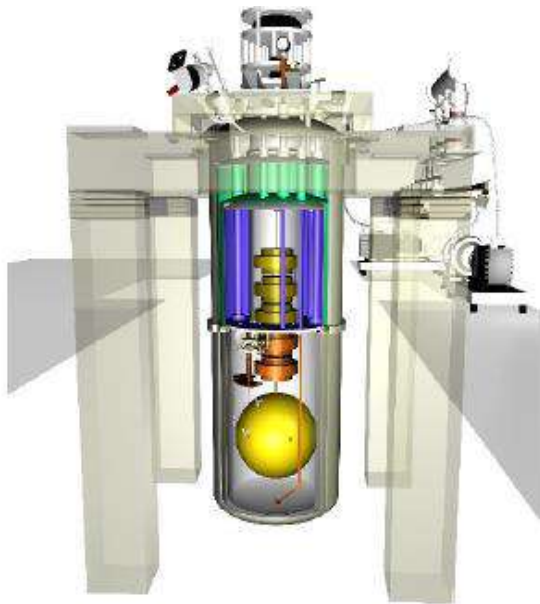


Fig. 1: The resonant-mass gravitational wave Brazilian detector SCHENBERG (Schematics by Xavier P. M. Gragens).

The expertise gained in the field of GW detection projecting the experiment entitled the group with knowledge to design an experiment to measure the speed of gravity. The measure of GW promises to determine the speed of gravity, nevertheless there will always be uncertainty if the signal coming from the GW is the correct one and multi messenger detections (GW and optical) seem to be quite rare.

In order to measure this speed a gravitational signal must be produced, but it is impractical to produce GW in the laboratory then a practical substitute is a gravitational tidal signal produced as a quadrupolar distribution of masses must rotate at a very high speed in a very stable motion, but this demands an engine operating at a very high and very stable rotational speed that could be very difficult. A substitute is to make masses oscillate by changing the

quadrupolar distribution of masses, as can be seen on the reference (Frajuca & Bortoli, 2019).

## II. METHOD

Let's follow the procedures presented in (Frajuca & Bortoli, 2019) where the model for the artificial generation of gravitational signals is presented.

The experiment consists of three sapphire devices, first consider that these devices are sapphire bars (see Fig. 2). These devices would be apart for a distance  $x$ , (see Fig. 3), suspended as seen in Fig.2. The bars at the sides would emit gravitational signals due to vibrations, these vibrations will be excited by PZT systems, and those signals will excite the central sapphire. The amplitudes of this vibrations will be determined using the central bar itself as a microwave cavity excited by an ultra-low-noise microwaves (Fig. 3). The experiment would operate at 4.2 K in high vacuum.

Sapphire was chosen due to its physical properties such as mechanical and optical: mechanical quality factor of  $10^9$  and electrical quality factor for microwaves of  $10^8$ . The determination of the gravitational tidal amplitude force applied to the central bar (detector) is done using the model shown in Fig. 4 and is presented in Ref. (Frajuca, 2019). Also in this reference the viability of the experiment is proven, and the change proposed below, that changes the bars for sapphire devices and the frequency optimization improves those results.

The improvement is given by changing the detection bar for a more complex oscillator that will work as the detector as this shape has three vibration modes, they will have a detection band wider, as the detection band is given by the distance between the lower and the higher detection frequencies. These detection bands were simulated with the aid of a Finite Element Modeling (FEM) program (Solidworks software). In Fig. 5 the new experiment mounting is shown. Figures 6, 7 and 8 display the detector's vibrational modes, which occur at the frequencies of 4722.0 Hz, 5958.7 Hz and 7169.6 Hz (for this example of the simulation, it can be changed, changing the length of the individual bars).

For this example the bandwidth is of the order of 2500 Hz, what increases the bandwidth by a big factor. Original detector had a very narrow bandwidth as the mechanical quality factor is quite high and it had one one vibration mode.

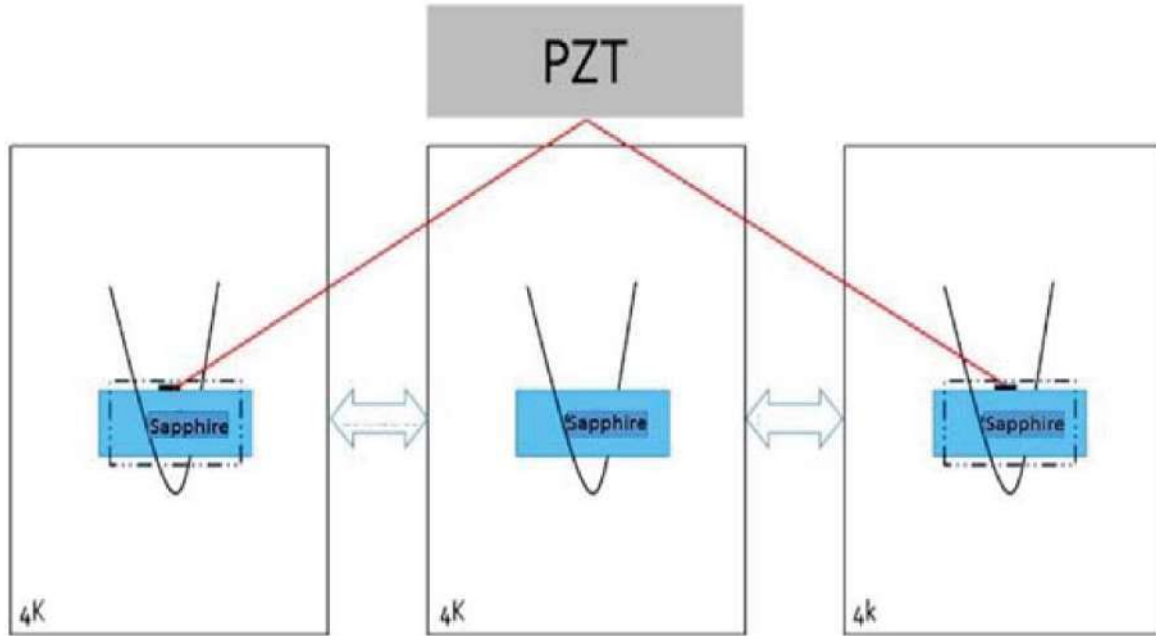


Fig. 2: Planned design of the project with PZT in phase signal. Distance  $x$  between emitters (in the sides of the experiments) and the detector (in the middle).

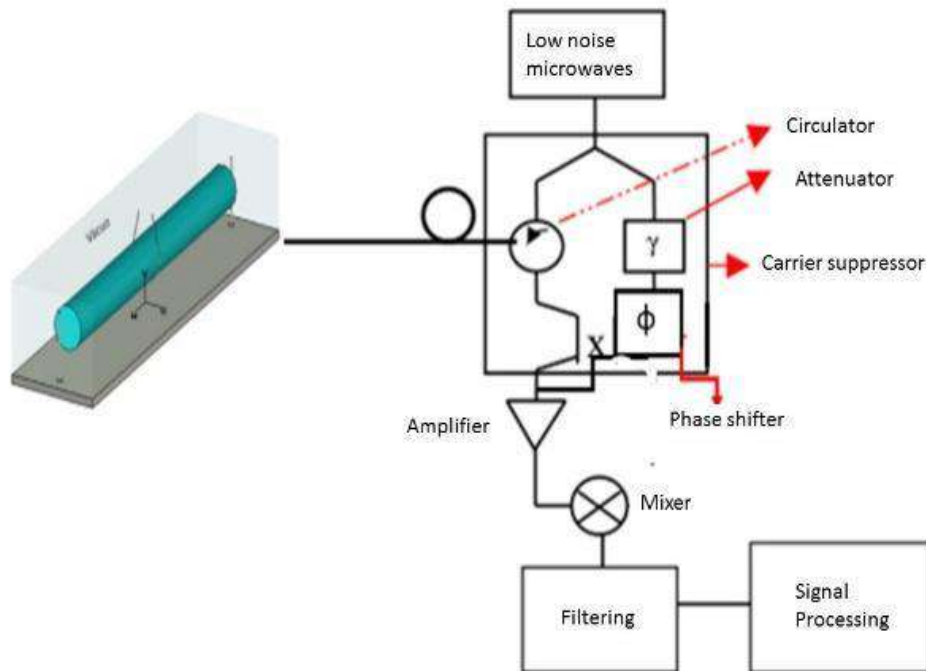


Fig. 4: Diagram of the experiment electronics using the low noise oscillator connected to the detecting central sapphire bar from the authors.

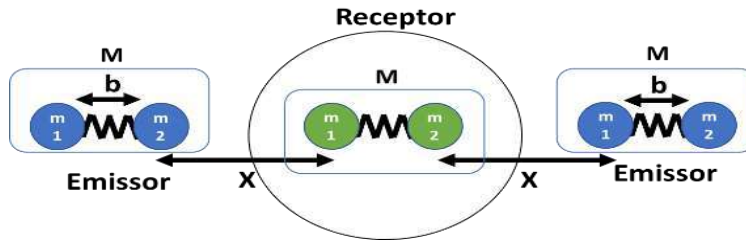


Fig. 4: Model for the detector and the emitters of oscillator tidal gravitational signals.(Figure from the authors)

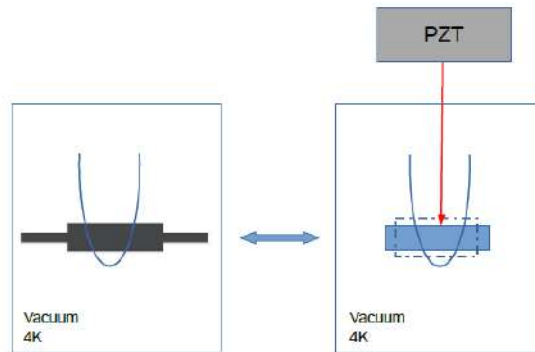


Fig. 5: The new experiment mounting of the planned detector. Figure from the authors

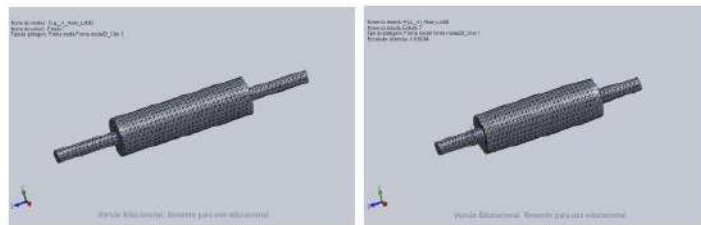


Fig. 6: Vibrational mode of the detector at 4722.0Hz. The authors.

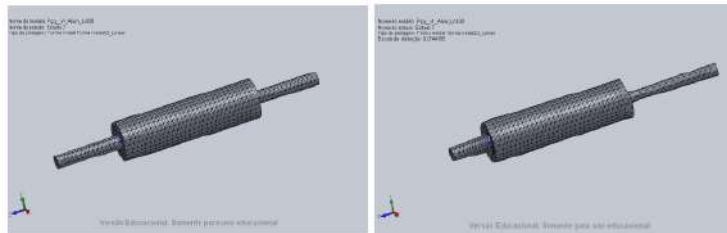


Fig. 7: Vibrational mode of the detector at 5958.7Hz. The authors.

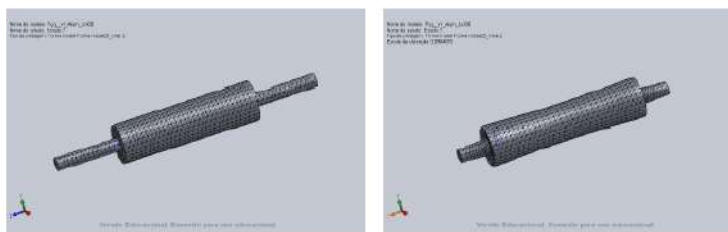


Fig. 8: Vibrational mode of the detector at 7169.6Hz. The authors.

### III. RESULTS

In the calculations of the next subsection follows the same steps presented at (Frajuca, 2019) with the following parameters:

Oscillator phase noise: -160 dBc/Hz at 1 kHz;

$$M_{eff} = 1kg;$$

x = 1 m distance between the masses;

$$Q = 10^9;$$

$$G = 6.67 \times 10^{-11} m^3 kg^{-1} s^{-2};$$

a = 10<sup>-4</sup> (Vibration amplitude of the bars);

b = 1 m (Equivalent size of the bars);

x = 1.0 m (Distance between detector and emitter);

Frequency bandwidth (BW): 1000 Hz;

$$h = 6.626\ 069 \times 10^{-34} J \cdot s;$$

$$f = 10^3 \text{ Hz};$$

$$K = 1.38064852 \times 10^{-23} m^2 kg \ s^{-2} \ K^{-1};$$

df/dx = 2 x 10<sup>12</sup> Hz/m (Frequency sensitivity).

#### 3.1 Signal amplitude

Following the work done in (Frajuca, 2019):

$$\Delta b = \frac{QGM_{eff}24ab^2}{w^2x^5} = 4 \cdot 10^{-12} \text{ m} \quad (1)$$

#### 3.2 Quantum limit

This corresponds to the minimum limit, when the number of phonons is 1. Therefore,

$$E = \hbar w. \quad (2)$$

$$hf = \frac{1}{2}A^2w^2m \Rightarrow hf = \frac{A^2w^2M_{eff}}{2}$$

$$\Delta b_{QL} = A = \sqrt{\frac{2\hbar}{\omega M_{eff}}} \quad (3)$$

$$\Delta b_{QL} = \sqrt{\frac{2\hbar}{M_{eff}2\pi f}} = 2 \cdot 10^{-19} m \quad (4)$$

#### 3.3 Equipment sensitivity limit

$$S_x(f) = \left(\frac{df}{dx}\right)^{-2} S_\phi(f) f^2 \quad (5)$$

$$S_x = 0.5 \sqrt{10^{-34}} = 5 \times 10^{-18} \frac{m}{\sqrt{Hz}} \quad (6)$$

Using BW (bandwidth) = 1000 Hz:

$$\Delta b_{ES} = 1,6 \cdot 10^{-18} m \quad (7)$$

#### 3.4 Thermal noise limit

$$\Delta b_{th} = \sqrt{\frac{KT}{2M_{eff}\omega Q (BW)}} \quad (8)$$

$$\Delta b_{th} = 2 \times 10^{-20} m \quad (9)$$

### IV. DISCUSSION AND OPTIMIZATION FREQUENCY OPTIMIZATION

The results show that the detection is possible. Let's try to optimize the frequency.

The angular velocity of a harmonic oscillator is given by:

$$w^2 = k/m \quad (10)$$

and the energy is given by:

$$E = \frac{1}{2} k a^2 = 0.5 m w^2 a^2 \quad (11)$$

Then the vibration amplitude of the resonator is given by:

$$a = 1/w \sqrt{\frac{2E}{m}} \quad (12)$$

Using the parameters chosen in this work this energy is equal to 20 J.

Replacing this expression for a given energy of equation (12) in (1) and finding the same value for Δb given by the expression in (6), one can obtain the frequency where these values are the same and its value is 53 kHz. Then an operation frequency chosen of 1 kHz is reasonable in sensitivity.

### V. CONCLUSION

The values for the frequency of 1 kHz for the signal and limit are:

Quantum limit: Δb<sub>QL</sub> = 4 x 10<sup>-19</sup> m;

Equipment sensitivity limit: Δb<sub>ES</sub> = 1.6 x 10<sup>-18</sup> m;

Thermal noise limit: Δb<sub>th</sub> = 2 x 10<sup>-20</sup> m.

The signal amplitude is  $\Delta b = 4 \times 10^{-12}$  m. The new shape for the detector improves the sensitivity of the because it lowers the sensitivity of the equipment noise sensitivity.

The frequency chosen makes the experiment possible at these parameters, nevertheless it is not determined yet if the phase can be obtained at this frequency and distance for the emitter and detector. The next step is to incorporate in the calculation the measurement of the phase difference between the emitted signal and the received one.

### ACKNOWLEDGMENTS

CF acknowledges CNPq for grant #309098/2017-3 and # FAPESP (Brazil) for grants #2013/26258-4 and #2006/56041-3.

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# Oil Royalties in Brazil: Constitutionality X Unconstitutionality

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Received: 22 Oct 2020;

Received in revised form:

15 Dec 2020;

Accepted: 25 Dec 2020;

Available online: 09 Jan 2021

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**Keywords**—Oil Royalties,  
Constitutionality, Producing  
areas, Federated entities,  
Environmental damages.

**Abstract**—The purpose of this article is to analyze the constitutionality of the distribution of oil royalties in Brazil to federated entities. Oil royalties are financial compensation received by the state and municipal oil-producing areas for the environmental damage caused by oil exploration. Art. 20 1<sup>o</sup>§ of the Federal Constitution of the Republic of Brazil of 1988 defines the legal nature of royalties, which is the compensatory form for the use of non-renewable goods by the States, Federal District, and Municipalities. Article 14 of Law 6.938/1981 established the strict liability regime for repairing and indemnifying damages caused to the environment and affected third parties. The legal system that regulates the matter of oil royalties is clear when it exposes the net and true right of the producing areas to financial compensation for environmental, social, and economic damages. The Supreme Federal Court decisions are consistent with the Federal Constitution and the NEP - National Environment Policy, Law No. 6938/1981. The methodology is based on bibliographic research on printed books, electronic articles, the 1988 Federal Constitution, and relevant legal norms. According to the Federal Constitution, legal norms, legal scholars, and the Supreme Federal Court, the allocation of royalties should be paid to the federal entities directly affected by the exploratory activity, which bear the various damages and risks of oil exploration.

## I. INTRODUCTION

Recently, one of the major discussions about oil royalties in Brazil is the constitutionality or unconstitutionality of their distribution to all federated producers and non-producers. There is a divergence between the political class and the Federal Supreme Court – FSC.

In this context, the following problem arises: Is the distribution of oil royalties to all federated producing and non-producing entities constitutional or unconstitutional?

Considering the legal rules, we will see how the issue is approached in the country, whether it is of a political or legal nature.

Today, oil royalties are distributed to all states and the Federal District, regardless of oil production.

However, producing states and municipalities bear the losses and the social and environmental damages of oil production. The environmental liability, the responsibility for repairing the environmental and social damage to nature and society, lies with the producing locations. Also, the percentage of the transfer of royalties to municipalities and producing states is less than 30% of the value produced by them.

The general objective was to analyze the constitutionality of the distribution of oil royalties in Brazil to the federated entities.

Regarding specific objectives, the aim was to:

Reflect on the unconstitutionality of the distribution of oil royalties in Brazil among federated non-oil producing entities.

Relate oil production to the liability of environmental liability and environmental damage to the producing entities.

The legal definition of the environment arises from Law No. 6938 of 1981, NEP - National Environmental Policy, in art. 3rd, item I:

Environment is the set of conditions, laws, influences, and interactions of a physical, chemical, and biological order that allows, shelters, and governs life in all its forms.

The Federal Constitution of 1988 was based on the environmental part of NEP, originating art. 225 that deals with the principle of a healthy and balanced environment:

Everyone has the right to an ecologically balanced environment, a common use good of the people and essential to a healthy quality of life, imposing on the Public Power and the community the duty to defend and preserve it for present and future generations.

Environmental policy in Brazil is constitutionally based on art. 225 and the State has the protection of the environment. Economic oil activities carry environmental risks and damages and are often confronted with this article that safeguards the environment as a fundamental and diffuse right.

## II. DEFINITION OF OIL ROYALTIES

Royalties are a form of financial compensation owed by concessionaires given the exploitation of oil and natural gas (non-renewable natural resources), which affect their monthly production, according to Pires (2012).

In the 1st § of art. 20 of the Federal Constitution, the participation of oil-producing entities and municipalities in the capital generated by the exploitation of oil or gas, water, and mineral resources is defined:

Under the terms of the law, States, the Federal District, and Municipalities, as well as organs of the direct administration of the Union, are guaranteed participation in the results of the exploitation of oil or natural gas, of water resources to generate electricity and other mineral resources in the respective territory, continental shelf, territorial sea or exclusive economic zone, or financial compensation for that exploration.

Mattos (2012) states that the theory of the legal nature of royalties is instituted from art. 20, 1º§ of the 1988 Constitution, which would be exclusively compensatory for the use of non-renewable goods.

The concept of royalties in the law of sharing of royalties, law nº 1234, of 30-11-2012:

Single paragraph. The royalties correspond to the financial compensation due to the Union, the States, the Federal District, and the Municipalities for the exploration and production of oil, natural gas, and other fluid hydrocarbons, as referred to in § 1 of art. 20 of the Constitution.

The sharing of royalties between the federated entities and production on and offshore according to Law no. 1234/2012:

Art. 42-B. The royalties due to the production of oil, natural gas, and other fluid hydrocarbons under the production sharing regime will be distributed as follows:

I - when production occurs on land, rivers, lakes, lake or river islands:

a) 20% (twenty percent) for States or the Federal District, if applicable, producers.

b) 10% (ten percent) for producing Municipalities.

c) 5% (five percent) for Municipalities affected by operations for loading and unloading oil, natural gas, and other fluid hydrocarbons, in the form and criteria established by the National Agency of Petroleum, Natural Gas and Biofuels (NAP).

d) 25% (twenty-five percent) for the constitution of a special fund to be distributed between the States and the Federal District.

II - when production occurs on the continental shelf, in the territorial sea, or in the exclusive economic zone:

a) 22% (twenty-two percent) for the confronting States.

b) 5% (five percent) for the confronting Municipalities.

c) 2% (two percent) for the Municipalities affected by operations of loading and unloading oil, natural gas, and other fluid hydrocarbons in the form and criteria established by NAP.

d) 24.5% (twenty-four integers and five-tenths of a percent) for the constitution of a special fund to

be distributed between the States and the Federal District.

There is a difference in the value of royalties paid between onshore and offshore production. Production on the offshore platform receives a higher royalty. The producing areas receive less than 25% of their production. From the exploration on the continental shelf, producing states receive 22% royalties, and from the exploration on land, producing states receive 20% royalties. Non-producing areas receive payment of royalties for loading and unloading oil via the port area.

### III. METHODOLOGY

The method used is bibliographic research based on doctrine and jurisprudence, through the analysis of books, magazine articles, and specialized journals on environmental law, ecological economics, oil royalties, constitutionality and unconstitutionality of oil royalties, the polluter pays principle, and environmental liabilities, which are the main thematic axes for the discussion of this article.

### IV. THE ISSUE OF CONSTITUTIONALITY, ENVIRONMENTAL DAMAGE AND RISKS

The genesis of the concern and observance of constitutionality in the country's legal system was born in 1891, in the first two years of the Brazil Republic's creation.

Regarding the origins of the Federal Constitution's safeguard institution and its control of constitutionality, Silva (2017) states that:

The constitutionality control (...) is an instrument whose primary purpose is to ensure the constitutional text's supremacy. It was inserted in the legal system from the 1891 Republican Constitution, being influenced by the United States law.

The Brazilian system of constitutionality control is similar to the United States system regarding the legal nature of the unconstitutionality of laws.

According to Gallotti (1987), "The United States system is based on the traditional doctrine of the supremacy of the Constitution and the consequent nullity of the unconstitutional legislative act, defended by Hamilton in *The federalistti* and established by Marshall in 1803." In the Brazilian system, as in the United States system, the supremacy of the Federal Constitution is over other laws.

Marshall, 1803 as cited in Gallotti, 1987 advocates the supremacy of the Constitution over other ordinary laws:

The Constitution is either a superior and predominant law - and an immutable law by ordinary forms - or is at the same level in conjunction with the legislature's ordinary resolutions, being changeable when the legislature wishes to modify it, like other resolutions.

Gallotti (1987) mentions that "Marshall affirms that the courts have the duty, in the face of a conflict between the Constitution and an ordinary law, to observe the first." For him, the Constitution's principle must be considered by the courts and the Judiciary and safeguard the Magna law to the detriment of the other ordinary laws.

"In Brazil, a diffuse constitutionality control system was established with the Republic, based on the classic Marshall doctrine, taught and disseminated among us by Rui Barbosa." Gallotti (1987).

The definition of constitutionality is presented by Amaral (2002), "But just as important for the rule of law - or even more important - is the principle of constitutionality. In other words, the legislator's duty to submit to the Constitution."

Regarding the violation of the constitution, Amaral (2002) emphasizes that "The legislator can violate the Constitution by action or inaction. By action, when it produces unconstitutional laws. By default, when it fails to produce laws expressly provided for in the Constitution."

"When the legislator violates the Constitution by action, the law produced by him is only eliminated from the legal system when revoked or constituted its unconstitutionality by an unappealable decision from the Supreme Federal Court," according to Amaral (2002). The SFC is the last legal instance to appeal legally and has the role of guardian of the Federal Constitution.

"At the Supreme Federal Court, the understanding that the unconstitutional act is null and void does not give rise to rights or obligations." Gallotti (1987).

Gallotti (1987), concludes "...that in the Brazilian legal system, despite the respectable opinions to the contrary, the unconstitutional norm is null *ab initio*, not obliging individuals or other powers." At any time, the unconstitutional rule may be revoked.

The Judiciary is responsible for giving the final word on the constitutionality of the laws, which does not exclude the performance of such control by the other authorities concerning their respective attributions, according to Gallotti (1987).



In Brazilian law, unconstitutionality is VICIO intrinsic to any rule contrary to the Constitution, resulting in the invalidity, *ab initio*, of the addicted rule. Gallotti (1987). Unconstitutionality is configured as a constitutional error.

Gallotti (1987) states that "The Supreme Federal Court's jurisprudence is peaceful on the subject. In his vote at Representation No. 933, Minister Xavier de Albuquerque said:

The rules will be considered unconstitutional, with the result that there will be no rights of any kind based on them. If administrative acts have been performed, they may be undone, because they are based on a law declared unconstitutional."13

In November 2019, the judgment of the division of oil royalties to the federated entities by the SFC was expected in terms of its constitutionality. One of the burdens that the oil-producing area is responsible for is the environmental damage caused by oil exploration.

Paulo Bessa Antunes as cited in Guimarães, 2002 "teaches that damage is the destruction (a negative change in the legal, material or moral situation) caused to someone by a third party who is obliged to be compensated."

Concerning the liability for environmental damage produced by economic activities, Wedy (2018) states that:

The duty to repair environmental damage is taken from the constitutional text itself. As established in article 225, paragraph 2 of the Magna Carta, whoever "exploits mineral resources is obliged to recover the degraded environment, according to the technical solution required by the competent public agency, in accordance with the law."

Article 14, paragraph 1 of Law 6,938/81 established the strict liability regime for repairing and indemnifying damages caused to the environment and affected third parties, according to Wedy (2018). It is worth mentioning that art. 225 of the 1988 Constitution, which deals with the environment, received Article 14 of Law No. 6938/1981, the National Environment Policy - NEP.

Regarding the perception of royalties, as financial compensation for producing areas that suffer from environmental damage, the SFC minister, Sepúlveda Pudence as cited in Pires, 2012, addresses that:

(...) the financial compensation is linked (...) not to the exploration itself, but to the problems it generates. (...) The exploration of mineral resources and electric energy potentials is an activity potentially generating a number of problems for public entities, especially environmental (...), social and economic, arising from population growth and the demand for public services."

Pires (2012) concludes that the allocation of the distribution of oil royalties falls to the producing areas, as recommended in the 1988 Constitution and by the analysis of legal scholars:

Due to its indemnity nature, after analysis of legal experts and jurisprudence, it should be noted that the destination of royalties should be to the federal entities directly affected by the exploratory activity, which effectively support the damages and risks of the exploitation.

The environmental liability of the oil industry regarding its environmental responsibility in repairing the social and environmental damage caused by the exploitation of the risk of an environmental accident, such as the exploitation of an oil deposit, falls on the company and the referred damages to society and the nature of the producing areas.

Environmental liabilities are understood as contingencies formed over a long period and arise from the possession and use of a mine, a steel plant, a river, a sea, and a series of spaces that make up our environment," according to Tinoco and Kraemer (2004) cited by Carvalho, 2012 as cited in Antonovz, 2014. Environmental liabilities are a company's obligations and responsibility to the environment, such as fines.

For NCB TE XXX cited by Antonovz (2014), the environmental liability is the value of the exact and estimated obligations for the recovery of areas degraded by the entity, such as indemnities to third parties, fines ...". For example, an environmental oil accident with an oil spill caused by drilling a well, causing pollution of the sea, marine fauna, and flora. In a company's environmental liabilities, a possible environmental degradation caused by economic activity is expected.

According to Antonovz (2014), environmental liabilities provide for current liabilities through environmental provisions, environmental degradation, and environmental tax obligations to be paid, as well as environmental indemnities to be paid, the activities of companies that cause negative impacts to the environment

and have negative consequences for these people or entities. An example of this is the case of PETROBRÁS, which illustrates the situation of environmental indemnity for environmental accidents, fines for damage, and damage to the environment: PETROBRÁS' environmental penalties from January to October 2019, totalizing 274 million reais due to 316 notices applied by IBAMA, according to the Folha de São Paulo newspaper. (Rodrigues, 2019).

It is worth mentioning that Brazil's oil-producing areas assume the environmental risks and damages foreseen in their company's environmental liabilities. This environmental obligation to indemnify the damage generates an expense for companies in the oil-producing states: Rio de Janeiro, São Paulo, Espírito Santo, Amazonas, Paraná, Rio Grande do Norte, Bahia, Sergipe, Ceará, and Alagoas. The burden of the environmental fine falls on oil-producing states, but non-producing states do not have this financial burden. In the case of royalties' distribution to federated entities, non-producing areas receive financial compensation without participating in environmental compensation for damage, pollution, and environmental degradation generated by oil activities. The oil-producing areas participate in the bonus and onus generated by oil production, while the non-producing areas participate only in the bonus, the financial indemnity.



Fig. 1: PETROBRÁS oilplatform. (F. Rodrigues, 2019).

The pollution generated by the oil industry imposes liability and charges with environmental liabilities and environmental taxation for damage to the environment and society. These charges are part of the polluter pays principle, consisting of one of the leading constitutional principles underlying Environmental Law.

The polluter pays principle is a mechanism used for environmental protection. Through it, the entrepreneur who pollutes the environment will have to contribute to

preserving the environment, even reducing, (...) part of his profit, according to Santana apud Santello (2017).

The relevance of the polluter pays constitutional principle to society, environmental taxation, and the environment is discussed by Santello (2017):

A constitutional principle of considerable relevance in the study of environmental taxes and the taxation of water resources is that of the polluter pays, which consists of compelling the polluter to reimburse society financially for the environmental damage caused. The polluter must be financially burdened for misusing natural resources or destroying the environment. It demonstrates that the use of financial penalties and collection of taxes that focus on facts related to the pollution, deterioration, and destruction of the environment is effective in environmental preservation and follows environmental constitutional principles.

The polluter pays principle is applied in Europe, the United States, Brazil, Argentina, and other countries to redress society and nature for the damage caused. Neves (2014) mentions that "This principle undoubtedly gained strength after its introduction in the Declaration of Rio in 1992, in the form of the 16 that establishes:

National authorities should seek to encourage the internalization of environmental costs and the use of economic instruments, taking into account the criterion that what contaminates should, in principle, bear the costs of contamination, taking due account of the public interest and without distorting international trade or investment. (UN, 1992).

The internalization of environmental costs "... means that the production process's costs must absorb the costs of negative impacts produced in nature. This burden cannot be shared with the community, considering that the profit from production belongs only to the industry, as Milaré teaches," according to Neves (2004). This internalization is assumed only by the oil-producing areas; however, it is not counted in the transfer to the federated non-producing entities in the division of royalties.

Petroleum activity poses a risk to society and the environment. The producing areas also assume this risk. However, what is the risk?

According to Kaercher (2016), the risk consists of:

One or more conditions of a variable with the potential necessary to cause damage. These damages can be understood as injuries to people, damage to equipment or structures, loss of material in process, or reduced performance capacity.

Non-oil producing areas have an infinitely lower environmental risk than the producing area. To scale the risk, the explosion of an oil platform in a production area has no way of comparing the severity of environmental damage with non-producing areas, such as a small oil spill transported by trucks to the port. The extent of environmental risk and damage is disproportionate, assessed at a high degree of risk to moderate or low risk.

From the perspective of the constitutionality of oil royalties, oil-producing areas' perception of this financial compensation is legal. No provision in the 1988 Federal Constitution guarantees the receipt of royalties to non-oil producing areas.

As such, the royalty sharing law is unconstitutional and may be revoked at any time.

## V. CONCLUSION

Based on the Federal Constitution of Brazil of 1988, the legal rules, the legal scholars, and the Supreme Federal Court, the allocation of royalties should be to the federal entities directly affected by the exploratory activity, which support the environmental-social-economic damages and risks of exploitation oil as environmental responsibility through the environmental liability of the producing company.

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# Analysis of Impacts Generated by Oil Spill on the Beaches of Cabo de Santo Agostinho, Brazil

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Received: 18 Oct 2020;

Received in revised form:

25 Dec 2020;

Accepted: 03 Jan 2021;

Available online: 09 Jan 2021

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**Keywords—** Causes, Consequences, Oil, Beaches, Solutions.

**Abstract—** Considered raw material for a wide variety of products, today oil is removed from nature on a large scale. From time to time there are problems with the oil spill in the ocean. The reasons range from oil tanker accidents, hull breaches and oil rig explosions. The environmental impacts of the oil spill are widespread. The stain spreads through the sea, killing thousands of fish, birds, and corals. The losses caused by the oil spill in the Northeast Region of Brazil are incalculable and have not yet been well dimensioned by the government. The health of the population close to the northeastern coast, must be carefully analyzed before an assessment of risks based on a food and trophic chain. This work aimed to present an analysis of environmental impacts based on the Leopold matrix regarding the oil spill that hit the municipality of Cabo, Pernambuco, Brazil. The subsidies used to analyze the situation in the area were collected through information obtained in the press, in addition to technical field visits with photographic records. In general, the Leopold matrix helped in the analysis of the analyzed aspects and impacts: the fauna and flora suffered impacts that will take years or decades to be recovered in case the cleaning and conservation is carried out partially. Among the solutions for the crude oil that reached the beaches, after receiving adequate treatment, they can be used as fuel and / or alternative raw material in the cement kilns of the industries.

## I. INTRODUCTION

Petroleum, which from the Latin *petra* (rock) and *oleum* (oil) mean “rock oil”, is a term currently used as a common term for crude mineral oils and natural gas, from which various oily and gaseous products are obtained. Petroleum is the product of thermochemical transformations of organic matter over millions of years [1].

Historically, the increase in world demand for oil has been the result of the nations' own economic growth, where energy represents an indispensable input for the production of consumer goods, where its derivatives are the raw material for the manufacture of numerous consumer goods and in this way, they have an increasingly

present and relevant role in people's lives [2]. However, to be used in the various areas of the industry, oil must go through a refining process, transforming it into products used in the most diverse applications such as: fuels, lubricants, plastics, fertilizers, medicines, paints, fabrics etc. Petroleum enterprises are established and developed at the expense of consumption of natural resources, production of liquid, solid and aerial waste, impacts on species diversity, use of water and soil [3]. Thus, they deeply affect the original characteristics of ecosystems, which, in turn, lead to changes in society / nature interrelations, especially in environmental health [4]. The losses caused by the oil spill in the Northeast Region of Brazil are incalculable and have not yet been well dimensioned by the government. The health of the

population close to the northeastern coast, must be carefully analyzed before an assessment of risks based on a food and trophic chain.

To analyze possible dimensions of the impacts caused, instruments of the Environmental Impact Assessment (EIA) can be used considering that it is a systematic process to identify, predict, evaluate and mitigate the relevant biophysical, social or other effects of projects or activities. According to [5], environmental impact is defined as any change in the physical, chemical, and biological properties of the environment caused by any form of matter or energy resulting from human activities that directly or indirectly.

## II. METHODOLOGY

### - Place of Study

The municipality of Cabo de Santo Agostinho extends over 446.6 km<sup>2</sup> and had 185123 inhabitants in the last census. The demographic density is 414.5 inhabitants per km<sup>2</sup> in the territory of the municipality. Neighboring the municipalities of Jaboatão dos Guararapes, Ipojuca and Moreno, Cabo de Santo Agostinho is located 20 km south-west of Jaboatão dos Guararapes, located 6 meters above sea level, and Cabo de Santo Agostinho has the following geographical coordinates: Latitude: 8 ° 17 '15' 'South, Longitude: 35 ° 2' 7 " West (Fig. 1). The highest concentration of spilled oil reached the beaches of the city of Cabo de Santo Agostinho with its greatest concentration, this being the municipality chosen for the study.

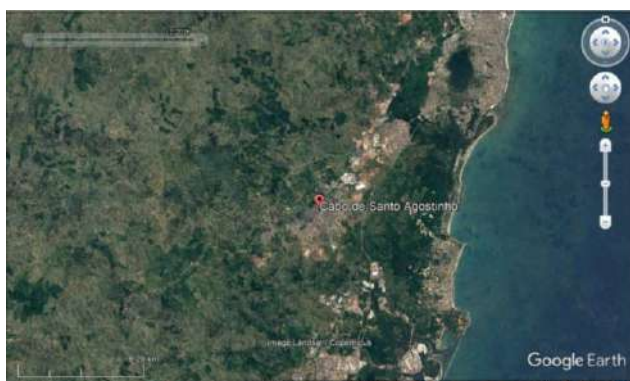


Fig. 1: Cabo de Santo Agostinho. Source: Google Earth.

### - Data Collection and Analysis

The study started with a bibliographic review and pertinent legislation on the theme, which supported the development of the study. The subsidies used to analyze the situation in the area were collected through information obtained in the press, in addition to technical field visits with photographic records.

For a more detailed analysis and visual representation of the data obtained, the Microsoft Office Excel program was used to create the graphs and tabulation of the data. Due to the complexity involved in the diagnosis of environmental impacts, it was necessary to have a holistic view in the analysis of the data, applying the Leopold Matrix, to identify and analyze the negative impacts generated and their consequences for the environment. The matrix was used to guide the assessment of the state of the environment and what can be done to mitigate or avoid current and future problems. The environmental impact classification was defined through the relationship between degree of importance versus severity, providing the final category. The environmental factors evaluated refer to soil, water and living beings. An adaptation was made regarding the score of the degree of importance, being considered points ranging from 1 to 5, where the number 1 corresponds to the condition of less importance and the number 5 corresponds to the maximum values of these attributes, etc.

## III. RESULTS AND DISCUSSION

### - In Loco Research and Partial Analysis

In the tragedy that occurred in the municipality, it is known that countless resources are affected, but without an impact analysis carefully analyzed. In turn, it was noted that fishermen, the local population, consumers of fish and shellfish, and volunteers in the removal of waste are the main affected by the oil spill in the region, being considered a high magnitude impact (Figure 2). It should also be noted that those responsible for removing these residues, manually and without adequate guidance or protection, may be suffering an even greater risk or impact. If fishermen used to live in journeys of up to ninety hours a week involved in the extraction and processing of seafood and fish, today, even without personal protective equipment, or access to periodic examinations, they have an increased vulnerability with the oil spill. Occupational and environmental hazards that were enhanced by the government's negligence and exclusion of these subjects from decision-making processes.

Considering that living conditions, morbidity and mortality profile of individuals, vulnerability of social groups and environmental degradation result from interrelationships between production, environment and health, guiding the way of production and consumption, these are references for the design of effective interventions to guarantee life and health of the population and the environment [6,7,8] Studies show an increase in vulnerabilities, conflicts and environmental injustices due

to tragedies such as the oil spill, bringing environmental hazards, as well as to the health of workers and people introduced in the territories and negative impact on traditional populations of the countryside and waters [9,10,11]. The Health Impact Assessment (HIA) has been recommended and recommended by the World Health Organization (WHO) and its branch, the Pan American Health Organization (PAHO), which published a guidance manual for its preparation. According to this manual, "health impact assessment is a systematic analysis of possible impacts on public health of policies and programs, in order to optimize health interests" [12].



Fig. 2: Fishermen, local population, consumers of fish and seafood, and volunteers in the removal of waste. Source: Authors (2020).

In response to the identification of crude oil / petroleum on the coast of Pernambuco and the possibility of damage to health, [13] monitored the cases notified by municipalities on the coast of Pernambuco. The cases were reported on the exogenous intoxication form, following the routine of the Notifiable Diseases Information System (Sinan); and immediately informed to the Center for Strategic Information on Health Surveillance (CIEVS). Until 12/1/2019, 154 suspected cases of oil poisoning in Pernambuco were reported. Another 21 cases reported by the municipalities are being analyzed by the Municipal and State Health Departments, since the notification forms do not have information, such as signs and symptoms, and are in the process of being qualified by the municipalities. Cases of patients residing in another state (N = 03) were also not included in this report. Of this survey, about 36 intoxicated people live in the city of Cabo de Santo Agostinho, place of study.

Still according to [13], the greatest predominance was cutaneous and respiratory, regarding the number of reported cases of exogenous intoxication according to the route of exposure. Considering the signs and symptoms

reported by the patients, headache, nausea, dizziness, vomiting, skin irritation and shortness of breath were the most reported.

People living in areas affected by oil spills are also more susceptible to contamination with chemicals of widely proven toxicology [14], and may suffer from acute or chronic, carcinogenic, mutagenic, and systemic disorders.

When effectively referring to the impacts of the oil spill at sea, economic and social losses are associated directly and indirectly due to the reduction of fishing, tourist, and industrial activities dependent on the quality of marine water, bringing risks to public health, such as death by explosions. and fires, poisoning from eating contaminated food, or dermatological problems and irritations, caused by direct contact with the oil [15], as seen in Figure 3. Seafood and oysters require even more special attention. They filter water for food and therefore accumulate more oil residues than fish.



Fig. 3: Beaches affected by oil. Source: Authors (2020).

According to [16], fishing communities were no longer able to market seafood, oysters, mussels, and crabs. This conclusion came about through interviews and meetings held with fishermen, middlemen and fish market traders. Between the second half of October and the first week of November, the sale of these products plummeted between 80% and 100% in Pernambuco. The sale of open sea fish (mackerel, snapper, and dorado) was also affected, decreasing by at least 60%, as well as of cultivated species (salmon, shrimp), around 50% in relation to the market prices before the leak. Although the fishing sector has been affected, fishermen themselves have been hardest hit, as they fish for seafood, oysters, and mussels.

Negative impacts tend to be common in people who work, have a family, or have fun in areas affected by spilled oil (Figure 4). Some residents report depressed and

anxious feelings and suffering from post-traumatic stress. Others may experience levels of depression, mental illness, and stress mainly up to two years after the disaster. Depression and anxiety impacts can also be seen in residents of oil-free areas who are concerned about the environment, human health, and the safety of marine foods.



Fig. 4: Fish killed by oil and the fisherman's despair. Source: Raul Spinassé / Folhapress.

People who had their source of income in the oil industries and lost them tend to suffer more impacts than the others, and may experience more anxiety or depression, increasing alcohol consumption, in addition to possible suicidal thoughts. Not only adults can suffer impacts on mental health. Children of parents who lost their income are 1.5 times more likely to develop mental problems. However, these problems are not only due to the oil spill, but these families had faced problems before and were not supported by coping policies.

According to [17], in the oil spill in the gulf, people linked to fishing had higher stress levels than others with a source of income, with migration to work in the period when fishing was banned, however, in areas most heavily affected the oil was not released because of contamination. A year later, residents of municipalities with people linked to fishing were more stressed and concerned about the economy in the future than those related to tourism.

**- The Use of the Leopold Matrix**

To analyze possible dimensions of the impacts caused, instruments of the Environmental Impact Assessment (EIA) can be used considering that it is a systematic process to identify, predict, evaluate, and mitigate the relevant biophysical, social, or other effects of projects or activities. According to [5], environmental impact is defined as any change in the physical, chemical, and biological properties of the environment caused by any form of matter or energy resulting from human activities that directly or indirectly.

Having the Leopold matrix as one of the chosen tools, according to Figure 5, an analysis of the environmental impacts is observed. As you can see, in all, 18 elements and 6 actions were summarized. The matrix of the present study was composed of the crossing of 18 environmental components (columns) and 6 potentially impacting actions, resulting in a total of 108 squares.

In summary, a total of 6 environmental impacts related to the oil spill were obtained. It is observed that the highest degree of severity of negative impact is associated with the oil spill followed by humans as transforming agents. Regarding the aspect of modifications or alterations in the environment, it is suggested that the flora has suffered greater impacts, considering the corals belonging to this modality in this study. According to [18] a coral reef is a rocky, rigid structure that resists the mechanical action of waves and marine currents and is built by marine organisms (animals and plants) with limestone skeletons. As for the necessary operation, such as cleaning and post-spill conservation, it is essential to rescue the impacted landscape, which will bring positive impacts from an economic, cultural, and environmental point of view (Figure 5).

		Elementos da natureza																
		Características Físico-Químicas						Condições Biológicas				Fatores Culturais		Relações Ecológicas				
		Terra	Água	Atmosfera	Flora	Fauna	Interesses	Cultura	Relações Ecológicas	Relações Ecológicas	Relações Ecológicas							
Ações	Modificações	Propriedades Físicas	-4	-4	-5	-5	-4	-4	-4	-5	-2	-3	-5	-5	-5	-4	-5	
		Propriedades Químicas	-4	-4	-5	-3	-2	-2	-4	-4	-2	-5	-5	-5	-1	-5	-2	-5
	Agentes Transformadores	Qualidade da água superficial	-5	-5	-4	-5	-2	-5	-5	-4	-3	-3	-4	-5	-3	-2	0	-2
		Temperatura	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
		Qualidade das águas profundas	-5	-5	-3	-5	-1	-3	-4	-4	-4	-4	-5	-5	-1	-3	-5	-5
		Gasos	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Operação Necessária	Gasos Tóxicos	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
	Limpeza e Conservação	2	2	2	2	3	3	5	1	1	4	1	5	5	5	3	1	

Fig. 5: Leopold matrix for polluted beaches in Cape Town. Source: Authors (2020).

In general, the Leopold matrix comes to prove aspects and impacts analyzed in loco: the fauna and flora suffered impacts that will take years or decades to be recovered in case the cleaning and conservation is partially carried out. Among the solutions for the crude oil that reached the beaches, after receiving adequate treatment, they can be used as fuel and / or alternative raw material in the cement kilns of the industries. If the use is made possible, this material will be destroyed, avoiding new environmental impacts caused by an eventual incorrect disposal. The use of solid residues contaminated with oil in the production of cement occurs through the technology of coprocessing,

used to replace fossil fuels - such as petroleum coke and mineral coal - in the generation of thermal energy for the manufacture of cement.

In the Leopold matrix, seen in Figure 5, the cleaning and conservation associated with the reuse of the oil will bring numerous environmental benefits, as well as generating income and employment for the local population (even temporarily) If they use the environmental protection equipment properly.

#### IV. CONCLUSION

Negative impacts tend to be common in people who work or have some activity related to the area affected by the spilled oil, the most likely being depressive feelings, anxiety and post-traumatic stress.

The levels of depression, mental illness, and stress mainly up to two years after the disaster can be seen in the local population, especially those who are concerned with the environment, human health and the safety of marine foods.

The adopted methodology enabled the identification and evaluation of local environmental aspects and impacts, pointing out as the most significant the spill / leakage of oil / chemical in the sea, characterized as to the severity of the direct and indirect consequences that may cause to the environment.

Among the suggestions for reducing these environmental impacts, it is suggested: reuse of oil sludge, proposing to minimize the hazardous waste and the consumption of natural resources, in addition to guiding the population on possible emergency plans in the event of a new occurrence.

The applied matrix objectively ordered the main environmental impacts that were caused by the oil spill on the beaches of Cape Town in Santo Agostinho, Pernambuco, Brazil. It is a tool that guides the most impactful activities, allowing managers a broad view of the aspects and impacts generated.

#### ACKNOWLEDGEMENTS

To the Catholic University of Pernambuco and the Health Department of the State of Pernambuco, Brazil.

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## Unveiling the meaning attributed to nursing care at the perspective of person with cancer

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Received: 09 Oct 2020;

Received in revised form:

25 Dec 2020;

Accepted: 05 Jan 2021;

Available online: 09 Jan 2021

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**Keywords— Oncology Nursing. Nursing care. Oncology Hospital Service. Humanization of Assistance. Professional-Patient Relations.**

**Abstract— Objective:** to verify the meaning attributed to nursing care from the perspective of the person with cancer. **Method:** descriptive, exploratory research, with a qualitative approach, using an interview script as an instrument and the semi-structured interview as a collection technique. **Participated in the research 13 patients, hospitalized in the surgical clinic of the inpatient units of the oncology ward of a public hospital, Center of High Complexity in Oncology, located in the city of Belém, State of Pará, Brazil. Research conducted in August 2019, and for the construction of the data, the thematic content analysis technique proposed by Bardin was used. Results:** the analysis of the speeches showed that patients recognize nursing professionals as the main reference for care, comfort and safety, and it is presented as a source of information, both for the health team and for patients and family members. **Conclusion:** when caring, the meaning of therapeutic intervention and qualitative professional relationship between patient and family are attributed. Knowing the meanings that patients attribute to the act of health professionals, contribute greatly to thinking about the decision making of more targeted and individualized therapeutic plans.

## I. INTRODUCTION

Cancer is defined as a pathology developed through recurrent genetic and epigenetic changes in two types of genes called: tumor suppressor genes and proto-oncogenes. In this context, the word "cancer" is conceptualized as a set of multiple diseases that have in common the malignant and disordered growth of cells, which invade tissues and organs quickly, which can cause the individual to develop metastasis, that is, the proliferation of cells to other regions of the body. As they multiply quickly and aggressively, they end up becoming uncontrollable, thus forming tumors (malignant neoplasms) due to the accumulation of cancer cells in the organs and tissues<sup>(1,2)</sup>.

The incidence of cancer has increased by 20% in the last decades worldwide, mainly in developing countries. The National Cancer Institute (INCA) estimated more than 600 thousand new cases for the year 2018; and the types of cancer that most affected the population are prostate cancer, leading the estimate with 68,220 new cases, followed by breast cancer with 59,700 cases. The incidence was also high for cancer of the colon, rectum, lung, stomach, cervix, oral cavity, central nervous system, esophagus and leukemia<sup>(1)</sup>. The diagnosis of cancer triggers several reactions in individuals, both physical and emotional, with a whirlwind of feelings, internal and family conflicts that can lead to a psychic disorganization leading to an increase in the suffering of this patient. Considering the previous aspects and the serious consequences that they can generate, the communication between the health professional and the patient becomes essential, together with access to information that is of great relevance within the therapy, as the individual is familiarized and understands their pathology itself<sup>(3)</sup>.

However, there is still a lot of prejudice and fear from the population in relation to the theme, and the oncological diagnosis is seen by the patient as a path with no possibility of cure. This brings up feelings of distress that refer to the idea of a disease directly related to death, possible mutilations and treatments that cause discomfort. Thus, demystifying the diagnosis of cancer presents itself as a challenge to be faced by nursing professionals, preventing this from being an obstacle to an early intervention<sup>(4)</sup>.

In this perspective, having to live with the need for aggressive cancer treatment becomes the first obstacle to be overcome because, along with chemotherapy, side effects become part of the patient's daily life, which makes with the main feeling experienced by the individual being the suffering of physical pain, associated with the fragility

of having to live with a disease whose treatment is exhausting and complex<sup>(4)</sup>.

In addition, in most cases, chemotherapy causes side effects such as nausea, vomiting, alopecia, dyspnoea, fever and fatigue. Directly interfering with the patient's quality of life, causing irritation and depression, affecting the physical, social, emotional and cognitive dimensions; living with pain, threat of death, fear of the prognosis, leading to a low quality of life<sup>(5,6)</sup>. Such difficulties faced by patients are pointed out by Marinho, Domingues and Olário (7), when they state that the performance of the nursing team in the face of oncology must bring much more than scientific knowledge and well-performed practices, there is a need to understand the human being as a whole, considering its physical, psychological, social, economic and spiritual dimensions.

In this scenario, the nursing team assumes great responsibility regarding the care of these patients, and it is their competence to provide assistance in the diagnostic assessment, treatment, rehabilitation and care for family members. This context requires nurses to take care with priority in the integral evaluation of the patient and his family. Thus, the need to understand the relevance of the care of this professional from the patient's perspective emerged, in the context of his assistance during hospitalization in the hospital environment<sup>(8)</sup>.

The research problems for the foundation of this study were chosen because of the scope of scientific research on the subject and its considerable value, taking into account the importance of oncology nursing, since it deals directly with physical, psychological and emotional state of the individual with cancer. Given the above, the following research question was elaborated: what is the meaning attributed to nursing care from the perspective of the person with cancer? Therefore, this study aimed to verify the meaning attributed to nursing care from the perspective of the person with cancer.

## II. METHOD

Descriptive, exploratory study with a qualitative approach, performed in a surgical clinic of the inpatient units of the oncology ward of a public hospital, Center for High Complexity in Oncology (CACON), located in the city of Belem, State of Para, Brazil. The data collection period was during the month of August 2019.

Thirteen patients participated in this research, which were identified by means of alpha numeric codes, with the following name: "P1, P2 ... where the" P "means participant and the number in the order in which they were addressed in the interview.

An interview script was used as an instrument for data collection, and the semi-structured interview was used as a technique, with the sample closing method being carried out through saturation around the theoretical axes. Minayo<sup>(9)</sup> reports that in this saturation sample method, the author limits the entry of new participants in the group when information collected from a certain number of individuals begins to show redundancy. The reason would be that, theoretically, the information obtained by the new participants would add little to the data already obtained.

Inclusion criteria were: people diagnosed with cancer, of both genders, aged between eighteen to seventy-five years, with the ability to talk, who were hospitalized for a minimum of three days, undergoing any type of treatment of an oncological nature. The exclusion criteria were: patients who did not respond to at least one of the items of the data collection instrument, patients in outpatient treatment and patients with neoplasms that compromise the ability to verbalize or who are using medical devices (tracheostomy, CPAP, others.) that make verbalization unfeasible.

The content of the interviews was transcribed in an original way, preserving the expressions used by the participants. However, to use them as a unit of analysis, orthographic corrections were made, excluding language vices, exchange or absence of letters, but maintaining linguistic vices that have meaning in the context of speech.

After transcription, a careful reading was performed, following the methodological criteria proposed by Bardin<sup>(10)</sup>. This research was submitted to the Research Ethics Committee of the Instituto Campinense de Ensino Superior LTDA, CAAE: 06943219.8.0000.5173, with approved opinion, number 3,211,767, on 03/20/2019. All participants signed the Free and Informed Consent Term and Authorization Term for Voice Recording before participating in the study.

The research was carried out following the norms that regulate research involving human beings contained in resolutions 466/12, 510/16 and 580/18 National Health Council (CNS) / National Commission for Ethics in Research (CONEP).

### III. RESULTS

In the analysis of the data, it was found that among the thirteen participants, eleven were male and two female. Age ranged from 29 to 75 years with an arithmetic mean of 54.2 years, median of 52 years and standard deviation of 13.8. Most individuals were married (69.23%), as can be seen in Table 1.

Table 1 - Characteristics of study participants, according to gender, age, place of birth and marital status, 2019.

Participant	Gender	Age	Place of birth	Marital status
P1	M	72	Afuá (PA)	Married
P2	M	51	Mosqueiro	Married
P3	M	52	Benevides	Married
P4	M	29	Belém	Married
P5	F	65	Belém	Single
P6	M	64	Breves	Married
P7	M	45	São Miguel	Married
P8	F	48	Capitão poço	Single
P9	M	68	Belém	Married
P10	M	36	Belém	Married
P11	M	48	Mocajuba	Widower
P12	M	75	Breves	Married
P13	M	52	São João de Pirabas	Single

Source: Field Research, Belém, Pará, Brazil, 2019.

The results indicate the aspects related to the importance attributed to the nursing teams that work in the care of cancer patients. The study corpus made it possible to organize the content into two empirical categories, grouped according to the theme extracted from the responses.

#### Meaning attributed to nursing care

This first category analyzes the meaning of nursing care, the meanings given to the care work offered to patients and how this care impacts in different ways on the continuity of life. It was noticeable in the speeches that the nursing actions are more than direct care to patients, they also go through the emotional and psychological aspects, emerging as assistance support, as can be seen in the following speeches:

*“Here, nursing gives us strength and support, through serum, blood pressure measurement, glucose. They never missed anything”. (P1)*

*“Everyone treats them well, gives them a smile and makes us happy. It is a profession that exercises care and deals with situations with the patient”(P2)*

*“For me, nursing care is that care offered by a person who is in a ward, close to a bed, who is helping with a bath, in a dressing, is helping in what the person needs”. (P3)*

*"They help a lot in the rehabilitation of the sick. They always try to make us well and happy, there is no way to be sad because they are always offering us support ". (P5)*

*"Nursing is the one who provides guidance and emotional support. They provide the necessary support with guidance, information and support, both for us and for our family ". (P7)*

*"When they transferred me here, they gave me attention and even today they have not abandoned me. Nursing offers all support for the patient. " (P8)*

*"Nursing is the one that is always here with us. It deals with the patient directly, with medication, taking care of people ". (P10)*

*"Nursing gives guidance so that we are not nervous. They come and come here and talk [...] They spend a "positive energy". (P11)*

*"They treat us well. They talk to give emotional support. They take care not only of the apparent wounds, but also of the emotional ones ". (P13)*

#### **Unveiling the meaning attributed to nursing care in the person's experience with cancer hospitalized**

This thematic category seeks to describe the expression of the interviewees' feelings when receiving nursing care. It was possible to observe that in the care process, patients and nurses create bonds of affection, directly influencing care, the professional-patient relationship and the quality of care. It is well known that the creation of a professional-patient bond, which can influence the prognosis of patients. This can be seen in the following statements:

*"Everyone treats me with great care and efficiency. Here is the same as being in heaven, even with my illness, everyone treats me very well ". (P1)*

*"I get emotional, because it is difficult to have cancer (pause), and here we are treated well. I thank God and everyone here for all their strength, their affection; at all times and are always here to help ". (P3)*

*"I created a wonderful friendship with everyone, from nurses, doctors to other employees. They are all wonderful. The pleasure of being here is enormous ". (P7)*

*"I would like to thank you for all the care you give me because I know that it is tiring to be with us, and even then they are always helping me. The*

*nurse talks to me whenever she can. I have a huge affection for them "(P11)*

*"I have a lot of affection for everyone, as we are well attended, I never had any doubts, because whenever I needed an answer I was very well attended. I am happy to be treated like this. " (P12)*

#### **IV. DISCUSSION**

##### **Meaning attributed to nursing care**

From the speeches, it is possible to understand the participants' perception of nursing care. This care is expressed in the technical actions carried out on a daily basis; understood by the interviewees as "dressing", "bath", "serum and medication". Care is present during daily life, being attributed to the nursing team, as highlighted by Silva et al.<sup>(11)</sup>, when he mentions, that nursing treats the cancer patient in a direct assistance and emotional care.

The role played by the nursing team goes far beyond assistance, given that the sense of the nurse's profession, caring, is multidimensional and permeates the actions of prevention, promotion, recovery and rehabilitation of health, constituting steps of extreme importance<sup>(12)</sup>. Thus, nursing care has a much deeper, broader and broader meaning than what is seen daily by the user's view, which shows, in its majority, a somewhat vague perspective and focused on the assistance technique. However, this plausible perception and corroborates with a study on the oncology patient's perceptions of care<sup>(3)</sup>, which deals with the user's perception of acting based on procedural technique, intrinsic to the client's experience. That is, the client reports what he witnesses and observes during his hospitalization.

Regarding the meaning attributed to nursing care, from the speeches, it can be observed that words such as "strength", "affection" and "efficiency" became evident, allowing to infer that nurses have an important role in care, especially as a mechanism of emotional support, which is believed to directly imply in the improvement and prognosis of the patient. In this context, nursing care, which for several moments, needs to meet physical demands, involving procedures and techniques, of an objective and based on facts, is complemented and challenged to meet human demands and responses affected in the subjective dimensions, inviting the nursing to establish a relationship with patients that transcends this material and physical world<sup>(13)</sup>.

It was found that patients give nursing a meaning that corroborates the feeling of security and trust. In this understanding, it is considered essential to exercise this

support, since cancer impacts on the various dimensions of daily life, radically changing the routine and life projects. Thus, humanization involves the protagonism and appreciation of the patient and his family in the context of care for cancer patients, as an important source of emotional support<sup>(14)</sup>.

Corroborating the findings of this study, it appears that nursing interventions are configured and reach not only objective aspects involving procedures, but also dimensions of emotional support, promotion of hope, strengthening of self-esteem, listening activity, among others, highlighting the role of bringing comfort, in the face of the stress experienced by cancer patients; in this sense, when well developed, these actions make the experience tolerable and humanize the treatment trajectory<sup>(15)</sup>.

### **Unveiling the meaning attributed to nursing care in the experience of people with cancer**

The process of caring for cancer patients is long and arduous. Therefore, nursing needs to deal with the patient's psychosocial situations and take responsibility for creating a safe and comfortable space. In this way, the patient-nurse binomial needs to create a bond and from that the experiences are built. When asked about the experience, the study found words like "affection" and "friendship". This leads us to infer that the treatment in the researched scenario was based on respect, emotional support, trust promoting an affinity and even affection among the actors involved. Corroborating these findings, it is described that oncology needs to carry out quality care, more than technical professionals with theoretical skills, it needs a professional who understands all the nuances of the client's physical and emotional dimensions<sup>(16)</sup>.

In this study, speeches emerge, which transform the environment more pleasant and help in the recovery of the patient, helping him in the acquisition of abilities to become resilient. It is described that the feeling of mutual and reciprocal respect is significant for the patient's stay, establishes a bond and, after treatment, becomes a feeling of gratitude<sup>(17)</sup>.

In the meantime, some actions of nursing reception are recognized as attitudes that promote well-being, such as: communication, respect, attention, comfort, equal treatment and commitment, which become facilitators of humanization, build a safe environment for the patient and family members and finally collaborates for satisfaction<sup>(18)</sup>; promoting the overcoming of adversities and aligning the treatment course for the patient and nurse<sup>(19)</sup>.

Therefore, humanization emerges as an important tool, which includes communication, interpersonal activities and psychosocial support. Nursing must work towards maintaining a satisfactory service that promotes recovery, not only physical, but emotional of the patient. This bond between nursing-patient enables a new sense of care, transforming it into a key point that makes the experience, in the face of a disease with so much social and psychological weight, more acceptable, facilitating recovery and coping<sup>(20)</sup>.

## **V. CONCLUSION**

It was found that the methodological resource applied allowed understanding about the meaning attributed to nursing care from the perspective of the person with cancer. When caring, the meaning of therapeutic intervention and professional patient-family relationship is attributed.

We understand that getting sick with cancer changes not only the existential project of the person who gets sick, but also the entire family and social environment. Experiencing the experience with cancer evokes feelings of fear, fear and frustration in people.

Understanding how patients attribute meaning to the experiences they experience in this new context of their lives is important to reflect on care actions.

Thus, knowing the meanings that patients attribute when doing health professionals, contribute greatly, in thinking about the decision making of therapeutic plans more targeted and individualized to their needs, aiming to improve not only their quality of life during the provision of care during hospitalization, but also in the sense of mediating the relationship with patients and their families.

Thus, the diagnosis often acquires a tragic character capable of giving rise to feelings of hopelessness, depression and anxiety, as well as fears, mainly related to death. Furthermore, the diagnosis brings up thoughts that can influence the individual's emotional state, mainly because it was built and reinforced throughout life, such as: cancer is a disease that leads to a quick and painful death.

In this understanding, the study made it possible to give participants a voice to openly expose their experiences related to such a unique moment in their lives. Thus, the results outlined here contribute to fill an important gap evidenced in the literature, which is the approach of people who experience the process of becoming ill with cancer.

The results presented in this study are not generally applicable, given that it focused on understanding the

meaning attributed to nursing care based on the experiences of people with cancer. Thus, one of its possible limitations is the time frame in which the participants were questioned, that is, the inclusion of people with different and singular trajectories in relation to the time of the disease may have influenced different perspectives and perspectives on their understanding of care received during hospitalization. Another limitation is the small number of participants.

Finally, it is expected that this study will encourage research that considers the inclusion of participants with similar illness trajectories and that take into account the complexity that revolves around the experience of people who are diagnosed with cancer, which may be the subject of other studies.

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# A Systematic Review on Industry 4.0 Maturity Metrics in the Manaus Free Trade Zone

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Received: 20 Oct 2020;

Received in revised form:

27 Dec 2020;

Accepted: 03 Jan 2021;

Available online: 09 Jan 2021

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**Keywords—** Industry 4.0, Innovation, Maturity Model, Pro-Know-C, Systematic Review.

**Abstract—** The term industry 4.0 has been widely used as a symbol of the fourth industrial revolution, and in this context, the adequacy of companies to the set of digital technologies has become a meaning of competitiveness or leadership maintenance, with research, development, and innovation as the basic prerequisite for the company or its partners to materialize the cited improvement. In this scenario, measuring the maturity of companies is the main requirement for establishing strategies for the digital advancement of industry in the form of private actions or government public policies. With the purpose to obtain the state-of-the-art regarding the measurement of maturity under the metrics of industry 4.0 and its relation with innovation, this work used the Knowledge Development Process - Constructivist (ProKnow-C) tool, which enabled the construction of a bibliographic portfolio composed of 27 papers published in Journals and 4 publications of actors involved in the industry digital transformation. Although the richness of the selected literature concerning maturity models, it was acknowledged a scientific gap concerning its relationship with innovation investments involving tax benefits from the government, which is one of the main objectives of this work.

## I. INTRODUCTION

The introduction of the paper should explain the nature of the problem, previous work, purpose, and the contribution of the paper. The contents of each section may be provided to understand easily about the paper.

Considered by the literature as the fourth industrial revolution, industry 4.0 was inserted in the manufacturing historical context started in the 18th century with the invention of the steam engine, followed by the use of electric energy for mass production and, later, industrial automation, culminating in the current generation of cyber-physical systems of autonomous and intelligent production involving a great variety of other technologies (Geissbauer et al. 2016, Schuh et al. 2020, Yao et al. 2019).

The possibility of integrating processes both vertically and horizontally allows not only production to benefit from technologies related to industry 4.0, but all relations involving supply chain actors and the respective processes.

Understanding that it is of absolute importance for the positioning of Brazilian production value chains, more specifically from the Manaus Industrial Pole (MIP), the Brazilian Government has made efforts towards the implementation of public policies to encourage the advance of production in the direction of digital transformation.

An example of this is the publication of Ordinance No. 2,091, of December 17, 2018 (Brazil 2018), from the then Ministry of Industry, Foreign Trade and Services (assignment currently assumed by the Ministry of Economy), which provides for the methodology to be adopted in investments in research, development, and innovation (RD&I) aimed at industry 4.0 in the Manaus Free Trade Zone, which, in short, defines that projects must promote digital evolution under metrics based on the system developed by the German Association of Science and Engineering (ACATECH) applied under a diagnosis

of a productive process in which a project is to be executed.

Such investments are foreseen within a broader context treated by Federal Law No. 8,387, of December 30, 1991 (Brazil 1991), also locally known as the Informatics Law (IL), which establishes an obligation for application in RD&I to all companies that manufacture computer goods at MIP that take advantage of taxes benefits in the purchase of imported production supplies, as well as in the sale of manufactured computer goods.

Facing the aforementioned initiatives, there are movements involving various actors of the regional ecosystem, which include the companies that receive benefits from the mentioned law, the academy, institutes of science and technology (IST), startups, among others (Brazil 1991), whose activities have effects that are not yet completely transparent from the socioeconomic point of view, what can be proved by the lack of scientific literature evidencing such results: the companies' capacities to insert themselves in the desired set of systems that makes industry 4.0 one of the ways to remain competitive and lead by the use of benefits provided by the law and its regulations.

From production development means and methods in the sense of industry 4.0, and bearing in mind that, as conceptualized by Zaoui and Souissi (2020) and Ercan and Samet (2020), measuring the maturity or readiness of companies is the basis for defining the roadmap to successfully achieve the digital transformation, this work aims, through a systematic review of the scientific literature, to reach the state-of-the-art in measuring the maturity (or readiness) of companies under the metrics of industry 4.0, relating results to the RD&I performed by them as an obligation under the Informatics Law.

Intending to scientifically strengthen the understanding of the theme, this work uses the Knowledge Development Process - Constructivist (ProKnow-C) methodology developed at the Multicriteria Methodologies Laboratory in Decision Support of the Federal University of Santa Catarina to solve a problem related to the abundance of information available in a research sources multitude that makes the researcher work increasingly complex to find the most appropriate references to the research being carried out (Ensslin et al. 2015, Ensslin, S. and Ensslin, L. 2014). Such a tool has been consolidated for obtaining a portfolio based on searches in the databases of journals to build a bibliographic reference centered on the topic from the researcher's point of view.

## II. SCENARIO

### Industry 4.0 and RD&I in Manaus Free Trade Zone

Initially used in Germany, the term "Industry 4.0" has become synonymous with the digital transformation of the means of production, focusing on making industrial plants hyper-connected, intelligent, and autonomous (Buhr 2015, Schuh et al. 2020, Wittenberg 2015) through the use of information and communication technologies (ICT) embedded in cyber-physical systems involving three paradigms: (i) the product, which must enter as part of the process, addressing itself which values should be added in terms of components and services; (ii) the machine, which must be autonomous, intelligent and connected; and (iii) operator, whose functions have to be completely flexible within the process, adapting to the challenges provided by the systems (Weyer et al. 2015).

According to GERMANY TRADE & INVEST-GTAI (2016) and Buhr (2015), such a change is not only made by companies but involves academia in professionals formation, governments in the elaboration of public policies, IST for the development of new technologies, among other actors.

In a study carried out worldwide by PwC, in which Brazil was inserted, it was identified that in 2016, only 9% of Brazilian companies were classified as having a high degree of processes digitalization, and the same research concluded that entrepreneurs, at the time, believed that this indicator would be at 72% in 2020 (Geissbauer et al. 2016).

In the same direction as the observation that Brazilian industrialization has faced challenges in the direction of digitalization, Federal Law no 8,387/1991 (Brazil 1991), which establishes an obligation to invest in RD&I to all TIC goods manufacturers that make use of the Manaus Free Trade Zone benefits the equivalent to 5% of the gross revenue earned on such products, minus taxes, returns and purchases of inputs also beneficiaries of the referred Law, must be compulsorily carried out annually within the geographic limits of the Western Amazon or the State of Amapa (SUFRAMA 2020, Brazil 1991),

The Federal Government of Brazil is represented in the aforementioned region by the Manaus Free Trade Zone Superintendence (SUFRAMA) which, among other activities aimed at regional development, has the role of monitoring the investments made under IL, which reached in 2018 R\$ 681.8 million (SUFRAMA 2020), as shown in Fig. 1, with the academy, IST or the eligible companies to use it (Brazil 1991).

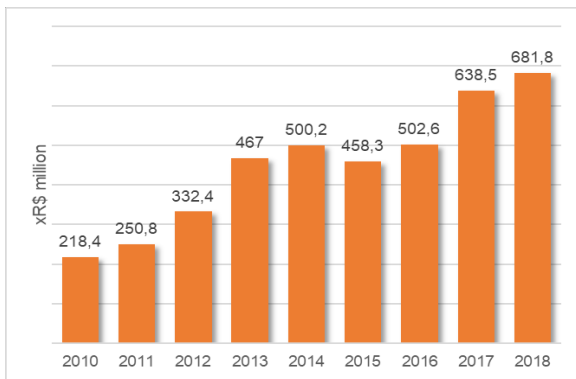


Fig. 1: Investment in RD&I in Manaus Free Trade Zone – Informatics Law (x R\$ million)

Within the theme of industry 4.0, there is also the regulation of two standards related to the IL: Ordinance No. 2,091, of December 17, 2018 (Brazil 2018), which deals with investments made by companies in their industrial parks to promote the digital gain on their processes; and CAPDA<sup>1</sup> Resolution No. 9, of October 29, 2019, which defines the “INDUSTRY 4.0 AND INDUSTRIAL MODERNIZATION” program as a priority in the area covered by SUFRAMA’s influence. (Brazil 2019).

Having verified the large volume of resources used for RD&I in a closed geographical area, concurrently with government actions in terms of public policies, it is expected that the companies holding this obligation are at least outlining the path for the implementation of the three paradigms proposed by Weyer et al. (2015), given that, according to Mihardjo et al. (2019), companies need to be innovative to bring to their processes the new digital age characterized by industry 4.0.

In this context, this work deals with the bibliographic survey for the scientific reference determination to reach the maturity (or readiness) measurement under the metrics of industry 4.0 that will be a subsidy to position the companies benefiting from IL in terms of digital transformation in their value chains.

### III. METHODOLOGY

The present work is exploratory-descriptive research from the objectives, considering that it aims the literature finding to expand the knowledge on the subject, and selection procedures must be performed to determine the set to be used as a study reference (Silva and Menezes 2001).

<sup>1</sup> CAPDA: Committee for Research and Development Activities in the Amazon created by IL.

As for the approach, it is configured as a quantitative work since it will systematically identify the bibliographic portfolio on the topic obtained through the use of the Knowledge Development Process – Constructivist (ProKnow-C) methodology, given that, as mentioned by Ensslin et al. (2015), the tool works to provide the necessary knowledge to start the research that is intended to be carried out in a constructivist way through the process of data collection and analysis.

ProKnow-C as a system is divided into macro processes (Ensslin et al. 2015), two of which were carried out in this work, shown in Fig. 2 and detailed below:

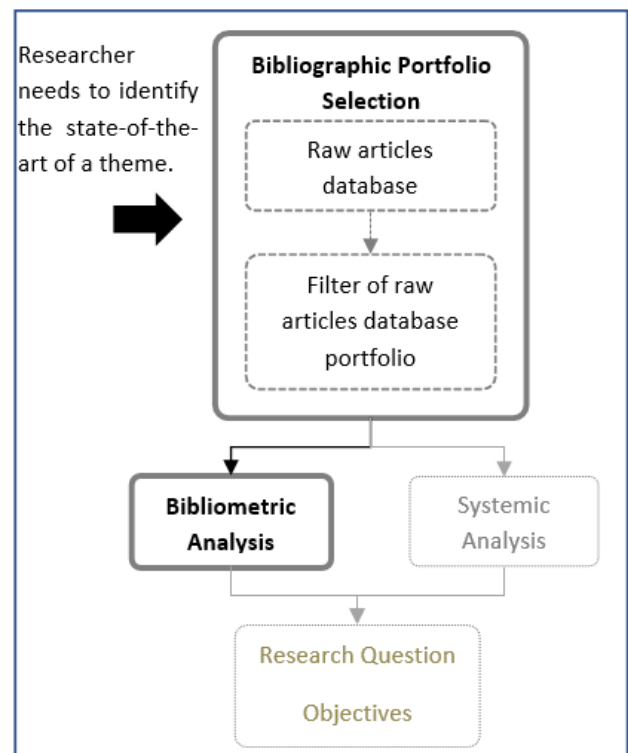


Fig. 2: ProKnow-C macro processes, emphasizing those used in this work

#### 3.1. Construction of the Bibliographic Portfolio

It is about the selection of the set of publications that will compose the bibliographic portfolio which is presented in two stages: (i) the selection of the raw article database and (ii) the filter of the selected database based on the researched topic (Fig. 2).

##### 3.1.1. Selection of raw articles database

The first step in the selection of the raw article database considers the research dimensions related to the theme, from which the keywords are determined (table 1). The defined dimensions take into account the core of the research, those are industry 4.0; model; maturity; and research and development.

Table 1: Dimensions and keywords definition

industry 4.0	model	maturity	R&D
“Industry 4.0”	Model	Maturity	R&D
“Smart Manufacturing”	Assessments	Readiness	“Research and Development”
“Digital Transformation”			Innovation
“Fourth Industrial Revolution”			
“4th Industrial Revolution”			

Source: Developed by the authors (2020), based on ProKnow-C methodology (Ensslin et al. 2015).

The keywords in Table 1 resulted in 60 combinations applied to the Journals portal of Coordination for the Improvement of Higher Education Personnel (CAPES)<sup>2</sup>, resulting in publications available in 19 databases.

From the periodical bases selected by the CAPES portal, it was possible to merge the research as follows (table 2).

Table 2: Journals Bases result

BASE/COLLECTION	SOURCE BASE
Scopus (Elsevier)	Scopus Elsevier
Materials Science & Engineering Database	ProQuest
Advanced Technologies & Aerospace Database	ProQuest
Technology Research Database	ProQuest
Engineering Research Database	ProQuest
Mechanical & Transportation Engineering Abstracts	ProQuest
Computer and Information Systems Abstracts	ProQuest
Civil Engineering Abstracts	ProQuest

<sup>2</sup>CAPES Portal is available on: <https://www.periodicos.capes.gov.br/>

Materials Business File	ProQuest
Solid State and Superconductivity Abstracts	ProQuest
Aerospace Database	ProQuest
ANTE: Abstracts in New Technology & Engineering	ProQuest
Materials Research Database	ProQuest
Science Citation Index Expanded (Web of Science)	Web of Science
Social Sciences Citation Index (Web of Science)	Web of Science
Directory of Open Access Journals (DOAJ)	DOAJ
OneFile (GALE)	GALE
SpringerLink	Springer
Taylor & Francis Online – Journals	Taylor & Francis
Emerald Insight	Emerald Insight

Source: Developed by the authors (2020) using data collected on the CAPES portal, access on July/24/2020

The researches in the related databases were carried out, restricting the period of publications to the last 5 years, since this is a technologically new topic, as well as focusing on filtering articles published in peer-reviewed journals to obtain scientifically reliable information. As a result, 4,144 articles were obtained.

Considering that the topic is very broad, involving numerous technologies, applied to different economic sectors and in different countries, 14,791 keywords were identified, however, the research was not redone because of the impossibility of extracting the most relevant ones for the study, considering that the volume of keywords reveals no preponderance among the terms used by the authors. Besides, the quantity of obtained articles from the research is considered numerically consistent to obtain the bibliographic portfolio.

**3.1.2. Filter of raw articles database**

The following filters were used to evaluate the raw articles database (4,087 articles):

- a) Alignment of titles to the proposed theme;
- b) Check the significance of the articles based on citations collected in Google Scholar;
- c) Alignment of abstracts with the proposed theme

As a product of the analysis of the titles, it was considered opportune to separate the selected ones in this phase into two alignment classes: (i) 72 articles aligned with the maturity measurement (or readiness) of companies concerning industry 4.0; and (ii) 11 articles that, even indirectly, deal with RD&I, maturity and industry 4.0.

The relevance analysis through a search on Google Scholar regarding received citations resulted in (i) 18 articles on maturity measurement, which received 90% of all citations in the evaluated set; and (ii) 6 articles that even indirectly deal with RD&I, maturity, and industry 4.0. From reading the abstracts, no article was excluded from the collection, resulting in the Primary Bibliographic Portfolio depicted in Table 3.

Table 3: Primary Bibliographic Portfolio

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### Primary Bibliographic Portfolio

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Akdil, K. Y., Ustundag, A., & Cevikcan, E. (2018). Maturity and Readiness Model for Industry 4.0 Strategy (pp. 61–94). [https://doi.org/10.1007/978-3-319-57870-5\\_4](https://doi.org/10.1007/978-3-319-57870-5_4)

Basl, J., & Doucek, P. (2019). A metamodel for evaluating enterprise readiness in the context of industry 4.0. *Information (Switzerland)*, 10(3). <https://doi.org/10.3390/info10030089>

Basl, J., & Kopp, J. (2017). Study of the Readiness of Czech Companies to the Industry 4.0. *Journal of Systems Integration*, 8(3), 40–45. <https://search.proquest.com/docview/1927971210?accountid=26540>

Canetta, L., Barni, A., & Montini, E. (2018). Development of a Digitalization Maturity Model for the Manufacturing Sector. In *2018 IEEE International Conference on Engineering, Technology and Innovation, ICE/ITMC 2018 - Proceedings*. <https://doi.org/10.1109/ICE.2018.8436292>

Castelo-Branco, I., Cruz-Jesus, F., & Oliveira, T. (2019). Assessing Industry 4.0 readiness in manufacturing: Evidence for the European Union. *Computers in Industry*, 107, 22–32. <https://doi.org/10.1016/j.compind.2019.01.007>

Cividino, S., Egidi, G., Zambon, I., & Colantoni, A. (2019). Evaluating the degree of uncertainty of research activities in Industry 4.0. *Future Internet*, 11(9). <https://doi.org/10.3390/fi11090196>

Colli, M., Madsen, O., Berger, U., Møller, C., Wæhrens, B. V., & Bockholt, M. (2018). Contextualizing the outcome of a maturity assessment for Industry 4.0. *IFAC-PapersOnLine*, 51(11), 1347–1352. <https://doi.org/10.1016/j.ifacol.2018.08.343>

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Daemrlich, A. (2017). INVENTION, INNOVATION SYSTEMS, AND THE FOURTH INDUSTRIAL REVOLUTION. *Technology and Innovation*, 18(4), 257–265.

<https://doi.org/http://dx.doi.org/10.21300/18.4.2017.257>

De Carolis, A., Macchi, M., Negri, E., & Terzi, S. (2017). A maturity model for assessing the digital readiness of manufacturing companies. *IFIP Advances in Information and Communication Technology*. [https://doi.org/10.1007/978-3-319-66923-6\\_2](https://doi.org/10.1007/978-3-319-66923-6_2)

De Carolis, A., Macchi, M., Kulvatunyou, B., Brundage, M. P., & Terzi, S. (2017). Maturity Models and Tools for Enabling Smart Manufacturing Systems: Comparison and Reflections for Future Developments. In *IFIP Advances in Information and Communication Technology* (Vol. 517, pp. 23–35). Springer New York LLC. [https://doi.org/10.1007/978-3-319-72905-3\\_3](https://doi.org/10.1007/978-3-319-72905-3_3)

Erro-Garcés, A. (2019). Industry 4.0: defining the research agenda. *Benchmarking*. <https://doi.org/10.1108/BIJ-12-2018-0444>

Gökalp, E., Şener, U., & Eren, P. E. (2017). Development of an Assessment Model for Industry 4.0: Industry 4.0-MM. In *Communications in Computer and Information Science* (Vol. 770, pp. 128–142). Springer Verlag. [https://doi.org/10.1007/978-3-319-67383-7\\_10](https://doi.org/10.1007/978-3-319-67383-7_10)

Jung, K., Kulvatunyou, B., Choi, S., & Brundage, M. P. (2016). An overview of a smart manufacturing system readiness assessment. (N. I., V. O., R. J.M., G. R.F., S. M.T., K. D., & von C. G., Eds.). National Institute of Standards and Technology (NIST), Gaithersburg, MD, United States: Springer New York LLC. [https://doi.org/10.1007/978-3-319-51133-7\\_83](https://doi.org/10.1007/978-3-319-51133-7_83)

Kosacka-Olejnik, M., & Pitakaso, R. (2019). INDUSTRY 4.0: STATE OF THE ART AND RESEARCH IMPLICATIONS. *LOGFORUM*, 15(4), 475–485. <https://doi.org/10.17270/J.LOG.2019.363>

Kotarba, M. (2017). Measuring Digitalization - Key Metrics. *Foundations of Management*, 9(1), 123–138. <https://doi.org/http://dx.doi.org/10.1515/fman-2017-0010>

Lee, J., Jun, S., Chang, T.-W., & Park, J. (2017). A smartness assessment framework for smart factories using analytic network process. *Sustainability (Switzerland)*, 9(5). <https://doi.org/10.3390/su9050794>

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Rajnai, Z., & Kocsis, I. (2018). Assessing industry 4.0 readiness of enterprises. In *SAMI 2018 - IEEE 16th World Symposium on Applied Machine Intelligence and Informatics Dedicated to the Memory of Pioneer of Robotics Antal (Tony) K. Bejczy, Proceedings* (Vol. 2018-Febru, pp. 225–230). <https://doi.org/10.1109/SAMI.2018.8324844>

Rocha, C. F., Mamédo, D. F., & Quandt, C. O. (2019). Startups and the innovation ecosystem in Industry 4.0. *Technology Analysis and Strategic Management*, 31(12), 1474–1487. <https://doi.org/10.1080/09537325.2019.1628938>

Schagerl, M., Jodlbauer, H., & Brunner, M. (2016). Readiness model for industry 4.0 - The path to digital transformation. *Productivity Management*, 21(4), 40–42. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-84987715150&partnerID=40&md5=cdcb5875e8162a9b1c0a1522e734b50b>

Schuh, G., Anderl, R., Dumitrescu, R., Krüger, A., & ten Hompel, M. (2020). Industrie 4.0 Maturity Index. Managing the Digital Transformation of Companies – UPDATE 2020. <https://en.acatech.de/publication/industrie-4-0-maturity-index-update-2020/>. Access 14 July 2020.

Schumacher, A., Erol, S., & Sihni, W. (2016). A Maturity Model for Assessing Industry 4.0 Readiness and Maturity of Manufacturing Enterprises. In *Procedia CIRP* (Vol. 52, pp. 161–166). <https://doi.org/10.1016/j.procir.2016.07.040>

Schumacher, A., Nemeth, T., & Sihni, W. (2019). Roadmapping towards industrial digitalization based on an Industry 4.0 maturity model for manufacturing enterprises. In *Procedia CIRP* (Vol. 79, pp. 409–414). Elsevier B.V. <https://doi.org/10.1016/j.procir.2019.02.110>

Shpak, N., Odrekivskiy, M., Doroshkevych, K., & Sroka, W. (2019). Simulation of innovative systems under industry 4.0 conditions. *Social Sciences*, 8(7). <https://doi.org/10.3390/SOCSCI8070202>

Zaoui, F., & Souissi, N. (2020). A triaxial model for the digital maturity diagnosis. *International Journal of Advanced Trends in Computer Science and Engineering*, 9(1), 433–439. <https://doi.org/10.5267/j.msl.2019.6.015>

Source: Developed by the authors (2020), based on ProKnow-C methodology (Ensslin et al. 2015).

Afonso et al. (2012) further say that, as the significance of recently published articles can be affected by the analysis of citations, it is still necessary to verify the adequacy of publications made in the last two years. Under this criterion, 3 articles were added to the list (table 4).

Table 4: Articles added to the Primary Bibliographic Portfolio

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**New Selected Articles (published in the last two years)**

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Lucato, W. C., Pacchini, A. P. T., Facchini, F., & Mummolo, G. (2019). Model to evaluate the Industry 4.0 readiness degree in Industrial Companies. *IFAC-PapersOnLine*, 52(13), 1808–1813. <https://doi.org/10.1016/j.ifacol.2019.11.464>

Santos, R. C., & Martinho, J. L. (2019). An Industry 4.0 maturity model proposal. *Journal of Manufacturing Technology Management*. <https://doi.org/10.1108/JMTM-09-2018-0284>

Kohnová, L., & Papula, J. (2020). WHO drives innovation activities? Evidence from innovative European countries. In *Proceedings of the 15th European Conference on Management, Leadership and Governance, ECMLG 2019* (pp. 227–236). <https://doi.org/10.34190/MLG.19.500>

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Source: Developed by the authors (2020), based on ProKnow-C methodology (Ensslin et al. 2015).

### 3.2. Bibliometry

Based on the selection of the 27 articles, a bibliometric analysis of the set will be carried out, which, according to Pimenta et al. (2010), it is a technique that, through the use of quantitative and statistical evaluations, can measure and understand the evolution of scientific productions. This understanding is corroborated by Afonso et al. (2012) and Ensslin et al. (2015) that carry bibliometric analysis out on the Primary Bibliographic Portfolio in 3 stages: (i) relevance of journals; (ii) relevance of the authors; and (iii) most used keywords.

#### 3.2.1. Relevance of journals

The Bibliographic Portfolio formed before the selection of articles by citation relevance was composed of 83 articles published in 56 journals, 2 of which proved to be the most relevant, totaling 3 publications each in the portfolio: Lecture Notes in Mechanical Engineering and IFAC-PapersOnLine. From the references of these articles, 211 journals and events were identified, of which only those with the greatest relevance (published the article in the bibliographic portfolio and/or published referenced article) will be graphically presented (Fig. 3).

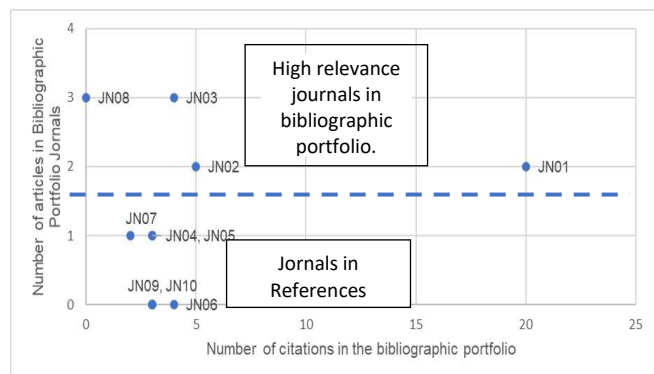


Fig. 3: Representativeness of the main journals in the bibliographic portfolio and their references

It appears that the journal *Procedia CIRP* (JN01) is considered of high relevance in bibliographic references. Standing out with the high relevance status in the bibliographic portfolio are the online *IFAC-Papers* (JN03) and *Lecture Notes in Mechanical Engineering* (JN08).

Table 5: Journals codes

Code	Journal	Code	Journal
JN01	<i>Procedia CIRP</i>	JN06	<i>MIS Quarterly</i>
JN02	<i>Computers in Industry</i>	JN07	<i>Industrial Management &amp; Data Systems</i>
JN03	<i>IFAC - PapersOnLine</i>	JN08	<i>Lecture Notes in Mechanical Engineering</i>
JN04	<i>International Journal Product. Res</i>	JN09	<i>Business &amp; Information Systems Engineering</i>
JN05	<i>Manufacturing letters</i>	JN10	<i>Procedia Computer Science</i>

Source: Developed by the authors (2020), based on ProKnow-C methodology (Ensslin et al. 2015).

The scientific impact of the 10 journals was also verified under the CiteScore metrics, which is obtained by adding the citations of a journal in a given year with those received in the last 3 years, divided by the sum of the same citations from the last 3 years; and the SJR (SCImago Journal Rank), which measures the prestige of a journal through the article citation link (ELSEVIER 2020). The results are shown in Table 6, in which it is possible to verify that the most relevant journals in terms of presence

and citations in the bibliographic portfolio are not the highlighted ones on the Citescore and SJR indicators.

Table 6: Greatest impact Journals and Citescore and SJR relevance indicators.

Journals	Quantity of articles in Bibliographic Portfolio	Quantity of citations (Portfolio)	CiteScore indicator	SJR indicator
<i>Procedia CIRP</i>	2	20	3,6	0,728
<i>Computers in Industry</i>	2	5	10	1,007
<i>MIS Quarterly</i>	0	4	11	4,531
<i>IFAC - PapersOnLine</i>	3	4	1,6	0,332
<i>International Journal Product. Res</i>	1	3	7,6	1,776
<i>Business &amp; Information Systems Engineering</i>	0	3	7,6	1,306
<i>Manufacturing letters</i>	1	3	4,6	0,855
<i>Procedia Computer Science</i>	0	3	2,5	0,342
<i>Industrial Management &amp; Data Systems</i>	1	2	9,1	2,084
<i>Lecture Notes in Mechanical Engineering</i>	3	0	0,5	0,165

Source: Developed by the authors (2020), based on ProKnow-C methodology (Ensslin et al. 2015).

Checking the works of the best-placed journals in the raw articles database indicators, it was not possible to identify texts that are aligned with the theme for inclusion in the bibliographic portfolio, which remained the same.

**3.2.2. Scientific relevance of articles**

The articles' scientific relevance in the bibliographic portfolio was measured based on the number of citations



consulted on Google Scholar and their relationship to the main author’s number of citations in the references (Fig. 4).

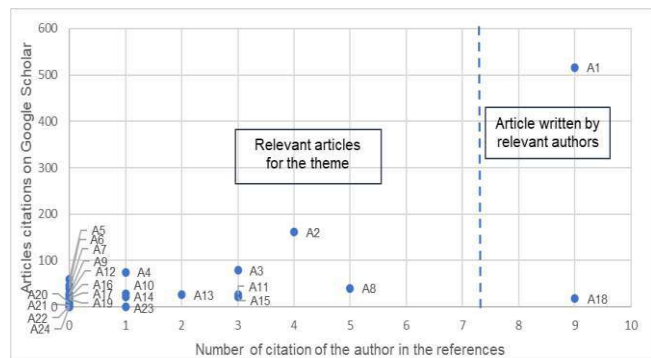


Fig. 4: Articles and their authors in the bibliographic portfolio

The articles references coded in Fig. 4 are shown in Table 7:

Table 7: Codes of bibliographic portfolio articles.

Article	Code	Article	Code
Schumacher et al. 2016	A1	De Carolis et al. 2017-b	A15
Schuh et al.2020.	A2	Basl, and Doucek 2019	A16
De Carolis, et al. 2017-a	A3	Basl and Kopp 2017	A17
Gökalp, E.et al. 2017.	A4	Schumacher et al. 2019.	A18
Castelo-Branco et al. 2019.	A5	Daemmrich 2019.	A19
Akdil et al. 2018.	A6	Erro-Garcés 2019.	A20
Kotarba 2017.	A7	Shpak et al. 2019.	A21
Jung et al. 2016	A8	Cividino et al. 2019.	A22
Colli, et al. 2018.	A9	Kosacka-Olejnik and Pitakaso 2019.	A22
Schagerl et al. 2016.	A10	Rocha et al. 2019.	A22
Lee et al. 2017.	A11	Lucato et al. 2019.	A23
Canetta et al. 2018.	A12	Santos and Martinho 2019.	A24
Zaoui, and Souissi 2020.	A13	Kohnová and Papula 2020.	A24

Rajnai and Koc  
sis 2018. A14

Source: Developed by the authors (2020), based on ProKnow-C methodology (Ensslin et al. 2015).

3.2.3. Authors Relevance Level

The authors' relevance is given by the number of articles within the bibliographic portfolio and within its references (Ensslin et al. 2015). The bibliographic portfolio includes 74 authors, of which Schumacher, A. and De Carolis, A. account for two articles each. In the bibliographic references, there are 225 authors of works cited in the bibliographic portfolio articles, of which Schumacher, A. is found in 9 references, and also represents the highlight in this axis (Fig. 5).

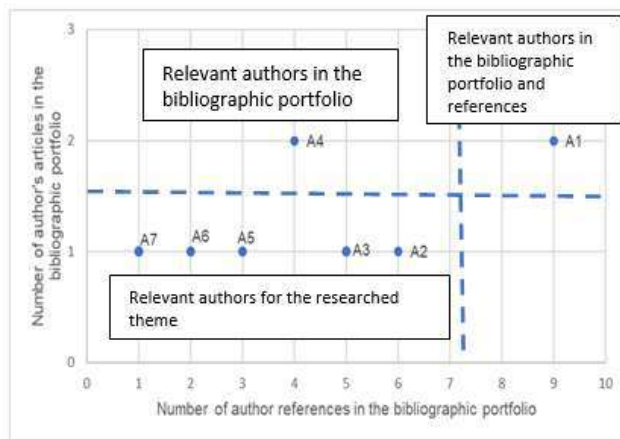


Fig. 5: Most relevant articles in the bibliographic portfolio by author

Due to the number of authors in the portfolio, it is impossible to represent them all graphically, and those shown in Fig. 5 are coded according to Table 8.

Table 8: Codes of the most relevant authors in the bibliographic portfolio

Authors	Codes	Authors	Codes
Schumacher, A.	A1	Jodlbauer, H	A6a
Schuh, G.	A2	Cruz-Jesus, F.	A6b
Jung, K.	A3a	Anderl, R.	A7a
Erol, S.	A3b	Facchini, F.	A7b
Macchi, M.	A3	Nemeth T	A7c
De Carolis, A.	A4	Oliveira, T.	A7d
Lee, J.	A5a	Rajnai, Z.	A7e

Zaoui, F.	A5b	Lucato, W.C.	A7f
		Madsen O.	A7g

Source: Developed by the authors (2020), based on ProKnow-C methodology (Ensslin et al. 2015).

In addition to the authors listed in the bibliographic portfolio, it was evident in this research that publications made by entities that study the industry evolution have works that are also well-referenced, which are not found in the consulted journals. They are (table 9):

Table 9: Articles produced by institutions referenced in the Bibliographic Portfolio

Entity	Title	Quantity of references on bibliographic portfolio
Pricewaterhouse Coopers (PwC)	The Industry 4.0/Digital Operations Self Assessment	3
	Industry 4.0: Building the digital enterprise	4
McKinsey & Company	Industry 4.0 after the Initial Hype	4
	Industry 4.0: How to navigate digitalization of the manufacturing sector	3

Source: Developed by the authors (2020), based on ProKnow-C methodology (Ensslin et al. 2015).

#### IV. ANALYSIS OF THE BIBLIOGRAPHIC PORTFOLIO

The bibliographic portfolio obtained using ProKnow-C methodology can be divided into three distinct classes within the proposed theme, namely:

- i) Industry 4.0 maturity models: the first 18 articles in table 3 and the first 2 articles in table 4;
- ii) RD&I related to the technologies implementation involving industry 4.0 systems: the last 6 articles in table 3 and the last article in table 4; and
- iii) publications by representative entities that have studied industry 4.0 and that are not available in journals: table 9.

Considering that maturity models are the first stage for the roadmap towards the implementation of technologies linked to the concept of smart manufacturing (Zaoui and Souissi 2020, De Carolis et al. 2017), they have greater relevance in the bibliographic portfolio, resulting in a greater scientific volume of this part of the theme.

Maturity indicates whether something is complete, perfect, or ready, that is, maturity indicators are used to identify the current status within a development process, and readiness indicators give information prior to maturity, however, both are used to measure industry 4.0 metrics as synonyms (Schumacher et al. 2016), thus, several widely used indicators were developed, exemplified by the Technological Readiness Level (TRL), which measures technological maturity from a commercial point of view (innovation) or the Manufacturing Readiness Level (MRL), which indicates the technological maturity of a production process, and it is not possible, through them, to make a broad diagnosis of industry 4.0 (Jung et al. 2016).

Thus, Schumacher et al. (2016), identified 62 control variables scattered over 9 dimensions represented on a radar graph, with 5 levels in each item measured by answering a questionnaire whose result was obtained by specific software to reach to a graphic outcome. The calculation of the dimensions result also considers a system of each variable relevance within the concept of industry 4.0 to obtain a weighted average.

In the study performed by De Carolis et al. (2017), maturity in digital transformation is measured in 4 dimensions and 5 variables, however, there is no case study demonstrating the developed model.

Since quantitative studies have not been found in the literature to identify industry 4.0 implementation level in countries or companies, Castelo-Branco et al. (2019) used data published by Eurostat regarding digitization indicators in the European industry. Through factor analysis method, two dimensions were reached: infrastructure in 4.0 and maturity in Big Data, both expressed through 9 control indicators.

Based on a detailed steps flow for defining the maturity measurement model, Schumacher et al. (2019) developed a model with 8 dimensions evaluated in 65 measurement variables using questionnaires structured by four levels of maturity. If filled in with maximum maturity grades 3 or 4, the method requires the participant to inform an example that supports the given grade to gain accuracy in collecting information. The final value of each analyzed variable corresponds to the average of the responses and that of the analyzed dimension is the result of the weighted average, considering each variable importance. The results are also displayed on a radar chart by the authors.

From table 10 presenting the models examples it is shown that:

i) Schumacher et al. (2016) and Schumacher et al. (2019), in both works, presented a complex system of metrics, including variables that cover a large part of the processes and people involved in the digital transformation of a company, and in the article presented in 2019, the axes and variables gained greater scope (Fig. 6 and Fig. 7);

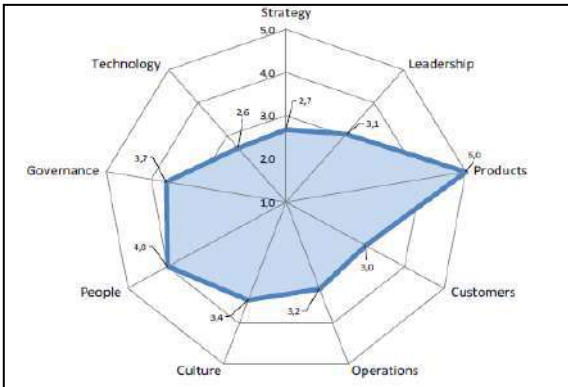


Fig. 6: Maturity model developed by Schumacher et al. (2016).

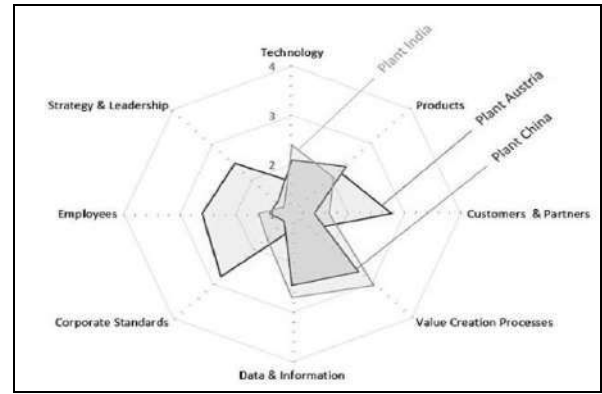


Fig. 7: Comparison of maturity using the model developed by Schumacher et al. (2019)

ii) the model developed by Castelo-Branco et al. (2019) resulted in information that relates European countries to each other, based on data provided by Eurostat (Fig. 8), with no conclusion on the application in a manufacturing plant;

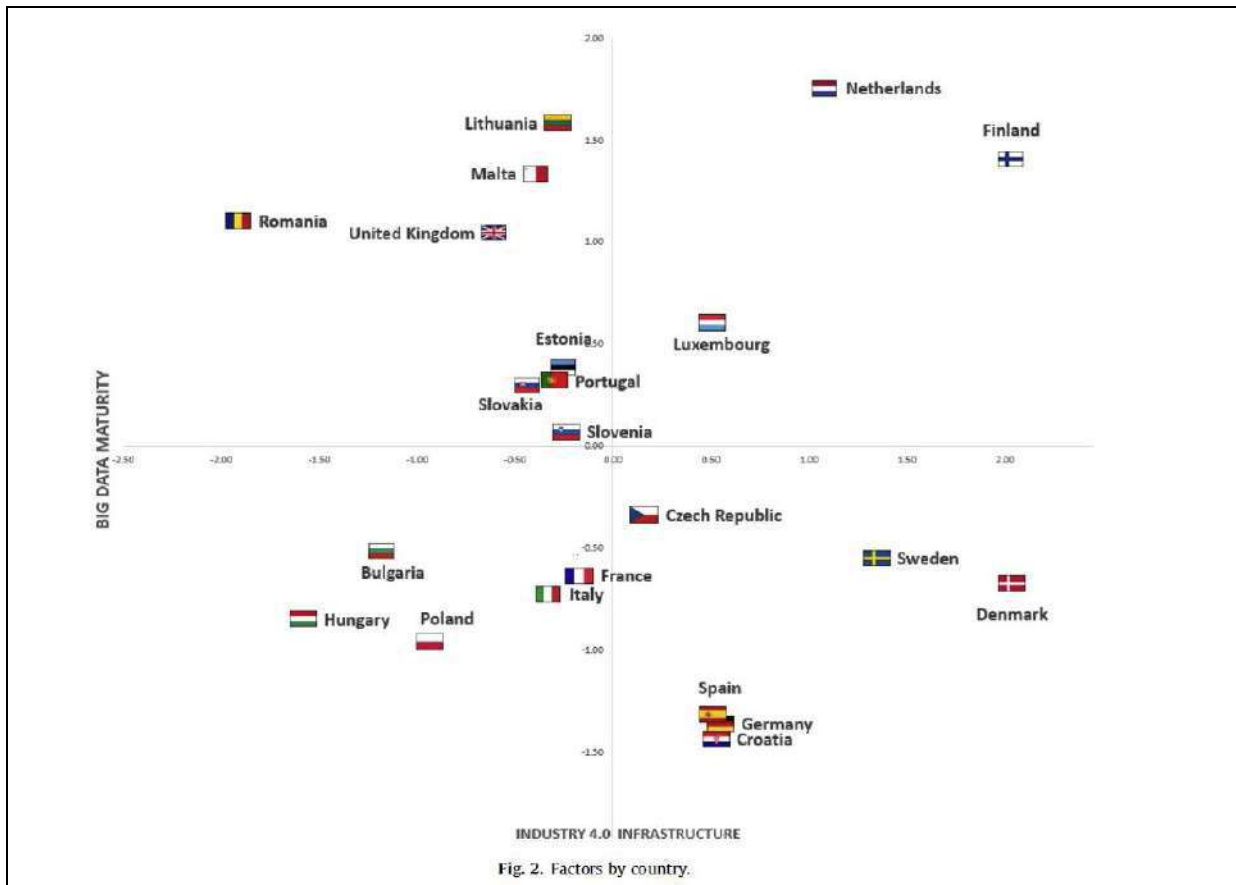


Fig. 8: Result of the model developed by Castelo-Branco et al. (2019)

Table 10: Examples of maturity models

ARTICLE	DIMENSIONS/AXES	VARIABLES	LEVELS
<b>SCHUMACHER; EROL; SIHN (2016)</b>	1- Strategy	1.1-Implementation of industry 4.0 roadmap	5 levels for each variable
	2- Leadership	1.2- Availability of resources	
	3- Customers	1.3- Adaptation to business modes	
	4- Products	...	
	5- Operations	2.1- Will of leaders	
	6- Culture	2.2 - Management skills	
	7- People	2.3- General coordination in industry 4.0	
	8- Governance	...	
	9- Technology	3.1- Use of customer data	
		3.2- Sales Digitalization	
		3.3- Customer digital competence	
		...	
		4.1- Individualization of products	
		4.2- Digitization of products	
		...	
		5.1- Processes decentralization	
		5.2- Models and simulation	
		5.3- Interdisciplinarity	
		...	
		6.1- Information sharing	
		6.2- Open-innovation program	
		6.3- ICT value in the company	
		...	
		7.1- ICT skills	
7.2- People's receptivity to new technologies			
7.3- Employee autonomy			
...			
8.1- Employment regulations for industry 4.0			
8.2- Adherence to technology standards			
8.3- Protection of intellectual property			
...			
9.1- Existence of modern ICT			
9.2- Use and mobile devices			
9.3- Communication			
...			
<b>SCHUMACHER;</b>	1- Technology	1.1- Information sharing technology	4 levels for each

<b>NEMETH; SIHNA (2019)</b>	2- Products	1.2-Use of technologies in the cloud	variable
	3- Customers and partners	1.3- Mobile devices on the factory floor	
		...	
	4- Value creation processes	1.8- 3D printing	
		1.9- Use of robots	
	5. Data and information	2.1- Individualization of products	
	6- Corporate standards	2.2- Flexibility of product characteristics	
	7- Employees	2.3- Collection of information on the product use	
	8- Strategy and leadership	...	
		3.1- Receptivity to new technologies	
		3.2- Competence in ICT	
		3.3- Contact with digital client	
		3.4- Customer integration in product development	
		...	
		4.1- Automation in the value creation process	
		4.2- Autonomous machine lines	
		4.3- Sharing information between machines	
		..	
		4.8- Human-robot collaboration	
		5.1- Digital information processes	
		5.2- Data collection Automation	
		5.3- Analysis of collected data	
		...	
		5.4- Software simulation of future scenarios	
		6.1- Monitoring of the industry 4.0realization	
		6.2- Technology standards	
		6.3- Recruitment for industry 4.0	
		...	
		6.6- Increased cybersecurity	
		7.1- Receptivity to new technologies	
		7.2- Competencies in TIC	
		...	
		8.1- Strategy for industry 4.0 implantation	
	8.2- Centralized control of activities related to industry 4.0		
	8.3- Financial resources		
	...		

<b>DE CAROLIS; TERZI; MACCHI (2017)</b>	<ul style="list-style-type: none"> <li>1- Process</li> <li>2- Monitoring and control</li> <li>3- Technology</li> <li>4- Organization</li> </ul>	<ul style="list-style-type: none"> <li>1- Design and engineering</li> <li>2- Production management</li> <li>3- Quality management</li> <li>4- Maintenance management</li> <li>5- Logistics management</li> </ul>	5 levels for each variable
<b>CASTELO-BRANCO; CRUZ-JESUS; OLIVEIRA (2019)</b>	<ul style="list-style-type: none"> <li>1- Infrastructure in Industry 4.0</li> <li>2- Maturity in Big Data</li> </ul>	<ul style="list-style-type: none"> <li>1- Mobile internet connection to access work applications</li> <li>2- Maximum contracted internet connection is at least 100 Mbps</li> <li>3- Companies with ERP to share information between different functional areas;</li> <li>4- Companies whose processes are automatically linked to the systems of suppliers and customers</li> <li>5- Companies sending only B2B paper orders</li> <li>6- Purchase cloud processing for internal company processing</li> <li>7-Analyze big data from any source</li> <li>8- Analyzes big data by internal systems and sensors</li> <li>9- Analyze geolocation big data from mobile devices</li> </ul>	The analysis was performed based on data provided by Eurostat.

Source: Developed by the authors (2020), based on Castelo-Branco et al. (2019), Schumacher et al. (2016), Schumacher et al.(2019) e De Carolis et al. (2017)

It appears that there are different models for measuring maturity, and it is common among all mentioned here that they carry out a cross-sectional assessment in more than one dimension, not only measuring the level of application of digital technologies but include, for instance, training employees, available resources for investments, and strategies. Thus, the results are usually expressed in several axes and not just by a single value, which is comprehensible in the consideration that the transition to industry 4.0 involves irreversible changes in machines, systems, and their relationship with humans (Erçan and Samet 2020).

As for the articles in item “b” above, they appear as the least relevant (identified in table 7 and represented in graph 2 in codes A19, A20, A21, A22 and A24) of the bibliographic portfolio, however, they are important for the theme, as they make it clear that, in the case of the fourth industrial revolution, as well as the first to third revolutions, industry 4.0 demands an innovation system (Schpak et al. 2019) with a transversal impact on value

chains, having differential when compared with other industrial revolutions the aim of reducing the barriers between inventors and markets through the digitalization of trade (Daemmrich 2017), thus the structuring of innovation in the context of industry 4.0 with different actors for a new ecosystem creation is the basis for value chains generation supported by the end-to-end integration with a high scale of relationship between the participants who, through innovative technological solutions, will be able to ever, monitor and digitally simulate physical conditions through digital twins with the objective to make decisions in an assertive manner, reducing risks of activities. (Cividino et al. 2019, Lim et al. 2020).

It is important to note, however, that the public policy established by IL that obliges beneficiary companies to invest in RD&I defines a unique scenario, not being explored in any of the selected articles even in an analogous way, evidencing a scientific gap regarding the relationship of the maturity of industries concerning industry 4.0 metrics with investments made in RD&I.

## V. FINAL CONSIDERATIONS / CONCLUSION

The development of industrial processes to implement technologies applied to the concepts of industry 4.0 has been seen by entrepreneurs, academia, and government as a way to maintain the competitiveness of national or local production, thus, strategies must be adopted so that physical systems are digitized with intelligence and connectivity gains.

However, establishing an advancement of industrial parks plan has as a prerequisite the knowledge of the maturity level at which companies are to establish adequate public policies (government), training plans and qualification of human resources (academy), and investments (entrepreneurs).

Bearing in mind that public policies to encourage research, development, and innovation are part of the recent history of the Manaus Industrial Pole and that these three pillars support the implementation of industry 4.0, this work used a systemic process to select the main scientific literature, here called the bibliographic portfolio, available on industry 4.0 maturity measurement models linked to the RD&I.

Obtaining the bibliographic portfolio occurred along with two of the four stages defined in the ProKnow-C methodology, which are (i) the definition of the raw articles database and (ii) the realization of filters (Fig. 2).

Then, 12 keywords were selected, distributed in 4 research axes, which, inserted in the journal database maintained by CAPES, made it possible to select 8 journal bases that returned as result a set of 4,144 articles, from which 57 duplications were filtered, reaching the raw articles database, subsequently submitted to the alignment filters of the title, abstract, number of citations and the full text, resulting in the bibliographic portfolio, composed of 27 articles.

The following step was the portfolio bibliometry by which the relevance of journals, articles, and authors was analyzed resulting in:

a) journals: the most relevant journal in terms of occurrence (2 articles) and citations (20) in the bibliographic portfolio was *Procedia CIRP*, however, the biggest impact on Citescore and JSR was the *MIS Quarterly* (table 6). This result did not cause any change in the defined portfolio, since, in the re-analysis of titles and abstracts, the articles did not adhere to the theme;

b) articles: with the number of citations as an indicator, the most relevant article in the bibliographic portfolio is the “A Maturity Model for Assessing Industry 4.0 Readiness and Maturity of Manufacturing

Enterprises.”, whose authors are Schumacher, A et al. W., with 516 citations indicated by Google Scholar, who are also the most-cited authors in the references of the bibliographic portfolio with 9 citations, a fact that also includes the article entitled “Roadmapping towards industrial digitalization based on an Industry 4.0 maturity model for manufacturing enterprises.”;

c) authors: with 2 works in the bibliographic portfolio, the main authors of the most relevant articles are Schumacher, A. and De Carolis, A. As for the authors that appear in the references of the bibliographic portfolio, Schumacher, A. is also the most relevant.

RD&I is treated in the bibliographic portfolio in less significant articles from the point of view of the bibliometric study, however, they bring relevant content regarding the need to generate an innovation ecosystem capable of sustaining the development of the industry for the digital transformation.

Finally, the bibliographic portfolio resulting from the applied ProKnow-C methodology showed a gap as to the intersection between the companies' maturity in industry 4.0 metrics and their obligation or willingness to invest in RD&I, which is the scenario brought up by the theme of this work, as well, it is evident the need for studies that can translate the unique condition generated by public policies that, within the imposition and investments, allows the application of resources in smart manufacturing.

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# Investigation of Dairy Cattle Concentrate Quality, Traceability & Handling Practices Adopted by Farmers – A Case Study Conducted in Sri Lanka

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Received: 18 Oct 2020;

Received in revised form:

30 Dec 2020;

Accepted: 01 Jan 2021;

Available online: 09 Jan 2021

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**Keywords**—dairy cattle concentrate, handling practice, moisture content, product information, traceability.

**Abstract**— This study was done in selected dairy farms in Central Province of Sri Lanka. As the Stage 1, 67 farms were selected and type, quality, traceability and farm level handling practices of different dairy cattle concentrates were identified. Analyzed results were; scale of dairy farming and farming method used, dairy cattle concentrate types used, product information & packaging and handling practices. Major findings were; average number of cows per farm was 3.1, concentrate types identified were coconut oil cake and formulated dairy cattle concentrate, 75.9% of the coconut oil cake products on the market had an unknown origin, all the coconut oil cake products had no product details and none of the farmers used total mix rations to feed their animals.

For the Stage 2, 64 dairy farms were selected. Moisture content of the dairy cattle concentrates were analyzed with respect to the storage method and they were statistically analyzed. Out of all the farms, 37.5% used coconut oil cake and 62.5% used formulated dairy cattle concentrates as their dairy cattle concentrate. In coconut oil cake uses, there was a significant difference ( $P < 0.05$ ;  $P = 0.003$ ) of moisture content between products stored on pallets without sealing well and well-sealed products on pallets and there was no significant difference ( $P > 0.05$ ;  $P = 0.159$ ) between the moisture contents with respect to the storing methods used to store formulated dairy cattle concentrates. Hence, this study provides an indication that coconut oil cake requires careful sealing and storing since it has a greater tendency to absorb atmospheric moisture.

## I. INTRODUCTION

Over the past few decades, world cows' milk production has increased significantly. Milk yield per cow has increased about 2% per year. In 1980, milk yield of an average cow was about 5,500kg per year/ 15.06kg per day and in 2005, it was about 8,500kg per year/23.29kg per day (Eastridge et al., 2006). In 2017 world cows' milk production was

increased to 828 million tons (FAO 2018) and the dairy cow population in 2016 was recorded as 278,482,840 (AHDB 2018).

Even though the world's dairy industry has developed rapidly over the past few decades, the present situation of the most developing countries is not satisfying. In 2006, Sri Lankan cow milk production was 164,862,200 liters and the

dairy cattle population was about 1,214,000 (Perera & Jayasuriya., 2008) which resulted 136 liters per year/ 0.357 liters per day average milk yield per cow. Therefore, local dairy industry in Sri Lanka is not sufficient to fulfill needs of its population. Sri Lanka had 290,628 registered dairy all farms around the country in 2015. From those, 36,981 dairy cattle farms were recorded in the Central Province and the milk production was 21,028,300 liters (DAPH 2015). Hence, the central province in Sri Lanka can be considered as the hub of milk supply in the country, emphasizing the need of analyzing the efficiency of dairy production and dairy farming practices in the central province.

Studies reveal that the main three aspects of improving milk composition are nutrition and management, cow genetics and dairy processing methods (Walker et al., 2004). However, cow nutrition itself is the only way to alter milk composition in a short period of time. It is known as the most suitable way to meet dynamic market demands (Ferland et al., 2018).

Dairy cattle concentrates are playing an important role in dairy cattle nutrition. Cattle concentrates are being fed to cows to fulfill all the basic nutritional needs that are required for efficient milk producing. Mainly they provide a considerable amount of energy needed for the metabolism. Also they are low in fiber content and the protein content can be low, medium or high (Isher et al., 1914). Some studies have reported that milk composition can be altered by feeding the cow with different grains. Casper et al., (1990) declare that the milk yield of cows fed with corn grain is higher than the cows fed with barley. Also, high moist corn has a greater impact on milk yield than the dry ground corn (Wilkerson et al., 1997). Providing total mix rations are proven to increase the milk performances such as milk yield, protein content, fat concentration etc., than feeding the concentrates separately (Burkholder et al., 2004; Ferland et al., 2018; Istasse et al., 1985; Kennelly 1996; Kolver & Muller et al., 1998). Hutjens (1996) states that providing total mix ration meal twice a day would significantly increase the milk performance. A study done by (Jin et al., 2007) revealed milk yield and the milk protein can be significantly ( $P < 0.05$ ) increased when the cows are supplemented with palm kernel cake in 10 – 18%. However same study proclaimed supplementing cows with palm kernel cake had no significantly ( $P > 0.05$ ) effect on the milk fat, total milk dry matter and lactose content.

In advance, some of the latest studies revealed that introducing microalga spices to the cattle diet can increase the quality of the milk properties. Morgan et al., 2019 declare that supplementing dairy cattle with *Aurantiochytrium limacinum* in the meal form can successfully enrich the milk with docosahexaenoic acid (DHA) in 84 days. According to the study, level of supplementation have

no effect on the milk yield and the other milk properties (fat, protein, lactose content).

Therefore, this study was conducted to investigate three main factors in the local dairy farm community. One reason is to investigate the dairy cattle concentrate quality, traceability, handling and feeding practices followed by farmers; in aim to provide suggestions regarding quality, traceability, handling and feeding practices to the farmers. Because still the majority of the farmer community has not been provided with adequate basic scientific knowledge about enhancing the cattle nutrition, which is the only method to improve the composition and the yield of milk in a short period of time. On the other hand, there are adequate studies have conducted island wide to enhance the finish good characteristics of dairy products. For example, recently conducted study by (Samarathunga et al., 2020) developed a drinking yoghurt fortified with Calcium and Zinc also having higher antioxidant capacity by using plant extract rather than using pharmaceutical ingredients. However, since these type of studies are based on dairy products, having good raw milk with better composition will have a major positive impact on the study and the final product. Therefore, the actual state of the farmers' knowledge regarding dairy cattle concentrates, their usage frequency, efficacy and handling practices can be investigated.

Second reason is to investigate the ongoing food handling and safety practices carrying out by the dairy cattle manufacturers and the responsible parties. Because due to the importance of the dairy cattle concentrates quality parameters and safety guidelines have been legislated (Animal Feed (Amended) Act No 15 of 2016 Parliament of the Democratic Socialist Republic of Sri Lanka ; Codex Alimentarius Commission 2008).

Final reason is to investigate the moisture content of the dairy cattle concentrates with respect to their storage method at the farmer level. Because farmer level handling practices are as much as important as the handling practices done at the manufacturer level to provide animals a safer and nutritive dairy cattle concentrate product.

This study model maybe useful for any other similar country, who wish to evaluate the conditions/ practices of dairy farming, in aim to upgrade the efficacy and quality of their dairy production.

## II. MATERIALS AND METHODS

The study was conducted in selected dairy farms in Central Province of Sri Lanka from December 18<sup>th</sup> of 2017 to April 30<sup>th</sup> of 2018. Areas selected were Peradeniya, Gampola, Doluwa, Nawalapitiya, Pussellawa, Doluwa, Kothmale and

Atabage (Figure 1). The overall research conducted was divided into two stages; Stage 1 was conducted as a survey; to identify the quality, traceability and farm level handling practices of dairy cattle concentrates. Stage 2 was conducted to investigate the moisture levels of different dairy cattle concentrate types that were being used in the selected dairy farms of the area with respect to their storage conditions.

2.1 Stage 1 – Investigation of quality, traceability and farm level handling practices of dairy cattle concentrates

67 dairy farms were selected for the study by simple random sampling. Data was collected through an open question questionnaire. Collected information included; farm location, no of cows available in a farm, cow breed, farming method, dairy cattle concentrate type used, brand of the dairy cattle concentrate, purchasing place, product information, type of the packaging material, number of dairy cattle concentrate meals given per cow, dairy cattle concentrate quantity given per cow and method of serving. Product details were collected to test whether the industry was obeying the regulations (Sri Lankan Animal Feed Act 2016). Data collected regarding the product information were; availability of Manufacturer’s details, Batch number details, manufactured date and expire date details. Minitab 17 software was used to analyze the data obtained.

2.2 Stage 2 – Investigation of the moisture level of dairy cattle concentrate types with respect to the storage method at the farm level

64 dairy farms were selected for the study by simple random sampling. Dairy cattle concentrate samples which were

collected from the farms and were projected to test the moisture contents. Samples were collected to airtight bags. Recorded data were; dairy cattle concentrate type that is being used and the storage method practiced at the farm. To analyze moisture content, 2g of dairy cattle concentrate samples were taken and the weight was recorded (analytical balance; ABS 220-4, Max 220g, d=0.0001g). Then the sample was dried at 100°C of temperature under 100 mm/Hg (moisture oven; model: B35535 S Electron Italy) until obtained a constant weight. Moisture content was measured through the weight loss percentage (AOAC 2018). This process was triplicated and mean value was taken as the final moisture content of a dairy cattle concentrate sample. Minitab 17 software was used to analyze the data obtained.

III. RESULTS

3.1 Stage 1 – Investigation of quality, traceability and farm level handling practices of dairy cattle concentrates

Scale of dairy farming and farming methods used: Mean value of 3.1 No of cows per farm was obtained with a standard deviation of 5.2. Minimum value was 1 and the maximum value was 40. In the selected area, 89.55% of the farms did not have more than 4 dairy cows and only 2.98% of the farms have more than 10 cows (Figure 1). 16.42% of the farms were using the “Semi-Intensive Farming Method” and 83.58% of the farms were using the “Intensive Farming method”. None of the farmers were using “Extensive Faming Method”.

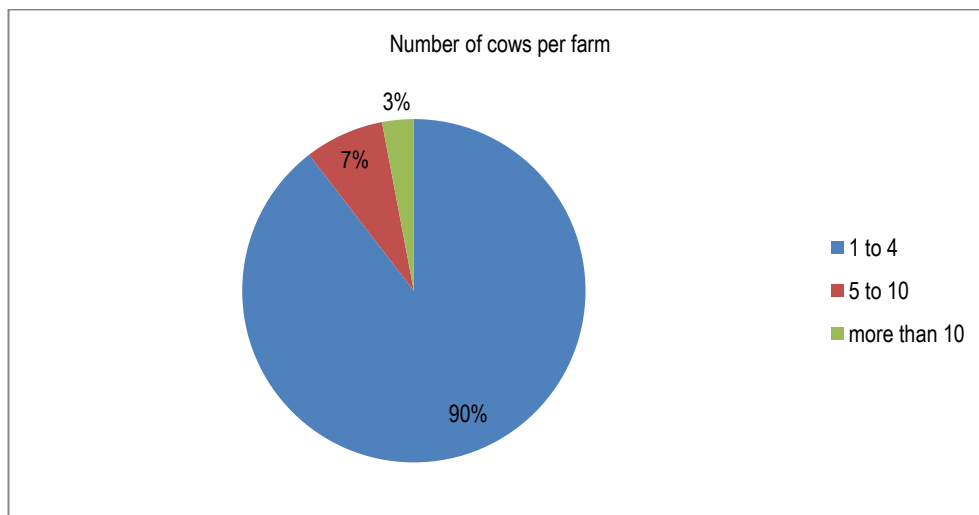


Fig.1: Number of cows per farm

Dairy cattle concentrate types used and purchasing place: One of the two main dairy cattle concentrates identified was coconut oil cake. These products were purchased from six different retail shops available in the area. Five out of six of these shops have no link with the coconut oil cake producing companies and only one shop has a link with the

producer. 43.3% of the farmers were using coconut oil cake as their cattle concentrate (Figure 2).

Other dairy cattle concentrate identified was formulated dairy cattle concentrate. Formulated concentrates were provided not only as a protein source, but to fulfil all

nutritional requirements that is not provided through forages. Under formulated dairy cattle concentrates, five brands were identified. All the formulated dairy cattle concentrates were purchased from authorized retailers. Therefore, the shops had a direct link with the formulated dairy cattle concentrate producing companies. Overall, 6.7% of the farmers were using formulated dairy cattle concentrates as their cattle feed (Figure 2).

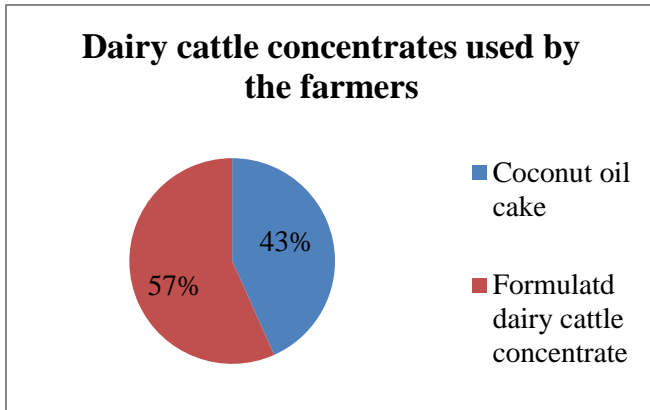


Fig.2: Types of dairy cattle concentrates used by the farmers

Product information and packaging: Considered product details were manufacturer’s details, batch number records and manufacture and expire date information. Manufacturer’s details of 75.9% of the coconut oil cake products that were supplied to the market are from unknown origins. Origin of the remaining 24.1% coconut oil cake products were known by the retailers (Figure 3 & Figure 4).

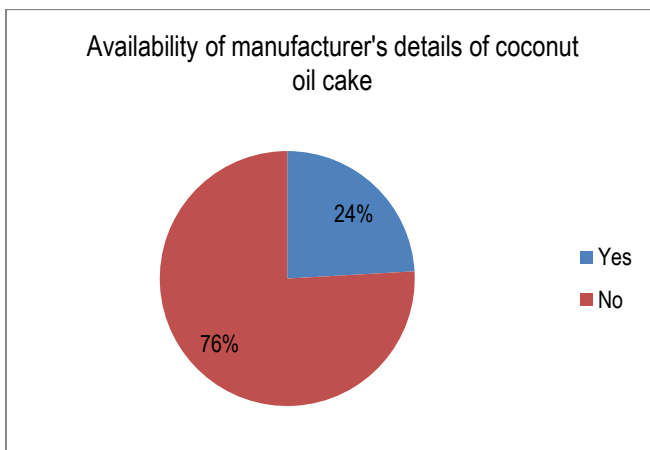


Fig.3: Availability of manufacturer's details; coconut oil cake products

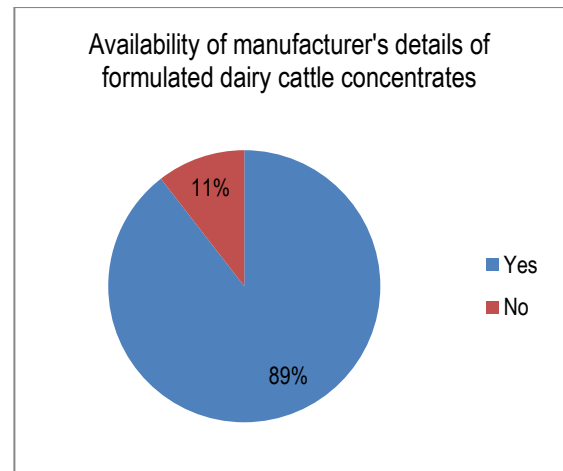


Fig.4: Availability of manufacturer's details; formulated dairy cattle concentrates

However, the manufacturer’s details were not available on those products or labels either. Hence, 100% of the products contain no manufacturer’s details on the product or on the labels. Results obtained for formulated dairy cattle concentrates revealed, 89.5% of the products contained manufacturer’s details. Only 10.5% of the products did not contain manufacturer’s details (Figure 3 & Figure 4).

Under Batch Number details and nutrition details, none of the coconut oil cake products contained Batch Number records and nutritional details. But, 89.5% of the formulated dairy cattle concentrates contain information on Batch Number records and nutritional details.

All the formulated dairy cattle concentrate products contain manufacture date and expiry date information. However, none of the coconut oil cake products contained manufacture date or expire date information.

None of the coconut oil cake products contained a packaging. On the other hand all the formulated dairy cattle concentrates contained a packaging material. Nylon was used to pack all the formulated dairy cattle concentrates.

Handling practices: When considering about the average number of meals given for a cow per day, coconut oil cake users have fed their cows an average of 1.93±0.37 meals per day. Formulated dairy cattle users have fed their cow an average of 1.66±0.48 meals per day (Table 1).

An average amount of 2.64±1.13kg coconut oil cake was fed to a cow per day. On the other hand, an average amount of 3.30±2.11kg of formulated dairy cattle concentrates were fed to a cow per day (Table 1).

Table 1: Farm level handling practices of dairy cattle concentrates

Dairy cattle concentrate type	Average daily number of meals per cow	Average daily quantity per cow
Coconut oil cake users	1.93±0.37	2.64±1.13kg
Formulated dairy cattle concentrate users	1.66±0.48	3.30±2.11kg

According to the results obtained for the feeding methods, 100% of the farmers have fed their concentrates separately. None of the farmers have used Total Mix Ration methods.

3.2 Stage 2 – Investigation the moisture level of dairy cattle concentrate types with respect to the storage method at farm level

As identified in stage 1; all farms were using by-product feeds and formulated dairy cattle concentrates as cattle feed. Under by product feeds, was all farms were using coconut oil cake.

Overall, 37.5% were using coconut oil cake as their dairy cattle concentrate in selected dairy farms. Three different storage methods were found at the farms that were using coconut oil cake. They were; storing concentrates on the floor without sealing, storing concentrates on wooden pallets without sealing and storing concentrates on the pallets well-sealed. According to the moisture analysis results, moisture percentages (<sup>W</sup>/<sub>W</sub> %) of concentrates are as shown in the table 2;

Table 2: Moisture levels of coconut oil cake with respect to storage conditions

Storage practice	Percentage of farms	Average moisture level
On the floor- without sealing	25.0%	0.0642±0.01g/g
On pallets- without sealing	58.3%	0.0815 ±0.01g/g
On pallets, well-sealed	16.7%	0.0451±0.01g/g

According to the results, moisture contents are significantly different (P<0.05; P=0.003) between products that were stored on pallets without sealing well and well-sealed products stored on pallets. Therefore, moisture content of coconut oil cake products can be determined as dependent on the storage condition.

Percentage of farmers who were using formulated dairy cattle concentrates were 62.5%. They were practicing four storage methods. They were; storing concentrates on the floor without sealing, storing concentrates on the floor well-sealed, storing concentrates on the pallets without sealing and storing concentrates on the pallets well-sealed. Moisture analysis results are as shown in the table 3;

Table 3: Moisture levels of formulated dairy cattle concentrates with respect to the storage conditions

Storage practice	Percentage of farms	Average moisture level
On the floor without sealing well	40.0%	0.0967 ±0.0g/g
On floor, well-sealed	2.5%	0.1098g/g
On pallets without sealing well	15.0%	0.0943±0.01g/g
On pallets, well-sealed	42.5%	0.1054 ±0.01g/g

There was no significant difference (P>0.05; P=0.159) between the moisture content with respect to the four storing methods used to store formulated dairy cattle concentrates. Hence, moisture content of the formulated dairy cattle concentrates maybe independent on the storage condition. One of the reasons for not having the moisture absorption impact on formulated dairy cattle concentrates can be due to the good packaging practices done by the manufacturers.

IV. DISCUSSION

4.1 Stage 1 – Investigation of quality, traceability and farm level handling practices of dairy cattle concentrates

Scale of dairy farming and farming methods used: Mean value of 3.1 No of cows per farm was obtained with a standard deviation of 5.2 for this study. Mean value of cows per farm obtained was equivalent to the global value of number of cows per farm which is also 3.1 (IFCN 2017). Since Sri Lanka is a developing country, average dairy cow per farm value is less. Registered dairy cattle farms reported in 2017 were 332,335. Total no of dairy cows reported in 2017 was 642,683, which elicits average number of dairy cows per farm as 1.93. In the Central Province, number of registered farms were 40,160 in 2017 and the dairy cows available were 59,816 which results an average number of cows per farm as 1.49 (DAPH 2017). However in the selected areas, average number of dairy cows per farm is higher than the values reported for the Central Province and for the whole country.

Most popular farming method observed among the farms in this study was the intensive farming method. In the Central Province of Sri Lanka; intensive, semi-intensive and extensive farming method practicing farms in 2017 were 42%, 45% and 13% respectively (DAPH 2017). The number of farms practicing intensive farm management system is higher than the other two methods. High altitude and the slope lands are the main reason for obtaining a higher number for intensive farm management system practicing farms. Austria; being a prime dairy producer in the world; has moved to Intensive Farming from Extensive Farming Method due to its reliability and efficacy. Current results reveal that farms using intensive method in Austria are around 80% to 85% and the farms using extensive method are 15% to 20% (Knaus 2016).

Dairy cattle concentrate types used and purchasing place: Isher et al (1914) revealed that there are mainly three types of concentrates available. They are cereals, plant or animal protein sources and by-product feeds. However, in selected farms for this study; cows were not given any cereals as a concentrate in the area. Either plant or animal based protein sources were not given directly to the cows.

Kavanagh (2016) proclaimed that dairy cattle concentrates can be divided into two main categories. They are energy feeds and protein feeds. According to the results obtained through the study, two main dairy cattle concentrate categories were identified. They were “by-product feeds” and “formulated dairy cattle concentrates”. Under by-product feeds, solely used product by local farmers was “coconut oil cake”. By-product feeds are usually used for ration formulation. Some by-products contain high-energy and/or high-fat. Hence, they can be used to balance the nutrient composition of rations (Isher et al., 1914). However in selected farms, by-product feeds were being given to the cows as straights. None of the farmers used coconut oil cake to formulate rations.

Product information and packaging: Even though coconut oil cake product was lack in product information, Sri Lankan Animal Feed Act 2016 reveals that the composition of the feed must be indicated as percentage by weight or if the product is a liquid composition must be indicated in grams per litre (Sri Lankan Animal Feed Act 2016).

Codex Alimentarius Commission (2004) has proclaimed under good animal feeding practices; in order to inform animal feed users to handle, store and use properly, the product information shall be stated on the animal feed packaging material clearly. Information that shall be stated are; information about the species or category of animals that the feed is intended, the purpose for the feed is intended, a list of feed ingredients, including appropriate reference to additives in descending order of proportion, contact

information of manufacturer or registrant, registration number if available, directions and precautions for use, lot identification, manufacturing date and expiry date. Also the same document states that the animal feed industry shall practice proper record keeping prior to trace-forward and trace back.

About 75.9% of the coconut oil cake products observed in the study contained no manufacturer’s information, product information on their labels and traceability record details. On the other hand, majority of the dairy cattle concentrates consisted with product details on their labels.

Handling practices: Results obtained for the feeding quantities per cow per day reveal that the farmers who are using formulated dairy cattle concentrates were feeding their cows with larger portion sizes of concentrates than farmers who were using coconut oil cake. FAO; Harris (1992) states that the nutrient requirements of the dairy cows change according to the weight of the animal. However, none of the selected farmers have used a computation method to calculate the nutritional requirement of the cows in order to feed them to overcome nutrition deficiencies.

Even though none of the farmers were using total mix rations, studies have elicited that providing Total Mix Rations have high milk performances such as higher milk yield, protein content, fat concentrate etc, than feeding the concentrates separately (Burkholder et al., 2004; Ferland et al., 2018; Istasse et al 1985; Kennelly 1996; Kolver et al., 1998). Hutjens (1996) have found that the milk performances can be increased by feeding the cows twice a day by using total mix ration method.

4.2 Stage 2 – Investigation the moisture level of dairy cattle concentrate types with respect to the storage method at farm level

Results obtained through stage 2 provides an indication that coconut oilcake requires careful sealing and storing since it has a greater tendency to absorb atmospheric moisture rapidly. Overall, moisture absorption levels of formulated dairy cattle concentrates are not that dependable on sealing and storage methods. Studies have revealed that the storage conditions, storage time, substrate condition and high temperatures can lead to fungal growth and synthesis of aflatoxins (Stack & Carson 2003). Van Egmond (1993) has suggested that the aflatoxins detected in milk can be occurred when the animal has been fed with contaminated feed. Since the study has done in a tropical country, due to the high humidity and the tropical temperature there can be a tendency of fungal growth and synthesis of aflatoxins due to moisture absorption property of coconut oil cake.

## V. CONCLUSION

Formulated dairy cattle concentrates were comparatively higher in traceability and in compliance with the quality standards, compared to coconut oil cakes.

None of the farmers were using Mix Ration Method to feed their herds. Instead they all used the separate feeding systems.

Feeding frequency and portion sized were comparatively higher when cows are provided with formulated cattle concentrates.

Moisture content of stored coconut oil cake products significantly depend on the storage conditions and may have a greater tendency of fungal growth. Formulated dairy cattle concentrates have comparatively lower tendency to absorb moisture due to improper storage.

## VI. RECOMMENDATIONS

*Suggestions to farmers:* Coconut oil cake users have to follow proper storage practices to avoid moisture absorbance. Farmers need to practice total mixed ration feeding systems that may increase milk performances.

*Suggestions to dairy cattle concentrate producers:* Addition of product information (manufacturer's details, batch number details, manufactured date and expire date details) and traceability records to the product is a must to gain high quality milk output from farms.

*Suggestions for responsible parties:* Regular monitoring whether the cattle feed concentrate manufacturers are obeying the Animal Feed (Amended) Act No 15 of 2016 Parliament of the Democratic Socialist Republic of Sri Lanka is important.

*To researchers worldwide:* Frequent investigation of the quantity, efficiency, quality, handling practices and storage conditions in small scale dairy farms is of utmost importance for any country/community to estimate the development of the dairy industry in the particular country/region.

## ACKNOWLEDGEMENT

The authors thank Dr. Asitha Cooray and all staff members at the Instrument center at Faculty of Applied Sciences – University of Sri Jayewardenepura for their technical facilitation. . Also author thanks all the academic and nonacademic staff members of Department of Food Science and Technology, Faculty of Applied Sciences, University of Sri Jayewardenepura -Sri Lanka, and all the staff members of Fonterra Brands Lanka (Private) Limited, Delgoda, Biyagama for the support given during the study.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Disclaimer: No

Conflict of Interest: No

Source of Funding: No

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# From contingency planning in times of change and uncertainty to risk control

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Received: 05 Oct 2020;

Received in revised form:

22 Dec 2020;

Accepted: 03 Jan 2021;

Available online: 11 Jan 2021

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**Keywords—** *Planning,  
Contingencies, Change,  
Uncertainty. Risks.*

**Abstract—** *It is said that: "Nothing is permanent, except change." Indeed, at best the changes can be gradual and predictable; however, in the current era, most changes happen at unprecedented speeds, altering the status quo and placing organizations in conditions that can be favorable or unfavorable, depending on each particular case.*

*The planning process, which incorporates uncertainty, must include several scenarios that include different contingency plans, that is, create short and long-term analysis models based on speculation about the behavior of different variables that may affect the company.*

*. The more changeable the environment, the greater the need for a wide range of settings; more contingent plans must be generated to be prepared for the emergency.*

*The COVID-19 crisis has made visible the importance of risk control and internal auditing in companies.*

## I. INTRODUCTION

In many organizations, there is a devaluation of strategic analysis and an overvaluation of operational efficiency. It is difficult to reconcile the day to day and the future because the future is not the sum of several day to day. When operational issues leave no time for strategic concerns, the consequences can lead to the closure of the company.

In 1980, Porter developed a model related to how the structure of the environment can affect a company's strategy.

According to Andrews (1971), the sources of competitive advantage have an internal origin but will only make sense if they have a framework in the external environment.

## II. THE ENVIRONMENT

There are various environmental situations that can cause an emergency, for example: actions by the competition,

changes in customer preferences, technological advances or changes, social, political and economic problems, conflicts between countries, wars, etc. However, some of the changes that can have catastrophic consequences are natural disasters, such as fires, earthquakes, floods, climate change and pandemics; among others. The situation that the world has been experiencing since the beginning of 2020, related to the COVID-19 pandemic, has the attention of different sectors, precisely because it puts at risk the continuity of business, as well as the safety and health of humanity.

The speed of reaction to the speed of spread of the virus has become the decisive criterion for assessing the good or bad management of public and private organizations.

The prevalence of this criterion is a clear example of the generalized approach towards reactive management. The management of the pandemic is a case study, illustrative of the reactive culture versus the proactive culture of the strategic mindset. But, it is said that this is a situation that

none of them expected and they call it a health crisis and not an economic crisis with forecasts always lost in the economic models.

Barack Obama and Bill Gates in 2014 and 2015 will talk about global risk in a globalized world with the appearance of pandemics, pointing out the need to respond effectively and globally to the challenge.

Also the risk management consultancy Marsh, 15 years ago, in the annual study "The Global Risks Report", warned about the "imminence of a pandemic and the high degree of lack of preparation of countries and organizations to face a context of this nature".

So, how is it explained that the rulers and those responsible for the companies did not act with a strategic mentality?

For Taleb, The Black Swan is an event characterized by the following attributes:

1. It is a rarity, because it is outside of normal expectations;
2. produces a tremendous impact;
3. Despite its rarity, human nature causes us to invent explanations of its existence after the fact, which, erroneously, becomes explicable and predictable.

Why are we not aware of the phenomenon of black swans before they occur? Part of the answer, according to Taleb, lies in the fact that human beings are absolutely hardwired to learn specific things when instead they should be concentrating on generalities.

Therefore, we cannot really evaluate the opportunities, we are too vulnerable to the need to simplify, narrate and classify, as well as not being open enough to reward those who can imagine the "impossible."

### III. PLANNING

At the moment it seems appropriate to conclude that we have to definitively banish the false idea that planning and managing the future is a futile effort. The sustainability of organizations cannot be based on the ideas of a reactive culture of Steiner or Igor Ansoff typical of the last century.

The current pandemic related to COVID-19 represents a disruptive event that has an impact of great consequences worldwide. Both public and private institutions must analyze their strategies, evaluate and prioritize their objectives and action plans, to make a risk analysis and rethink their strategies towards achieving business continuity and sustainability.

Strategic planning as a powerful tool is not enough, we will talk about contingency planning. The typical planning

process focuses appropriately on the most likely events, but such concentration can result in an incomplete set of plans.

According to Steiner (2008) "Contingency plans represent the preparation to carry out a specific action (s) when an event occurs in which no planning was carried out during the formal process."

### IV. CONTINGENCY PLANNING

The two key concepts in contingency planning are probability and impact. In other words, contingency plans imply a high impact that do not have the highest probability of occurring, on the contrary, strategic planning also implies a high impact but with a high probability of occurring.

The most important contribution that contingency planning can make to an organization is the development of a process to identify and respond to unanticipated or unlikely events.

According to Goodstein (2000), the following key concepts should be considered in contingency planning:

- the contingency planning matrix
- the organizational status indicator
- macroeconomic indices
- business expansion rates
- composite indicators of budget variation

Contingency planning can be divided into two categories: internal vulnerabilities/ opportunities and external vulnerabilities/opportunities. Although most companies are more aware of internal than external contingencies, contingency plans should be established for each quadrant of the contingency planning matrix.

Uncertainty, volatility, change. Three words that describe the present and probably the near future. Churchill defended the need to "anticipate what will happen and then explain what did not happen." Anticipating future challenges is a necessary but fallible exercise, as is the diversity and complexity of the variables that can shape it.

This is where we must ask ourselves, how to plan in this context? Many planning processes are usually the main limitation to planning. Since they do not allow enough flexibility to make quick decisions. In a world of rapid and constant change, uncertainty is a key element to incorporate into planning and, in general, these types of decisions cannot wait for a slow and rigid planning process.

## V. RISK CONTROL

No risk map included the impact of a pandemic on an irruption company and the need to confine the population. The ability to react has marked the survival of companies, and management teams have had to develop action plans and business protection based on uncertain scenarios and taking into account multiple factors. And in the face of the new reality, the key is flexibility.

It is important to carry out an in-depth risk management analysis, under a comprehensive and continuous approach over time, covering key areas such as fraud risk management, allowing concrete and realistic measures to be taken that include the most appropriate tools and technologies. It must be based on continuous access to data and information, and the criteria for defining risk events must be refined taking into account the lessons learned from these months.

The health crisis has made visible the importance of risk control and internal auditing in companies. For months the focus has been on external threats that jeopardized its viability, but in some cases internal control has been neglected, increasing risk in critical areas such as fraud, regulatory compliance and internal information systems. Protocols have probably been relaxed that now need to be restored before it is too late.

These weak times are exploited by fraudsters to commit irregularities. They are times of perfect storm for fraud, due to financial pressures, disruption of supply chains and changes in the ways and processes of doing business.

In the turbulence of these times in which the priority is to keep the business wanting to return to normality, but in which the past normality will no longer exist, companies have compromised the verifications and controls of key processes and has led to supervision less stringent control framework gaps, threatening assets such as inventory, equipment, software, and data.

The risks have multiplied exponentially due to the reduction of some basic protocols, due to supply problems and the stoppage of transport on a global scale, together with the need to seek suppliers in markets where it had not operated before.

In this sense, a differentiation must be made between the short-term adjustments that companies must make and the more strategic actions as life returns to a more stable scenario. Immediately, there is a need to assess whether activities related to fraud, compliance, cash control, contract management, business resilience, and security are working as they should or have been significantly disrupted.

## VI. CONCLUSION

In turbulent and uncertain times like today, companies are increasingly vulnerable. In this context of accelerated change and ambiguity, promoting a long-term vision and exploring the future rigorously helps to decide better in the present and to prepare the company for inevitable changes.

We do not have control over many variables, but as Viktor Frankl said in his book *The Search for the Meaning of Man*, "everything can be taken from a person, except one thing: the last of freedoms: to choose your attitude in all circumstances." We have that last power. And to help us in the most difficult moments, our mind gives us two other powers: that of visiting the past, through our memory, and that of exploring the future, through our imagination.

For the future, it requires changes in the way of thinking and acting, it requires awareness, imagination and planning with enough flexibility to make quick decisions.

Exploring the future to revolutionize the strategic formulation process in the organization allows organizational agility to respond in a context of uncertainty and the development of more resilient and better prepared managers to deal with change.

In this context, managers must have competencies in three critical aspects for today's world: scanning the organizational environment, exploring different types of approaches and tools, simulating possible futures through the development and exploration of strategic scenarios and, lastly, building agility strategic and resilience, through the explicit articulation of the perspective with strategic management.

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## Biosafety, life and COVID-19: Online questionnaire

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Received: 28 Oct 2020;

Received in revised form:

29 Dec 2020;

Accepted: 04 Jan 2021;

Available online: 11 Jan 2021

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**Keywords—** Biosafety; SARS-CoV-2, Questionnaire, Quantitative exploratory analysis, Health education.

**Abstract—** COVID-19 or SARS-CoV-2 is a disease caused by a highly transmitted virus that led to the development of a pandemic in 2019-2020 causing many deaths and behavioral changes. Due to this high degree of infection risk, it is extremely necessary to disseminate information on biosafety and the correct compliance with social isolation, aiming at the non-transmission of the pathogen. The general objective of this study was to evaluate the population's knowledge about the means of biosafety used to prevent the spread of the SARS-CoV-2 virus and emotional state and habits in the face of the COVID-19 pandemic. For that, an exploratory-quantitative field research was carried out in a sample of 170 individuals, through a questionnaire via Google Forms. The data collected were evaluated using the IBM SPSS Statistics 25 software and dependence between variables was assessed using Pearson's Chi-square test. as a result, it was found that the interviewees used mainly fabric masks, the use of alcohol 70% was satisfactory, access to information about COVID-19 is vast and the levels of stress and anxiety were obtained. Therefore, it was concluded that a large part of the sample has knowledge and practices of biosafety, probably due to the intense work of social media, which, however, generated panic in most respondents.

### I. INTRODUCTION

COVID-19 or SARS-CoV-2 is a disease caused by a virus with high transmission and its main sign and symptom is Severe Acute Respiratory Syndrome (SARS) <sup>1</sup>. Thus, due to the high degree of risk, it is necessary to have a good care concern in order not to transmit this pathogen, and one of the ways of coping with COVID-19 is information <sup>2</sup>.

The SARS-CoV-2 virus can promote direct transmission, through droplets expelled during coughing or sneezing and indirectly, through contact with contaminated surfaces <sup>3</sup>. Thus, due to the simple form of transmission, social isolation and prophylactic measures are necessary to combat the spread of the disease <sup>4,5</sup>.

In the search for a fight against the pandemic, several media published information about COVID-19 and gave instructions on ways to prevent the spread of the virus <sup>6</sup>. According to the WHO <sup>7</sup>, several means of combating the SARS-CoV-2 Pandemic and infection control can be cited,

such as using disposable masks or tissue, practicing efficient hand hygiene, using the alcohol gel and gloves. According to a set of rules stipulated in the fourth edition of the biosafety manual of the World Health Organization (WHO) laboratory <sup>8</sup> the need for adequate disinfectants with proven activity against enveloped viruses, such as the use of alcohol and hypochlorite, was shown.

Moreover, the pandemic brought about changes that caused extensive job losses, consequently threatening the livelihood of millions of people. As a result, companies were forced to close to control the spread of the virus <sup>9</sup>. Ordinary life has undergone severe changes, such as the government decree on paralyzing on-site teaching in schools and universities and many employees being forced to work from home <sup>9</sup>.

In clinical and laboratory practice, professionals are required to use Personal Protective Equipment (PPE), which seeks to avoid cross-infection. Among the biosafety rules for coping with COVID-19, the new edition of the

WHO laboratory biosafety manual, such as: washing hands, using 70% alcohol, hypochlorite and social distance is extremely necessary<sup>7</sup>. The WHO also states that, for health professionals and for care aimed at the safety of the population, in addition to the hygiene methods mentioned above, it is necessary to use Personal Protective Equipment (PPE).

PPE is just one of many means necessary to prevent COVID-19<sup>10</sup>. In the current context, several means of combating the SARS-CoV-2 Pandemic and controlling acute respiratory infections can be cited; such as the use of medical mask N95 or with disposable upper protection, practice necessary hand hygiene, avoid contact with eyes, nose and mouth and use of gel alcohol<sup>8</sup>. The current challenge is to strictly follow the biosafety protocol<sup>11</sup>. Thus, it is necessary to mobilize the entire population to contain the progress of this disease.

Based on this knowledge, the present study sought to assess knowledge about biosafety and to analyze the influences of this pandemic scenario in the life of each individual, through the application of an online questionnaire; seeking to evaluate the population's knowledge about biosafety in facing cross-infection with the SARS-CoV-2 virus.

## II. METHODS

This study consisted of a field research with a defined universe, being classified as a quantitative exploratory analysis. The data were collected through an *online questionnaire* about biosafety and the influences of the pandemic on the life of each individual. The sample consisted of 170 participants. As inclusion criteria, they should be at least 18 years old and without maximum age, without gender and race restrictions.

The questionnaire was composed of closed questions about knowledge of ways to reduce infection by the SARS-CoV-2 virus, biosafety, emotional state and the daily life of the general population, based on several articles<sup>12-14</sup> and was applied from October to December 2020 through *Google Forms*. The questionnaire was summarized below (fig. 1).

The interviewees were also instructed about the research and signed the *Free and Informed Consent Term* (ICF). The variables addressed in the questionnaire were:

age, sex, education level, health professionals and students, use of mask and gloves, use of alcohol 70 as a disinfectant, and the observation of health professionals' biosafety by the population, daily during the pandemic, the probability of contracting the virus, taking the vaccine against the virus, means that information was acquired, level of stress and anxiety, physical activity and weight fluctuation during the pandemic.

For data analysis, the software *IBM SPSS Statistics 25* was used and, through the chi-square test, dependence between variables can be verified, with the level of statistical significance being  $p < 0.05$ .

## III. RESULTS

Table 1 presents several data, for which the sample consisted of 63.5% female participants and 36.5 male participants. We can also observe, regarding the age group, most of the sample or 73.5% represented individuals aged 18 to 25 years; 12.5%, from 26 to 35 years old; 7.6% from 36 to 45 years old and 6.5% from 46 years old or more.

When the participants were investigated in relation to any procedure in the health area: "*Passed or accompanied someone in some type of health care procedure during the pandemic: did the professional take appropriate precautions to prevent the spread of COVID-19?*"; only 56.5% of them stated that the professional performed all biosafety practices, while of the interviewees 15.9% reported that the professionals left something to be desired (Table 1). The rest of the sample (27.6%) did not pass or follow any health procedure.

Regarding whether or not you know that only 70 alcohol is effective against microorganisms - "*Did you know that only 70% alcohol is effective for disinfecting?*" - 97.1% of respondents reported having such knowledge and the remainder or 3.9% said they didn't know (Table 1). Regarding the use of disinfectant to perform hand hygiene (Table 2) - "*Do you use 70% alcohol to perform hand hygiene?*" - 80% reported always using alcohol and 20% use it when necessary. When correlating with age, no statistical differences were obtained ( $p > 0.05$ ); however, its use is more widespread among younger people. Of the sample, those who answered "*Yes Always*", 74.3% were 18-25 years old, against 11%, 8.1% and 6.6% for the others.

**Questionnaire: biosafety, life and COVID-19**

- How old are you?  
( ) 18-25; ( ) 26-35; ( ) 36-45; ( ) 46 or more.
- Gender:  
( ) Female; ( ) Male.
- Scholarity:  
( ) I didn't study; ( ) Incomplete elementary school; ( ) Complete elementary school; ( ) Incomplete high school; ( ) Complete high school; ( ) Incomplete higher education; ( ) Complete higher education.
- Are you a health professional?  
( ) Yes; ( ) No.
- If the answer to the previous question is "yes", which area of health do you work in / study?  
( ) Medicine; ( ) Dentistry; ( ) Nursing; ( ) Pharmacy; ( ) Physical Education; ( ) Physiotherapy; ( ) Other; ( ) Not applicable.
- In relation to your daily life: during the quarantine, what has changed?  
( ) Anything. I work and/or maintains my social life normally; ( ) I leave home just for work; ( ) I leave home just to do essential tasks; ( ) I don't leave the house under any circumstances;
- Have you used any type of protection when leaving home and / or getting in touch with other people?  
( ) Disposable mask; ( ) Fabric mask; ( ) Mask and gloves, both disposable; ( ) Fabric mask and disposable gloves; ( ) Other.
- You use 70% alcohol to perform hand hygiene?  
( ) Yes always; ( ) Yes sometimes; ( ) I never use.
- Did you know that only 70 % alcohol is effective for disinfecting?  
( ) Yes; ( ) Not so far.
- Passed or accompanied someone in some type of health care procedure during the pandemic: did the professional take appropriate precautions to prevent the spread of COVID 19?  
( ) He took proper care (use of mask, gloves, alcohol gel and sterile equipment); ( ) He left something to be desired; ( ) Not applicable.
- Have you ever contracted COVID-19?  
( ) Yes, and I had a good recovery; ( ) Yes, but I had complications with the disease; ( ) Doesn't contract the disease.
- According to a personal analysis of your daily practices, how likely are you to contract COVID-19?  
( ) High; ( ) Reasonable; ( ) Low.
- Would you get the vaccine for COVID-19 that will be made available by the Ministry of Health?  
( ) Yes, because vaccination is the only form of immunization against COVID-19; ( ) No, because the vaccine is not reliable and / or effective.
- Which social media platform (s) do you use to get news and information about COVID-19? (you can check more than one option):  
( ) Facebook; ( ) WhatsApp; ( ) Instagram; ( ) YouTube; ( ) I don't use any social networks; ( ) Other.
- Did the news on social media about COVID-19 spread panic among people?  
( ) Yes; ( ) No; ( ) Neutral.
- In this context of pandemic and quarantine, how would you rate your level of stress and anxiety?  
( ) Normal; ( ) Light; ( ) Moderate; ( ) Severe; ( ) Extremely severe.
- How would you rate your concern about yourself or a family member / friend getting COVID 19?  
( ) Without worry; ( ) Mild; ( ) Moderate; ( ) Severe; ( ) Extremely severe.
- Do you regularly practice any physical activity?  
( ) Yes, even before the pandemic; ( ) Yes, I started during the pandemic; ( ) No, even before the pandemic; ( ) No, I stopped during the pandemic.
- Regarding your weight, during the pandemic you:  
( ) Gained weight; ( ) Lost weight; ( ) Kept his weight.

Fig. 1: Questionnaire used in this study

Table 2 also presents the results on what types of individual protection the interviewee used - "Have you used

any type of protection when leaving home and / or getting in touch with other people?". Most of the total sample or

79.4% responded using only fabric masks, however when asked about disposable masks, only 17.1% said they used them. Regarding the use of disposable gloves, it was found that 1.2% of the survey participants used disposable gloves, both relating to fabric masks and disposable masks. In addition, when correlating with age, it became evident that these forms of protection are more used by younger people ( $p < 0.05$ ).

Table 3 presents the results in the way that the participants obtained knowledge about COVID-19 - “Which social media platform (s) do you use to get news and information about COVID-19?” - of the 170 respondents, 94.1% or 160 individuals stated that they had obtained information about the SARS-CoV-2 or COVID-19 pandemic through the media and / or social platforms. The “Instagram” and “Facebook” platforms were the most sought after, with 58.6% and 55% respectively. “WhatsApp” and “YouTube” reached close values, 37.3% and 32% respectively. The other information media, such as websites, blogs, Twitter and other digital platforms obtained 32.5% of utilization in the search for information about COVID-19. And, in addition, only 5.9% said they did not seek information on digital media or social platforms.

Moreover, when related to information obtained from social media and/or platforms with possible emotional changes - “Did the news on social media about COVID-19 spread panic among people?” - Table 1 showed that 55.9%

of the interviewees believed that the news caused panic in society, 21.18% said that they did not and 22.94% responded as neutral. Despite this point, when comparing the age and the panic that the news from COVID-19 may have caused, table 2 shows that the youngest are the most susceptible, with 75.8% for the 18-25-year-old age group, while older - age group 46 or older - only 6.3% said that news received from the SARS-CoV-2 pandemic caused panic. However, when analyzing the entire sample, there were no statistical differences ( $p > 0.05$ ).

Regarding the levels of stress and anxiety during the pandemic, table 1 shows that 43.5% of the interviewees stated that they were “Moderate”, 28.8% as “Severe”; 11.8% as “Light”; 8.8%, “Extremely severe”; and only 7.1% said they had no stress or anxiety due to the pandemic.

When the participants were asked about their daily lives during the pandemic (Table 4) - “In relation to your daily life: during the quarantine, what has changed?” - most of the sample or 61.8% reported leaving home only to perform essential tasks, 23.5% answered leaving only for work and 1.8%, reported not leaving the house under any circumstances, 12.9% of the total sample answered that nothing has changed and work and/or maintain social life normally. Therefore, it presented statistical differences when compared to age, for all the statements raised ( $p < 0.05$ ).

Table 1: Responses obtained for various variables

Questions	Answers	Frequency	Percentage
Gender	Female	108	63.5%
	Male	62	36.5%
Age Range	18-25	125	73.5%
	26-35	21	12.4%
	36-45	13	7.6%
	46 or more	11	6.5%
Are you a health professional?	No	42	24.7%
	Yes	128	75.3%
Passed or accompanied someone in some type of health care procedure during the pandemic: did the professional take appropriate precautions to prevent the spread of COVID-19?	He took proper care	96	56.5%
	He left something to be desired	27	15.9%
	Not applicable	47	27.6%
Did you know that only 70% alcohol is effective for disinfecting?	Yes	165	97.1%
	Not so far	5	2.9%
Did the news on social media about COVID-19 spread panic among people?	Yes	95	55.9%
	No	36	21.2%



	Neutral	39	22.9%
	Normal	12	7.1%
	Light	20	11.8%
Level of stress and anxiety	Moderate	74	43.5%
	Severe	49	28.8%
	Extremely severe	15	8.2%

Table 2: Crossing of the variables "type of protection used when contacting other people", "Did the news on social media about COVID-19 spread panic among people?" and "Do you use 70% alcohol for hand hygiene?" with "Age group".

Questionnaires		Age range								Total	
		18-25		26-35		36-45		46 or more		n	%***
		n	%**	n	%**	n	%**	n	%**		
<b>A. Have you used any type of protection when leaving home and/or getting in touch with other people?</b>	Disposable mask	14	48.3%	5	17.2%	7	2.1%	3	10.3%	29	17.1%
	Fabric mask*	110	81.5	15	11.1%	3	2.2%	7	5.2%	135	79.4%
	Mask and gloves, both disposable	1	50.0%	0	0.0%	1	50.0%	0	0.0%	2	1.2%
	Fabric mask and disposable gloves	0	0.0%	1	50.0%	0	0.0%	1	50.0%	2	1.2%
	Other	0	0.0%	0	0.0%	2	100%	0	0.0%	2	1.2%
<b>Total</b>										170	100%
<b>p&lt;0.05 (p=0.0)</b>											
<b>B. You use 70% alcohol to perform hand hygiene?</b>	Yes always	101	74.3%	15	11.0%	11	8.1%	9	6.6%	136	80.0%
	Yes sometimes	24	70.6%	6	17.6%	2	5.9%	2	5.9%	34	20.0%
	I never use	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
<b>Total</b>										170	100%
<b>p&gt;0.05 (p=0.751)</b>											
<b>C. Did the news on social media about COVID-19 spread panic among people?</b>	Yes	72	75.8%	9	9.5%	8	8.4%	6	6.3%	95	55.9%
	No	22	61.1%	7	19.4%	4	11.1%	3	8.3%	36	21.2%
	Neutral	31	79.5%	5	12.8%	1	2.6%	2	5.1%	39	22.9%
<b>Total</b>										170	100%
<b>p&gt;0.05 (p=0.496)</b>											

\*\*\*Percentage referring to the total sample, that is, 170 participants; \*\*Percentage in relation to the total number of participants who responded to the analyzed statement; \*Cloth factory masks.

Table 3: Social media in which the sample obtained information about COVID-19

	Frequency*	Percentage**
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**Which social media platform(s) do you use to get news and information about COVID-19?**

Facebook	93	55.0%
WhatsApp	63	37.3%
Instagram	99	58.6%
YouTube	54	32.0%
I don't use social networks	10	5.9%
Other	55	32.5%

\*Frequency for the total sample, that is, 170 participants; \*\*Percentage referring to the total sample, that is, 170 participants.

Table 4: Crossing of variable "In relation to your daily life: during the quarantine, what has changed?" with "Age range"

	Age range								Total		
	18-25		26-35		36-45		46 or more		n	%**	
	n	%*	n	%*	n	%*	n	%*			
<b>In relation to your daily life: during the quarantine, what has changed?</b>	Anything. I work and / or maintain my social life normally	18	81.6%	4	18.2%	0	0.0%	0	0.0%	22	12.9%
	I leave home just for work	21	52.5%	5	12.5%	7	17.5%	7	17.0%	40	23.5%
	I leave home just to do essential tasks	83	79.0%	12	11.4%	6	5.7%	4	3.8%	105	61.8%
	I don't leave the house under any circumstances	3	100%	0	0.0%	0	0.0%	0	0.0%	3	1.8%
<b>Total</b>										170	100%
<b>p&lt;0.05 (p=0.008)</b>											

\*\*Percentage referring to the total sample, that is, 170 participants; \*Percentage in relation to the total number of participants who responded to the analyzed statement.

In this study, 75.29% of the sample consisted of health professionals or students and 24.7% of non-professionals (Table 1). However, when the crossing of the variables "Are you a health professional or student?" and "According to a personal analysis of your daily practices, how likely are you to contract COVID-19?" (Table 5), it was identified that both groups have statistically equal concerns about the probability of contracting COVID-19 (p>0.05). 16.7% - non-professionals and 16.4% - health professionals answered that they are very afraid of contracting the disease; 54.8% - non-professional and 54.7% - health professionals reported having moderate fear; and 28.6% - non-professionals and 28.9% - health professionals said they had little fear that their daily

activities could cause contamination of COVID-19. In this study, 75.29% of the sample consisted of health professionals or students and 24.7% of non-professionals (Table 1). However, when the crossing of the variables "Are you a health professional or student?" and "According to a personal analysis of your daily practices, how likely are you to contract COVID-19?" (Table 5), it was identified that both groups have statistically equal concerns about the probability of contracting COVID-19 (p>0.05). 16.7% - non-professionals and 16.4% - health professionals answered that they are very afraid of contracting the disease; 54.8% - non-professional and 54.7% - health professionals reported having moderate fear; and 28.6% - non-professionals and 28.9% - health

professionals said they had little fear that their daily activities could cause contamination of COVID-19.

Table 5: Crossing of the variable "I According to a personal analysis of your daily practices, how likely are you to contract COVID-19" with "Are you a health professional or student?"

		According to a personal analysis of your daily practices, how likely are you to contract COVID-19?				Total
		High	Reasonable	Low		
Are you a health professional or student?	No	n	7	23	12	42
		%	16.7%*	54.8%*	28.6%*	24.7%***
	Yes	n	21	70	37	128
		%	16.4%**	54.7%**	28.9%**	75.3%***
Total	n	28	93	49	170	
	%	16.5%***	54.7%***	28.8%***	100.0%***	

p>0.05 (p=0.999)

\*\*\*Percentage in relation to the total sample, that is, 170 participants; \*\*Percentage in relation to 128 health professionals; \*Percentage in relation to 42 non-health professionals.

#### IV. DISCUSSION

The biosafety assessed in this study, as reported in others in the literature<sup>15,16</sup>, confirmed that the entire sample uses some type of facial protection, either through disposable or tissue masks. Arruda *et al.*<sup>16</sup> conducted a questionnaire among health students from a public university in Brazil and also reported that the entire sample used a mask for protection. Erthal *et al.*<sup>15</sup> conducted a study that the sample was composed of health professionals and non-professionals in the area; in its results it was also verified the satisfactory use of the mask by the evaluated population.

Furthermore, in this study, mainly young people, use tissue masks, as recommended by the World Health Organization (WHO)<sup>5</sup>, as an effective and low-cost means for individual protection. In addition, social isolation and hygiene measures must be strictly followed so that maximum control of the spread of the virus occurs<sup>4</sup>, as the vaccine against SARS-CoV-2 is currently unavailable, broadly and unrestrictedly

As already reported, general hygiene precautions are crucial to minimize the risk of contamination, and it is necessary to emphasize the use of gloves, especially for medical teams<sup>17</sup>. An infected health professional is a potential vehicle for the spread of the virus, as stated by Solomom *et al.*<sup>17</sup> and protecting the hands with disposable

gloves minimizes the spread of COVID-19<sup>9</sup>. In this study, although the use of a mask is recurrent, the portion interviewed who uses gloves for protection is very small.

As for those who underwent or accompanied someone in some type of health care procedure during the pandemic, a significant portion reported that the professional left something to be desired in the practice of biosafety, worrying data, because the situation at the moment the world lives in calamity and intense spread of the virus. However, several official health institutions, such as the Ministry of Health of Brazil<sup>18</sup> and the Federal Council of Dentistry<sup>19</sup>, affirm the need that professionals follow biosafety guidelines for coping with the disease. WHO<sup>20</sup> has established several protocols for health professionals such as the use of Personal Protective Equipment (PPE) (boots, long-sleeved gown, heavy-duty gloves, mask, and goggles or a face shield) and hand and surface hygiene with 70% alcohol.

On different types of inanimate surfaces, the virus can remain infectious from 2 hours to 9 days at room temperatures<sup>21</sup>. That is, this is the time that a person can be infected by touching a contaminated object if they don't perform hand hygiene later. In the study by these same authors, it was identified that ethanol (78 and 95%), 2-propanol (70 and 100%), the combination of 2-propanol (45%) with 1-propanol (30%), glutardialdehyde (0.5 and 2.5%), formaldehyde (0.7 and 1%), povidone iodine (0.23

and 7.5%), sodium hypochlorite (minimum concentration of 0.21%) and hydrogen peroxide (0.5%) had satisfactory antimicrobial action against strains identical to human coronavirus. Currently there are several studies and searches to provide cleaning of difficult surfaces, as described in the work of Queiroz *et al.* <sup>22</sup>, which suggests the possibility of using photodynamic therapy as a possible disinfecting action for surfaces and combating SARS-CoV-2. However, chemicals that are easily accessible to the population are more effective and faster tools, such as 70% alcohol and its high effectiveness in combating the new coronavirus.

When approached the subject of the use of 70% alcohol for hand and surface hygiene, it was observed that no individual answered that “*never uses*”, something positive to the study since this disinfectant is essential in fighting COVID-19 and preventing cross-infection <sup>20</sup>. The knowledge that only 70% alcohol is effective against the microorganism has shown positive results, reaching the mark above 90%. Thus, it is of great importance to emphasize this point, since the concentration of this disinfectant used in society has an excellent microbial control action, as demonstrated in the studies by QUEIROZ *et al.* <sup>23</sup>, GRAZIANO *et al.* <sup>24</sup> and KANF *et al.* <sup>21</sup>. However, negative values were also found when a considerable number of individuals said to use this tool only sometimes. That is, in general, the sample understands the importance of using 70% alcohol, but many don't use it routinely.

The COVID-19 pandemic resulted in several ways to decrease the transmission of the virus, one of which was social isolation <sup>25</sup>, with this, the rate of stress and anxiety increased moderately in most participants and a significant portion opted for the severe increase option. As indicated by Wang *et al.* <sup>26</sup>, many people report anxiety and stress symptoms after experiencing outbreaks of infectious diseases. Therefore, the COVID-19 pandemic hasn't only threatened physical health, but also the mental health of society.

In view of the great movement of the media and social networks on the subject, the majority of the interviewees stated that the news about SARS-CoV-2 led to the population's panic, as reported, since the sudden change in social habits led to the fear increased by the abnormal <sup>10</sup>. Other studies are consistent with this study <sup>27,28</sup>, where a large part of the sample is scared and under post-traumatic stress.

About the situation of labor crisis that the pandemic caused<sup>29</sup>, a significant portion of the interviewees continued to follow their tasks normally, showing a higher value among the younger population. In this work it was also noticed that a higher percentage continues to just go out

to work showing the economic need of the population. According to the literature <sup>30-33</sup>, attitudes that don't follow social isolation and that prioritize economics above all, as the political position of Brazil president of the current year - 2020, contribute to a greater number of hospitalizations and deaths resulting from COVID-19.

It is of great relevance to remember that oral health professionals show higher rates of COVID-19 infection, since the transmission of the virus is through aerosols and this was shown in the study according to a personal analysis by health professionals <sup>34</sup>. In this study, a large part of the sample was composed of professionals and students of dentistry. The percentage of responses from these in the item “*high*” for the probability of contracting COVID-19, was 3 times higher than the percentage of responses from the other interviewees.

Furthermore, the dental surgeon is significantly vulnerable to contagion due to the unique characteristics of dental procedures <sup>11</sup>, because, due to direct contact with droplets of the infected patient's saliva, the risk of cross-infection is increased among these professionals and the patient. Thus, WHO <sup>7</sup> affirms the importance of using protective equipment and hygiene measures. Thus, professionals and other people guarantee greater security for themselves and for others.

## V. CONCLUSION

Therefore, this research found that the concern about the probability of contracting the SARS-CoV-2 virus isn't related to being a health professional or not. The virus has a high rate of transmission and this makes the disease more worrying and even more contagious. For this reason, hand hygiene care and the use of masks is extremely important. Most of the people who composed this study are practicing biosafety measures and have a close knowledge of the subject, such as the effectiveness of gel alcohol. In addition, this work showed the interviewees' concern and fear about the virus and panic due to the intense production of news, which resulted in high levels of stress and anxiety.

## ACKNOWLEDGMENT

The authors wish to thank State University of Northern Parana – UENP.

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# Epidemiological Syphilis Study in Patients Pregnancy Answered in a Hospital Tertiary west Amazon

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Received: 07 Nov 2020;

Received in revised form:

28 Dec 2020;

Accepted: 07 Jan 2021;

Available online: 13 Jan 2021

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**Keywords—** Syphilis Prenatal care VDRL Treponema pallidum.

**Abstract—** Objectives: To report a prevalence of syphilis and Profile with pregnant women notification cases met the obstetric ward of Dr. Ary Pinheiro Base Hospital (CO-HBAP). Methods: It is a retrospective study of hum and secondary descriptive of pregnant notification of cases with syphilis met CO-HBAP. Were analyzed 89 reported cases of syphilis in pregnancy, in 2016, in the city of Porto Velho – Rondônia. Results: The prevalence of pregnant women with syphilis notification was 1,25%, the age ranged from 14 to 39 years, with a predominance of brown race. As the women surveyed performed at least six the prenatal consultations recommended by the Ministry of Health. Conclusions: This study indicates one syphilis is occurring in young people. Early onset of prenatal care, guarantee number query minimum, suitable management of pregnant women and their partners both diagnosis paragraph As treatment, are the criteria for best control transmission these vertical diseases.

## I. INTRODUCTION

Syphilis is a systemic infectious disease and sexually transmitted, caused by *Treponema pallidum* bacteria, is presented as a public health challenge worldwide. It is transmitted sexually (acquired syphilis) and vertically (congenital syphilis) via placenta from mother to fetus. Other forms of transmission may be by an indirect route (contaminated objects) and blood transfusion<sup>1, 2, 3</sup>

Syphilis has three stages: primary, secondary and tertiary. The primary phase begins, usually after 21 days of infection. The infected person develops painless genital ulcers, which can last for 2 to 6 weeks. The secondary phase is marked by the appearance of skin lesions

throughout the body, associated sometimes fever and muscle aches. This phase has the same duration as the primary; however, it is followed by a latency period lasting years, characterized by the absence of signs and symptoms. Finally, the tertiary stage occurs after several years of initial infection and includes, for example, the nervous, cardiovascular and cutaneous forms of the disease<sup>4</sup>.

Gestational syphilis, despite a simple diagnosis and effective treatment, still has alarming prevalence<sup>5</sup> produces severe outcomes to pregnancy and child, like premature birth, stillbirth and neonatal and congenital infection of the newborn<sup>6</sup>.

Prenatal care is critical to maternal and child health. During this period, activities related to health promotion and risk identification for the pregnant woman and the fetus should be developed, thus helping to prevent numerous complications, and reduce or eliminate risk factors and behaviors associated with various health problems. The Ministry of Health recommends prenatal care with at least six consultations with health professionals, at least two of them carried out by a physician. Also advises the start of care in the first trimester gestational<sup>7, 8</sup>.

The diagnosis of syphilis in pregnancy can be done using non-treponemal test VDRL flocculation type, should be performed early in prenatal care, repeated in the third trimester and at delivery. The first two tests aim to ensure early diagnosis of pregnant women with syphilis and its treatment in a timely manner, and the third allows early treatment of child.<sup>9</sup>

In case of positivity, it is recommended to confirm the diagnosis with treponemal test by particle agglutination (TPHA) or fluorescent antibody absorption test (FTAABs), but the absence of these should not delay treatment. If the VDRL is reagent, and the non-reactive treponemal test, this is a false positive, a fact which occurs in up to 30% of cases, after confirmation by treponemal test.<sup>10</sup>

Treatment of pregnant women infected with *Treponema* is made with penicillin G benzathine, and the regimen defined according to the clinical evaluation<sup>11</sup>. The only treatment is considered effective for both the woman and the fetus, completed at least 30 days before delivery and was the partner concomitantly treated.<sup>12,13</sup>

The Health Ministry, aware of the risks of pregnancy and congenital syphilis, became compulsory from 1986, notice of congenital syphilis; assuming in 1995 the commitment by the Pan American Health Organization (PAHO) for preparation of the Action Plan aimed at eliminating congenital syphilis by the year 2000, with the target set an incidence rate up to 0.5 cases per 1,000 live births.<sup>14</sup>

Data from epidemiological bulletin STD / AIDS Ministry of Health show that the number of reporting syphilis cases during pregnancy increases every year. Amounted to 14 321 in 2011 and in 2012 (January 1 to June 30) were reported 7,043 cases of syphilis in pregnancy, and 819 in the Northern region and 52 cases in the state of Rondônia<sup>15</sup>.

To describe the prevalence and profile of cases of syphilis in pregnant women notification met the obstetric ward of Dr. Ary Pinheiro Base Hospital (CO-HBAP), in Porto Velho-RO.

## II. METHOD

Treatment is a retrospective descriptive study of secondary data from case reporting of pregnant women with syphilis met CO-HBAP, in 2016, in Porto Velho. They considered cases of syphilis in pregnancy all pregnant women with positive serology result of the card or diagnosis of syphilis during hospitalization for childbirth.

Constituted information sources prenatal card pregnant, test results performed during hospitalization.

The information of the chips were entered to compose a Microsoft Access database, analyzed by Microsoft Excel.

For this research, it was only used secondary data without identifying the patients. The database was provided by the Center for HBAP Hospital Epidemiology. Thus, the study was approved by the Research Ethics Committee was waived.

## III. RESULTS AND DISCUSSIONS

In the year 2016 were carried out 7,105 consultations of pregnant women in CO-HBAP, these 89 (1.25%) were pregnant with syphilis notification, the average age was 22,3 years, ranging from 14 to 39 years, as most syphilis detection in pregnant women 20-24 years adolescence is a risk factor for syphilis, among mothers with the disease, 31,5% were teenagers. To be dealing with the ethnicity of the infected group dominates the brown race.

Table 1 shows the distribution of pregnant women with VDRL reagent, according to the age and race.

Had at least six prenatal consultations recommended by the Ministry of Health 58.5% of the women surveyed. With the information available in this study could not establish the clinical stage of infection of pregnant women, 52% of patients were from the low risk, since the Municipal Maternity is the gateway to pregnant women in the city of Porto Velho.



Table I – Profile of 89 pregnant women with syphilis notification met the CO-HB, 2016.

Variables	Media (DP)	n	%
Patient age	22,3		
11 – 20		34	38,0
21 – 30		49	55,0
31 – 40		6	7,0
<b>Race patient</b>			
Black		13	14,6
Brown		72	80,9
White		4	4,5

Table 2 shows the distribution of pregnant women according to the evaluated obstetric variables. In this study indicates that syphilis is occurring in young, there was a high number of teenagers with gestational syphilis, probably reflecting the profile of the municipality's pregnant.

Table II - Distribution of pregnant women according to the obstetric variables evaluated in the CO-HB, 2016.

Variables	N	%
<b>Prenatal realization</b>		
Yes	86	96,6
No	3	3,4
<b>Prenatal booklet</b>		
Completed	85	95,5
Not completed	1	1,0
Does not have	2	2,5
Unknown	1	1,0
<b>Gestational age at the time of consultation</b>		
< 37 weeks	24	27,0
37 – 40 weeks	52	58,4
> 40 weeks	13	14,6
<b>Origin</b>		
Inside	6	6,8
Low risk*	52	58,4
High risk**	25	28,0
Home	6	6,8
<b>Number of consultations in prenatal care</b>		
0	9	10,0
1 – 5	28	31,5
> 5	52	58,5

Prenatal care is critical to maternal and child health is a right of pregnant women and duty of the health professional perform it in the best possible way. During this period, activities related to health promotion and risk identification for the pregnant woman and the fetus should be developed, thus helping to prevent numerous complications, and reduce or eliminate risk factors and behaviors associated with various health problems. Failure to do this is regarded as one of the main risk factors for congenital syphilis.<sup>16,17,18,19</sup>

Despite efforts to prevent and control the number of syphilis cases in pregnancy continues to grow, it must improve the quality of reporting, attention to prenatal care, maintenance of vertical transmission of the disease and the increased migration of workers for project construction, taking place an explosive population growth.

The study shows the urgent need to review the procedures adopted and greater accountability of professionals towards an avoidable problem.

#### IV. FINAL CONSIDERATIONS

This study indicates one syphilis is occurring in young people. Early onset of prenatal care, guarantee number query minimum, suitable management of pregnant women and their partners both diagnosis paragraph As treatment, are the criteria for best control transmission these vertical diseases.

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# Social Responsibility and Business Excellence

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Received: 01 Nov 2020;

Received in revised form:

25 Dec 2020;

Accepted: 07 Jan 2021;

Available online: 16 Jan 2021

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**Keywords**— *Business excellence, social responsibility, value added, sustainable development, statement of value added.*

**Abstract**— *The article places social responsibility and business excellence into a comprehensive value-added management model which is focused on sustainable development. The author presents the original idea of the value added law and justifies the surplus of added value as a new category and source of participation of all stakeholders in the company. In accordance with this, the statement of surplus added value is presented as a new financial statement, which is the basis for analyzing and planning the performance of the company's operations in accordance with the principles of value added economics. The author therefore emphasizes the need for a comprehensive approach to corporate social responsibility. An important part of social responsibility is the excellence in the business of the organizations.*

## I. INTRODUCTION

Business excellence is not an end in itself. It is an important expression of the social responsibility of an organization and is a condition for its sustainable development.

The claim that social responsibility is a precondition for sustainable development is logical at first glance, but it must be acknowledged that in this respect the profession is not entirely unanimous. Friedman, for example, argues that “corporate social responsibility is an increase in profits” and warns that social spending can have a negative impact on investors. Others, on the other hand, argue that investors will reward a socially-oriented company with investments, despite the risk of lower returns (both claims are found in Milne and Chan, 1999, summarized after Van Staden, 2000, 9).

One of the problems is the fact that the assessment of social responsibility is difficult to include in one indicator or information, because it is a multifaceted concept. Nevertheless, there are empirical researches showing that corporate social responsibility increases both the market

value of a company (e.g. Zeng, 2013) and its profitability (e.g. Zakari, 2017).

In this paper, will be therefore presented a business system model that is focused on sustainable development on the basis of relevant information for business decision-making. Within its framework, will be placed the elements of social responsibility and business excellence.

To design such a model, it is necessary to define its basic starting point, which means the output from the business system. To this end, we will present and substantiate the value-added law in the next chapter.

## II. THE VALUE-ADDED LAW

For the start, using the system theory, following statements are offered:

1. The basic goal or the desire of human being is its existence, which arises from the instinct aimed at self-preservation, and from it, the human basic needs and interests arise.

2. This is the reason why all persons want to ensure adequate safeness. For this purpose people create various

organizational systems also to get the benefits from synergies; the component of the operation of each organizational system is the risk.

4. Combining people into organizational system, each person who operates within it, contributes to a common goal.

5. Where the value added (in the broadest sense) is not (or no longer) the common goal of the participants, is a system in the process of disintegration.

6. Participants shall manage the risk in accordance with their respective interests within the limits of the possibilities and within the limits set by the environment.

7. In the case of legal or contractual regulation of the mutual relations between the participants in the organizational system, there will inevitably be a re-allocation of risk.

8. If the interests of the participants are adequately met (and the narrow and short-term interests of some individuals do not prevail), the organizational system is in a balance.

9. The occurrence of a disproportion between the accepted risk and the yield attributable to an individual participant results in the creation of entropy forces or increases their power in the system.

10. The strengthening of entropy forces threatens the sustainable development of the organizational system.

12. The basic conditions for the effective participation of participants are the appropriate level of knowledge or competence and appropriate information system with an appropriate communication process involved.

13. The inclusion of a greater number of actors in the functioning of the system (in particular in terms of decision-making) can be dysfunctional and inefficient; therefore, solutions are needed in order to use appropriate methods for their creative cooperation and effective monitoring system.

14. Participants in the organizational system are responsible for ensuring the existence and sustainable development of the system, if its sustainable orientation is accepted jointly.

On the basis of the above starting points, we define the general law of creating and guiding value added (hereinafter: value-added law). Its dictum includes two aspects:

1. Value added is the net outcome of the organizational system in managing the risk inherent to the system and belongs to risk holders in proportion to their contribution to the functioning of the organizational system (the aspect of creating value added).

2. The disproportionately high or disproportionately low participation of individual risk carriers in the value added (considering their work contribution) increases the entropy of the organizational system and threatens the realization of its sustainable development (the aspect of value-added guidance and its distribution).

The value-added law is general because of its validation in all socio-economic systems (past, present and future). The value-added law operates regardless of the wishes or activities of the participants and regardless of the normative organization of the organizational system or its environment. It is, therefore, totally independent of the human will that created the organizational system. The value-added law has various forms of its presence in different economic and political environments and in different types of organization (relations between people) of associations.

On the basis of the value-added law, the entropy of organizational systems is mainly the result of the imbalance between participants' contributions and their participation in value added. This imbalance is devastating because it works against cooperation and mutual trust, which is necessary in the context of interdependence.

The contribution to the functioning of the organizational system should be understood also in its broadest sense, i.e. in all possible forms (e.g. materialized work, such as real and monetary inputs, knowledge, and of course current physical and intellectual work, including guarantees and opportunity costs or losses of individual participants). Mulej similarly speaks about "the effort for the lowest entropy" (Mulej et al., 2000, 269).

The important word in the dictum of value-added law is "net outcome" because it means the difference between the outcome (recognized by users or market certified) and the estimated costs of operating the system, which are: *basic* labor costs, consumption of natural assets or the cost of their replacement, and costs of environmental conservation associated with the outcome.

The basic labor costs mean only compensation for partly wasting work force (similar to the depreciation of fixed assets). They do not represent a newly created value, so they (in principle) are not a part of the value added. Basic labor costs also do not represent total wages, which belong to workers.

The same approach applies to the opportunity cost of capital, which does not represent a part of value added and also does not represent total participation, which belongs to owners of capital.

The result of deducting basic labor costs and opportunity cost of capital from value added is the surplus

value added (*SVA*), which will be discussed in next section.

More broadly, a notion "total net value added" (*TNVA*) is proposed. It consists of three dimensions, which mean three social values: economic, environmental and social (Business Dictionary, 2015). This is in line with the principles of triple bottom line accounting, which includes economic, social and environmental reporting (triple bottom line reporting). This focuses on sustainability accounting and represents a culmination in the development of accounting (Schaltegger et al., 2006, p. 6).

A broader understanding of added value is also known as "expanded added value" (e.g., Mook, 2003). Value-added measurement is no longer limited to accounting data, as many models have already been developed that complement traditional accounting information (e.g. *EVAS*-expanded value added statement, Community Social Return on Investment Model) (Mook et al., 2003a and 2007). Such an approach is also supported in principle by the European Union Directive (EU, 3003, point 14b), which also recommends the use of non-accounting indicators to better understand the company's achievements.

The value-added law includes the equality as a fundamental ethical category, which is not only the result of some subjective thinking about ethics or moral norms (e.g. honesty). The ethics is an objectively inseparable component of the value-added law due to the interdependence of people in a society as a system. Therefore, there is no need any more to stress ethical principles as a reason for corporate social responsibility.

The value-added law includes also the principle that the value added belongs to all those who bear the risk or contribute to the risk management in the organization, that is to the stakeholders. This means that stakeholders need to be divided to governors and non-governors in this regard.<sup>1</sup> Typical stakeholders that are non-governors are creditors, the state, and shareholders that are entitled to dividends but are inactive owners of financial capital (e.g. small shareholders). They bear the risk depending on organization success, but they have relatively small impact on business decision-making or controlling. Similar roles have the employees that are not co-owners and therefore have a small impact on business.

<sup>1</sup> There are, of course, several possible classifications of stakeholders (e.g. Groenendijk, 2003, p. 57).

### III. THE SURPLUS VALUE-ADDED STATEMENT

In creating a surplus value-added statement (*SVAS*) particularly the following starting points should be considered:

1. The statement should be useful for a wider circle of interested people or organizations.
2. The statement should be useful for creating indicators and improving the organizational climate.
3. The costs of products and services sold include minimum wages as an expression of the consumption of labor in the business.
4. The costs of products and services sold include the opportunity cost of invested financial capital.
5. The category gross *SVA* (with depreciation included) is not meaningful in comparing gross value added as a general known category, therefore it is not shown in the statement.
6. The statement should show the way of creating (sources) of surplus added value (*SVA*) and its distribution.
7. The most important starting point for *SVAS* is the equality of stakeholders in participating in surplus value added, consistently with their contribution to risk management. It means that both stakeholders as non-governors and stakeholders in the role of governors should be included.

For the illustration of the surplus value-added statement (*SVAS*) and its comparison with profit & loss statement (*P & L*) in Table 1, the following assumptions are made:

1. There are 100 employees.
2. Minimum wage per capita is € 800.00.
3. Total capital is € 5,000,000.00.
4. Opportunity cost of capital is 2.5 %.
5. Profit tax is 15 %.
6. Retained profit is allocated to employees and active owners in the ratio between the amount of rewards to active owners and the amount of salaries of other employees (the assumption of the agreement is one to two).
7. For the sake of simplification, we assume that all employees are active co-governors.
8. For the sake of simplification, we did not differentiate between gross and net amounts of remuneration (the difference is, in principle, the state's participation in surplus added value).

In Table 1, the surplus added value was allocated to:

1. Non-active (non-governing) stakeholders. They carry a small part of the risk and their common feature is that they cannot directly influence the business decisions, but have a possibility to control the operations.
2. Governing (active) stakeholders who, in addition to bearing the risk, also contribute to risk management.

In accordance with the idea of the extended value added, a broader aspect of the surplus value added could be defined, which is important for presenting of achievements from the social responsibility aspect. Therefore, this part should be included in the notes to the statement of the surplus value added. These explanations would play the similar role as the explanations to the income statement.

The above assumptions are shown in Table 1, which compares the income statement and surplus value-added statement.

Table 1: Income statement (P&L) comparing surplus added-value statement (in € 1,000)

	ITEMS	P&L	SAVS
	<b>A. GENERATING PROFIT AND SVA</b>		
1	Revenues	9,100	9,100
2	Material costs	4,900	4,900
3	Amortization and depreciation	1,280	1,280
4	Labor costs	1,900	
5	Financing costs	400	
6	Costs of minimal wages		80
7	Opportunity cost of equity		125
8	Profit	1,008	
9	Added value (4 + 5 + 8)		3,308
10	Surplus value added (9 – 6 – 7)		3,103
	<b>B. DISTRIBUTION OF PROFIT AND SVA</b>		
11	Tax	151	
12	Net profit (8 – 11)	857	
13	Net profit for dividends	525	
14	Net profit for management awards	32	
15	Retained net profit	300	
16	SVA for financiers (interest) <i>I</i>		400
17	SVA for non-active shareholders dividends		400
18	SVA for the state (taxes) <i>T</i>		151
19	SVA for non-active stakeholders (16 + 17 + 18)		951
20	SVA for employees		1,820
21	SVA for management awards		32
22	Retained SVA for employees		200
23	Retained SVA for active shareholders		100
24	SVA for active stakeholders (20 + 21 + 22 + 23)		2,152
25	Surplus value added (19 + 24) = 10		3,103

From the comparison between the income statement and surplus value-added statement in Table 1, it is possible to summarize in particular the following:

1. SAVS (together with explanations) takes into account the equality of stakeholders in accordance

with the added-value law and contributes to the disclosure of the corporate social responsibility, orientated to sustainable development.

2. SAVS does not mean only a different view of the organization's income statement, but it also shows that profit is not basic piece of information about the operations from the social responsibility point of view, and in terms of sustainable development. Profit as a category in SAVS simply does not exist anymore.<sup>2</sup>
3. SAVS takes over a leading role before the income statement. Therefore, it can no longer be regarded as only complementary information to the income statement.
4. SAVS is a useful basis for analyzing the efficiency and effectiveness of the operations, since the surplus added value replaces the profit as the underlying organization's goal.
5. SAVS is an important piece of information, especially for stakeholders of the organization who carry the risk of operations.
6. SAVS can be an important piece of information for investors and business partners, especially in terms of long-term and stable operations.
7. SAVS is also an important piece of information for wider public, especially in terms of social responsibility. In particular, information of the distribution of surplus added value is important.
8. Table 1 shows the connectivity of the surplus added value with the income statement, which is otherwise completely unnecessary for the preparation of SAVS.
9. This does not mean that P&L should not be prepared. It still contains (in terms of a different view of business) useful supplementary information. This is particularly true for a transitional period until value added is widely implemented.
10. SAVS should become an integral part of an integral reporting.

SAVS has some disadvantages, in particular the following ones:

- 1) In a comparative assessment (benchmarking) or within an activity, comparability is difficult, if there are differences in starting points for determining the

<sup>2</sup> This is consistent with the findings of many authors who demand a shift of organization's goal from shareholder's value to stakeholder value (e.g., Brennan, 2008).

minimum wage or assessing the opportunity costs of the financial capital.

- 2) For the same reasons, SAVS may be less suitable for statistical processing at the state level and for comparisons between different countries.

Problems with comparability can be solved satisfactorily with an appropriate standardized statement, which will undoubtedly be the subject of development over a longer period of time in the future.

Table 1 shows the relationship between IPDV and the income statement, but for its preparation the income statement is completely unnecessary. This does not mean that it should not be prepared, as it contains (due to a different view of business) useful additional information, especially in the context of management accounting and appropriate internal reporting. This applies in particular to the transitional period until the statement of surplus value added becomes more effective.

#### IV. MANAGEMENT ON THE BASIS OF VALUE ADDED

Based on the justifications of the importance of added value, we can form a management model based on added value, because on this basis, in its basic, and even better in a broader definition, we can take into account the interests of stakeholders. Therefore, in Figure 1, it was chosen as the fundamental goal of the management of the organization.

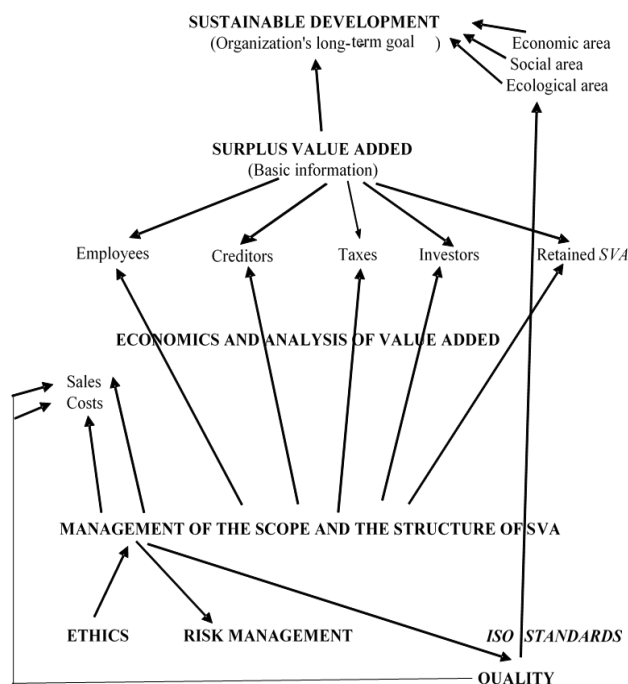


Fig.1: Management model on the basis of the value added

A precondition for sustainable development as a long-term goal is that organization behaves accordingly to social responsibility in three areas: economic, social and ecological. That is shown in Figure 1.

Figure 1 shows the value added as basic information about organization's performance to achieve sustainable development. Here should be immediately emphasized that the value added in Figure 1 is in its widest definition, i.e. also with non-accounting expressed achievements or returns (e.g. expanded value added). The structure of value added, however is shown only from an accounting point of view.

Figure 1 defines two basic orientations (focuses) of business management:

1. The *volume* of surplus value added (creating SVA) through maximizing revenues and optimizing costs.
2. The *structure* of surplus value added (distributing SVA) through adequate economic policy of value added that encompasses planning, investing, remunerating, borrowing, tax optimizing and dividend policy.

The appropriateness of decisions in three areas of social responsibility (economic, social and ecological) can be measured by principles and recommendations of ISO standards on quality of business in these areas (BSI, 2020), which is also indicated in Figure 1.

The quality management is focused on the current operations through quality of revenues and by costs management that is a matter of ISO standards as well. One of basic dimensions of management is risk management, which is also shown in Figure 1. Last but not least, organization's management must consider ethics' principles in creating and distribution of surplus value added. That is also shown in Figure 1.

The areas of business decisions listed and shown in Figure 1 reflect the full weight and responsibility of management, and their consequences are directly reflected in the added value created, (dis) consideration of social responsibility, and thus in the possibilities of sustainable development of the company. Such an orientation is also supported by empirical research, which substantiates added value as one of the key indicators of sustainable development (Oshika, Saka, 2015, 14).

Undoubtedly, the presented model requires further in-depth theoretical work. For example, it raises the question of the adequacy of the use of the profit category in various known and established economic models (for example, in assessing the value of companies). Above all, it means important changes in the existing legal order.

It is useful to take into account that the reason for not involving other stakeholders besides capital in management is not an insurmountable technical problem, but resistance of a purely ideological nature or a question of power and dominance in the corporation and hence in the economy and society.

It must not be forgotten that such changes in just one country are unlikely or almost impossible. It is therefore about changing the general view of the world and the functioning of man in it. It is therefore necessary to connect on a broader level, which, of course, does not happen overnight.

The strongest argument for preparing and enforcing changes is undoubtedly an alternative that is of no interest to anyone. This is a continuation of current trends in the world, which are by no means encouraging and we cannot be satisfied with them. Of course, changes need to be properly presented, which is a kind of challenge for both the profession when it comes to the preparation and the policy when it comes to the implementation.

## V. CONCLUSION

The commentary on Figure 1 shows the necessary observance of the principles of quality in the organization's operations, mainly due to its social responsibility, aimed at sustainable development. Where is the place of business excellence in all this? The excellence is, in principle, a process of continuous quality improvement. Business excellence therefore enables a constant competitive advantage and sustainable development of the organization. At the same time, it is the highest expression of its social responsibility.

Numerous management models and tools of total quality management can contribute to the achievement of business excellence, but due to the need for practical use, they are necessarily focused on individual areas of business. Each model has its advantages and disadvantages, its use is not necessarily optimal in each community, as they differ in many features.

Figure 1 provides a principled and comprehensive basis for shaping the mission, vision and strategy of an individual company, where quality and thus business excellence are a component of business that takes into account social responsibility and is aimed at sustainable development of the company.

In doing so, associations should also have enough support at the state level, in particular within the framework of the relevant *acquis*, with the aim of developing an appropriate corporate culture, public administration and civilizational norms. The role of civil

society in the broadest sense is extremely important in shaping and strengthening this support.

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# Learn between learning styles and teaching practices: Case of qualifying students

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Received: 02 Nov 2020;

Received in revised form:

30 Dec 2020;

Accepted: 03 Jan 2021;

Available online: 16 Jan 2021

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**Keywords**— *Learning performance,  
Learning styles, Efficiency,  
differential psychology,  
Educational practice.*

**Abstract**— *In a classroom, individual differences manifest themselves in learners at two levels: a rather quantitative level, that of learning performance, and a rather qualitative level, that of the form that learners give to their learning.*

*The notion of learning styles is therefore based on the idea that different learners have different ways of learning. That is, what can explain their success or failure is not only a question of level of efficiency, but also the different ways in which they perceive, store, process and render information, the way which they build their knowledge base. The discipline underlying thinking about learning styles is differential psychology. We will refer to it often.*

*First, we will briefly review the work that was carried out with a view to dealing with learning difficulties by taking into account differences in efficiency. We will then present two scientific concepts that shed light on the notion of learning styles: cognitive styles and vicarious processes. Then we will present statistics specific to the work of trainee teachers at TAZA CRMEF on the dominance of learning styles in the qualifying cycle. We will end by justifying with a few examples the pedagogical adaptations recommended to take into account the styles of learners in pedagogical practice.*

## I. INTRODUCTION

Learning difficulties have long been conceived solely as the result of deficits in the intellectual efficiency of learners. Contemporary and part of the early days of psychology as an autonomous science, the work of Binet (Binet & Simon, 1905) was intended to identify children who, because of their cognitive deficits, were in need of special education. Individual differences were assessed according to a single dimension: mental age. However, we will do justice to Binet by noting that from this period (Binet, 1909/1973), he had the intuition of qualitative differences when he described, for example, the different modes of operation of his two daughters, whom he probably did not suspect any debility.

Learning styles are more difficult to identify than cognitive styles, which enjoy the status of scientific constructs validated by laboratory measurements. They also suffer from the mediocre scientific quality of many models among which practicing pedagogues sometimes choose, unfortunately, according to superficial criteria, or because the model supports their preconceptions.

However, their practical and theoretical interest outweighs the flaws, which we have pointed out and which we consider provisional.

On a practical level, they allow the learner to take his personal characteristics into account. This consideration can be achieved without excessive “psychologization”. For example, learning styles, because they are modifiable and vicarious, avoid confining the subject's difficulties to

explanations formulated in terms of aptitudes or personality traits relatively independent of the situations. They encourage us to keep in mind that learning behaviors result from an interaction between components of the training situation and dynamic characteristics of the person.

Today, the teaching mission requires teaching practices that watch over the development of the learner's cognitive, metacognitive and socio-affective strategies in order to develop in the pupil a citizen a critical look towards himself and towards the students. other.

**II. THEORETICAL FRAME**

Learning strategies and styles are two distinct concepts (Wenden 1985; Oxford 1990a). Learning strategies are specific techniques or methods that learners use in learning situations to solve problems, tackle a task, prepare for an exam, or participate in ongoing activities. These strategies can be learned, and learners can consciously choose to apply a specific strategy in a given situation. In turn, learning styles are an integral part of an individual's personality and have a physiological basis. Learning strategies are implemented when the usual learning styles are ineffective in solving a problem (Riding &Rayner 1998: 11).

**A- Learning strategies**

Initially, research on learning strategies was initiated in order to establish a list of strategies employed by successful learners. These strategies are then taught to learners who are struggling (Naiman et al. 1978). Learning strategies have been the subject of much research in the field of language learning (Rubin 1975; Wenden 1985; Oxford 1990a and 1990b; O'Malley &Chamot 1990; Purpura 1999; Wharton 2000). Most of this research shows that the most successful learners are those who use the strategies most appropriate to the materials, tasks, learning objectives and personal needs. Using appropriate strategies can also foster learner autonomy, as Rebecca Oxford and Martha Nyikos claim "use of appropriate learning strategies empower learners to take responsibility for their learning through improved autonomy and independence (Oxford &Nyikos 1989: 291)"

Rebecca Oxford (1990) proposes a taxonomy "Table 1" of strategies. His model is widely used in research on language acquisition. Two categories of direct and indirect strategies, divided into sub-categories are proposed:

Table 1. Taxonomy of learning strategies

Direct strategies	Memorization strategies	Create mental connections Apply images to sounds Revise Act to learn
	Cognitive strategies	Practice the language Receive and send messages Analyze and reason Create structures
	Compensation strategies	Compensation strategies
Indirect strategies	Metacognitive strategies	Focus learning actions Plan and organize your learning Self-assessment / carry out a check
	Affective strategies	Control your anxiety anxiety Encourage each other Take your emotional pulse Emotion
	Social strategies	To ask questions Cooperate Create an empathetic relationship

**B- Learning styles**

With regard to learning styles, much research, for example, the Experiential Learning Theory (Kolb 1976; Joy & Kolb 2009), the inventory of learning styles learning (Learning Style Inventory) (Dunn, Griggs & Price 1993), or the theory of mental autonomy (Theory of Mental Self-Government) (Sternberg 1997; Zhang & Sternberg 2000), were carried out.

For our study, we retained the learning style inventory theory of Rita Dunn, Shirley Griggs and Gary Price (1993) because it associates learning styles with physiological and cognitive preferences and constitutes the closest model of our representation on learning styles.

The authors cite five factors related to learning styles (1993: 238): the classroom environment (sound or silence; soft or strong lighting; hot or cold temperature; arrangement of furniture) emotion (motivation; perseverance; responsibility; structure); social preferences (individual work, in pairs, with peers, in groups with an authoritative or accommodating adult; the need for variation or routine); physiological preferences (auditory; visual; kinaesthetic; the need to eat / drink or not when learning; the energy level during the day; the need for mobility or not); the processing trend (global or analytical; hemispherical preference: the right hemisphere of the brain is identified as intuitive, while the left hemisphere is logical; impulsive or reflective).

**C- Sense of personal efficiency**

The feeling of personal efficacy or self-efficacy is a psychological theory developed by Bandura (1977, 1997). This notion is defined as “beliefs in one’s ability to organize and execute actions necessary to produce expected results” 3 (Bandura 1997: 3). Madeline Ehrman (1996: 137) interprets this notion in the field of education, particularly language learning, as “the extent to which the learner thinks he is capable of facing the learning challenge”.

According to Bandura (1997), the construction of SEP has its source in four factors: active experiences of mastery (mastery experiences), social learning (vicarious experiences), persuasion by others (social persuasion) and physiological and emotional (physiological arousal).

- Active mastery experiences mean that successes serve as an indicator of capacity and therefore build a strong belief in self-efficacy, while failures undermine it.

- Social learning is the assessment of one’s own abilities against those of others. The individual draws conclusions from observing the actions of other people. These are the subjects whose characteristics (age, sex, etc.) are the closest who are most likely to be sources of information.

Persuasion by others means trusting others in their abilities. It is easier for someone to maintain a sense of effectiveness, especially when faced with difficulties, if other significant people express their confidence in their abilities.

- Physiological and emotional state means that in assessing their abilities, a person relies in part on the information conveyed by their physiological and emotional state, especially when their activity concerns health, physical activities and stress management (Lecomte 2004).

Research by Jay Jackson (2002) and Johan Ferla, Martin Valcke and GilberteSchuyten (2008) shows that MS has a positive correlation with academic achievement. The

important effect of this feeling in the school situation is thought to be due to its motivational aspect which affects the actions of learners. In view of the results of the cited research, we can hypothesize that learning styles and strategies appropriate or inadequate to the learning situation can increase or decrease the SEP which, in turn, provides the learner with information. so that he adjusts (or not, if he does not wish) his subsequent actions by aiming for other successes. Our study aimed to test this working hypothesis.

**D- Teaching style**

By drawing inspiration from the work of Blake and Mouton, in terms of management, we can identify 4 styles of teaching representative of observable teaching practices, from a two-dimensional model (attitude towards the subject, attitude towards towards learners).

- **Transmissive style:** the teacher communicates as much information as possible in the allotted time. His presentation directly transposes a written text without adapting it to circumstances and to the public

- **Incentive style:** the teacher is constantly concerned with involving individuals, he asks for ad hoc responses, but without effective use ("riddle" questions.

- **Associative style:** the teacher only grants relative trust to the learners. He intends to make them work, but does not expect much from this collaboration, he does not promise effective help, he "corrects" and "corrects"

- **permissive style:** the teacher remains passive, even lax. He is content to fill the time allotted to him without real consideration for the learners and for the objectives

**III. METHODOLOGY**

In our methodological framework we have formed a heterogeneous group of students, of 134 students who belong to the three branches of secondary education (first year of the baccalaureate), namely:

Table.2: Research samples

Scientific Section	Literary Section	Economic Section
43	44	47
33%	33%	34%

Table.4: Learning strategy

	Scientific Section	Literary	Scientific Section
Memorization strategies	21%	29%	16%
Cognitive strategies	26%	13%	28%
Compensation strategies	23%	11%	31%
Metacognitive strategies	14%	12%	4%
Affective strategies	6%	14%	9%
Social strategies	10%	21%	12%

We founded our theory through three different questionnaires:

In the first ; We used the Learning Styles Index test as a support which was published by Richard Felder (educator) and Barbara Soloman (psychologist) in 1991.

The test is available online, it contains 44 to reflect the learning styles of the students

Secondly, we distributed a questionnaire on learning strategies

And third, we asked our sample about their preference in teaching style.

#### IV. RESULTS

The results of our experimentation showed:

##### A- Regarding the learning style

Table.3: Student learning styles

	Scientific Section	Literary	Scientific Section
Visual style	52%	34%	41%
Hearing style	12%	54%	42%
Kinesthetic style	36%	12%	17%

From the results of table 3 we detect that the dominance of visual style for scientists and this due to the nature of the content which contains diagrams and figures, but with an important value

for the kinesthetic style also because of the concrete and palpable experiments practiced by this branch.

For the literary branch the dominant and auditory style which is explained by the nature of the narrative and the historical and philosophical aspect of the branch against the economist who are heterogeneous even for their learning styles

##### B- In relation to the learning strategy

We have classified the learning strategies according to the preferences of the students in relation to each branch.

The results mentioned in table 4 show that for each category of students, a learning strategy dominates which reflects the construction of knowledge on the one hand and the nature of the content addressed by the teachers on the other hand of which we note that the cognition is dominant among scientists against memorization for literary people and comprehension for economists.

In the context of our research, therefore, students seem to be much more interested in unusual and new activities than in activities that are supposed to be adapted to their learning style or old.

Conducted with our sample of 134 students who responded to a Table 5 questionnaire on the factors influencing their motivation, reveals the importance of using a variety of teaching strategies to capture students' attention and arouse their curiosity. The results of this research show that in addition to the personality of the teacher, the use of a variety of instructional strategies positively influences the motivation to learn of students.

Table 5: Classic or diversified strategy

	Teaching strategy classic	Diversified teaching strategy
For	3%	97%
Against	97%	3%

Conversely to learning strategies, students' appreciation of teaching styles was differently marked. table 6

Table 6: Teaching styles

Transmissive style	Incentive style	Associative style	permissive style
0%	31%	47%	12%

The preferred teaching styles are then, the incentive and the social; the non-preferred styles are the transmissive and the permissive despite the skills targeted by the latter.

Indeed, according to Sauvé, Debeurme, Wright, Fournier and Fontaine (2007), diversified educational activities offer students the possibility of making choices and breaking up the routine while promoting their

motivation to learn, other than the use of strategies. diversified teaching methods to respond to the diversification of learning styles and from the same perspective offer motivating content for students and have a positive effect on their academic success and perseverance.

## V. CONCLUSION

In this article, we have focused on a set of learning styles and learning strategies based on several studies from cognitive psychology or social psychology. These styles and strategies were linked to the students' perception and their representations of the learning content in order to identify the favorable factors. From the results obtained, we have shown that there are certain relationships between teaching styles and strategies and the feeling of success or failure. In other words, it is from a clear and well-founded definition of the characteristics.

of learners that we can propose a teaching approach likely to strengthen motivation and a factor in academic success.

In the same perspective, the results of the experiment confirmed that the search for a teaching strategy is based on the connection of four parameters directly linked to the prerequisites, to the cognition and to the psychology of the pupils, namely: The nature of the content offered, the degree of motivation and attraction of the students, the level of reflection and analysis of the students and the learning style recommended by each of the students.

However, the identification of learning styles should allow an optimal use of skills, more effective communication and the constitution of better performing teams at work, as well as a differentiation of the teaching strategy to respond to the variety. learning strategies to advance and perform all high.

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# Abstraction and Computational Thinking: Possibilities as from the New Brazilian National Common Curricular Basis

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Received: 28 Oct 2020;

Received in revised form:

02 Jan 2021;

Accepted: 07 Jan 2021;

Available online: 16 Jan 2021

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**Keywords**— *Abstraction, Computational Thinking, cognitive process, Brazilian school.*

**Abstract**— *The most important and highest-level cognitive process on computational thought is the abstraction one. A new regulating norm of the school curriculum in Brazil evokes the more diverse skills, which the adoption of communication and information technologies makes available in the educational process of computational thinking and its dominion on part of the students. This study aimed to clear this configuration in basic education, while taking the demands resulting from the National Common Curricular Basis and computational thinking into account in order to attain the proposed skills. Following up this perspective, we accomplished a bibliographical and documental review which led us into perceiving the computational thinking in the curricular and school environment. In accordance with the research, we then observed there is an appropriate moment in Brazilian education, inclusively of legal order, to work out the computational thinking at school towards allowing the construction of a logical, articulated, systematized and abstract thinking, capable of contributing to the growth of both competencies developed by means of learning to learn, the conscious use and integration and the reflexive forms of the apprehended contents and applied to various daily situations of Brazilian schools.*

## I. INTRODUCTION

When telling about computation, we are inexorably telling about abstractions. Therefore, the essence of the computational thinking is abstraction [1]. The automation of the abstract relationships and the information generated by these relationships is the basis of the computer science, which is fundamentally a science of abstraction since it creates models for thinking about problems and for designing appropriate mechanizable techniques for solving them. So, this automation necessarily implies both the knowing subject's coordination and differentiation through which he builds knowledge, like structure or capacity; secondarily, like content. However, the most important and

the highest-level computational thinking is the abstraction process [2], [3]. Based on these scholars, we understand thinking ought to refer to all psychic activity, while the set of cognitive phenomena and the abstraction like an operation of the being who, after having distinguished the different characters of an object, separate one of them from the others to consider it in isolation as a thing.

This positioning is confirmed once the computational idea of algorithm itself is linked to the abstraction of a process that receives inputs, executes a sequence of steps and produces outputs to satisfy a desired goal. Therefore, the efficient projection of algorithms intrinsically involves projecting solutions on these abstract data. When we

develop programs in high-level language, for instance, we are basing on low layers of abstractions. The programming languages incorporate many mechanisms of abstraction that allow part of a code to be written once and be repeatedly reused. This abstraction is the key to control the enormous complexity of real programs which consist of several layers of such abstractions. A priori, there is no worry about hardware details, about the operational system, the platform, the system of archives or about the network to carry out this program.

We therefore understand the essences of the computation science and mathematics itself are alike [1], because the primary products of both subjects and the models they build up are abstract. In such case, the mathematics primary products are the structures of inference, while the main IT products are the interaction patterns.

This context pushes us into seeing that abstraction is an indispensable component to the students’ cognitive growth, since – in infantile education – children are stimulated to pursue abstractions and generalizations. It is therefore a competency that is being developed as time goes by and, the more it is stimulated, the easier the construction of this competency will be. Contextualized activities are important to arouse attention and relevance [4].

Computational thinking can assist in this process in a playful way, so fomenting the learning to learn that the National Common Curricular Basis (BNCC) defends.

## II. COMPUTATIONAL THINKING IN BASIC EDUCATION: THE CONSTRUCTION OF THE LEARNING TO LEARN

Computational thinking represents a thinking process [2] involved in the formulation of a problem and in the expression of its solution in such a way that a human being or a machine can effectively accomplish. A computer program becomes an algorithmic sign which can both be interpreted by humans and machines [5]. The double interpretation allows for a dialectic relationship between computing activities and Computational Thinking instead of the dualistic traditional vs new approach.

Thus, it involves the solution of problems by projecting algorithms as per human understanding, while getting inspired in fundamental concepts of the Computation Science. Although the automation necessarily implies in some kind of computational device for the interpretation of abstractions, the computational thinking does not require a machine and tends to be a fundamental skill such as reading, writing and arithmetic.

Based upon the current importance of the theme, the International Society for Technology in Education [6] published a study that synthesizes the characteristics developed by students using computational thinking. These include (a) a formulation of definitions of problems adjusted to technology-assisted methods, such as data analysis, abstract models and algorithmic thinking to explore and find solutions; (b) the collection of data or identification of sets of relevant data, the use of digital tools to check them up and representing data in many ways to ease the solution of problems and making decisions; (c) the decomposition of problems in component parts, extracting important information and developing descriptive models to understand complex systems or facilitating the solution of problems; (d) understanding how the automation works and the use of algorithmic thinking to develop a sequence of steps to create and test automated solutions.

From these characteristics, we can produce evidence that computational thinking is not restricted to solution of problems, but also to their formulation. We understand that, on observing daily problems, the learner needs to structure a set of problems in order to (re)define it [1], [2], [4]. He will then be able to search for a structured solution. Data handling skill (identification, search, and categorization) is equally required [6].

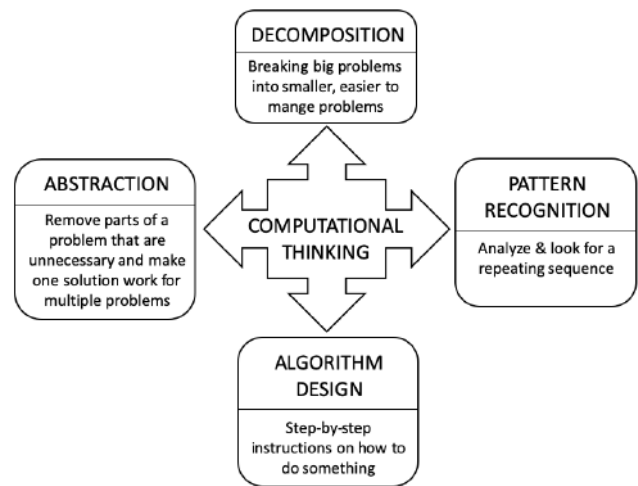


Fig. 1: Elements of Computational Thinking

In school practices, we can see that the student’s observation of the physical results, such as putting small lights to work (Light Emitting Diode – LEDs), and the running of engines throughout the Arduino Platform help the teacher to analyze the cognitive process that each student follows up to trace a sequence of steps to create and test his own solutions. Studies show that in Brazil, when applying the principles of computational thinking in



basic education, the most commonly used tools were Scratch, Lego Robots, Arduino, IDE, Code.org, App Inventor, Robocode [7]. Typically, programming courses include hands-on programming activities to allow students to practice and explore computing concepts as part of the learning process [7], [8].

In this aspect and considering the protagonism BNCC attributes to learning to learn [9], it is imperative that – in the early years of Elementary School – programming languages should be used to foster Computational Thinking. In this sense, the document addressed to elementary school explains that, children’s experience in their family, social and cultural environment, their memories, their belonging to a group and their interaction with the most diverse communication and information technologies are sources that stimulate their curiosity and the formulation of questions. The stimulation to creative, logical and critical thinking – by means of the construction and the strengthening of the capacity to ask questions and evaluate the answers, discussing, interacting with several cultural productions, making use of communication and information technologies – allows the students to enlarge the understanding of themselves, of the natural and social world, of the relationships of the human beings aid themselves and nature [9].

BNCC itself evokes the most diverse skills allowed by the adoption of the communication and information technologies in the educational process, which denotes the use of computer and, consequently, presupposes the students’ dominion of computational thinking.

As the Basis points out, “the social and affective links, the intellectual possibilities and the most abstract thinking capacity get enlarged” in the second step of elementary school. Still in accordance with the document, it is imperative that the school understands and incorporates more the new languages and their working methods, unraveling communication possibilities (and handling, as well), and that it may educate for more democratic uses of technologies and for a more conscious participation in the digital culture. In taking advantage on the digital communication universe potential, the school may institute new ways to promote learning, interaction and the sharing of meanings among teachers and students [9].

In view of the above, it becomes clear that it is important to think of new ways of teaching so that students may develop the practice of learning to learn in his schooling process, since the first steps in basic education.

As far as high school is concerned, this skill becomes even more pressing. The World Economic Forum – WEF (non-profit organization created to discuss the world’s most urgent issues) [10], there is a growing demand for

skill involving computational thinking in the labor world. Yet, to guarantee a solid formation to understand and apply computational thinking for all, this learning ought to be started in the early years of childhood.

Next, we present a chart in which the demands for skills required of the professionals trained for today’s society – present in the WEF document – are explained [10].

*Table.1: Main demands for skills in 2018 versus 2022*

2018	2022
- Analytical thinking and innovation	- Analytical thinking and innovation
- Solution of complex problems	- Active learning and learning strategies
-Critical thinking and analysis	- Creativity, originality and drive
- Creativity, originality and drive	- Design and technology programming
- Attention to details, reliability	- Complex solution of problems
- Emotional intelligence	- Social influence and leadership
- Reasoning, resolution of problems, ideation	- Emotional intelligence
-.Social influence and leadership	- Reasoning, resolution of problems, ideation
- Time and coordination management	- Analysis and evaluation of systems

The skills listed in the chart above show that the school cannot be restricted to go on working the contents without taking the current society complexity into account.

### III. THE NATIONAL COMMON CURRICULAR BASIS AND COMPUTATIONAL THINKING IN HIGH SCHOOL

The National Common Curricular Basis comes to meet a yearning that has been generated since the Promulgation of the Federal Constitution of 1988, article 210 of which provides fixed contents to be studied in Elementary School. The aforementioned article explains that: “Minimum contents are fixed for elementary education, so as to ensure basic education and respect for national and regional cultural and artistic values”.

As from this understanding and after several discussions, including quite divergent ones, the one tried by the National Council of Education (NCE) and BNCC – referring to High School – was approved. The

homologation by the Ministry of Education (MEC) happened on December 14, 2018. The document aims to guarantee integral formation of individuals through the development of skills of the 21st century. MEC executive management defended that the competencies of the 21st century have to do with the formation of more criticism-imbued citizens, with the capacity of learning to learn, of solving problems, of being autonomous to make decisions, citizens that are capable of working in team, respecting the other, the plurality of ideas, having the capacity to argue and defend their viewpoint. Furthermore, today's society itself imposes a new look at the central issues of education, in particular: what to learn, what to learn for, how to teach and evaluate learning.

Despite the most varied criticisms of the educational bodies, BNCC seeks to unify basic contents that shall be taught all over the country. These ought to integrate the compulsory minimum curriculum of all schools, also contemplating the traditional and regional teachings, which correspond to the diversified school curriculum. Therefore, schools can add what is typical of each community to their Pedagogical Political Project (PPP), without dispensing with the minimum contents provided by the BNCC.

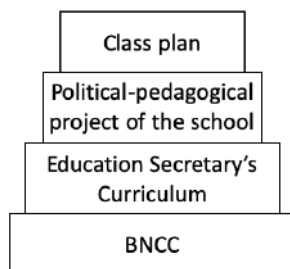


Fig. 2: Documents related to the Brazilian educational curriculum

According to the Basis, the students are supposed to develop cognitive and socio-emotional competencies through basic education. Among the ten competencies mentioned in the document, we highlight those in which computational thinking can contribute in a more effective way.

- To exercise the intellectual curiosity and seek the appropriate approach to sciences, including investigation, reflection, critical analysis, imagination and creativity, to investigate causes, elaborate and test hypothesis, formulate and solve problems and produce solutions (inclusive, technological ones) based upon knowledge of different areas

- To use different languages – verbal (oral or visual-motor such as Sign Language, and writing), body,

visual, sound and digital as well as knowledge about artistic, mathematical, scientific languages, to express oneself and share information, experiences, ideas and feelings in different environments and to produce meanings that lead to mutual understanding.

- To understand, to use and create digital technologies of information and communication in a critical, meaningful, reflexive and ethical way in the various social practices (inclusive, school ones) to communicate, access and disseminate information, to produce knowledge, solve problems and exercise protagonism and authorship in personal and collective life.

- To argue based on trustworthy facts, data, information, to formulate, negotiate and defend ideas, viewpoints and common decisions respecting and promoting human rights, socio-environmental consciousness and responsible consumption at local, regional and global levels, with ethical positioning in relation with self-care, other people's and the planet's.

BNCC has organized the contents in four areas of knowledge: (a) Languages and their Technologies; (b) Mathematics and its Technologies; (c) Sciences of Nature and its Technologies; and (d) Applied Human and Social Sciences. The Ordinance # 1432/2018 establishes that the high school curricula must be composed of two parts: the general basic formation, with a total working load of max. 1,800 hours and the forming itinerary, with total working load of at least 1,200 hours, as from four structuring axes: Scientific Investigation, Creative Processes, Mediation and Socio-cultural Intervention and Entrepreneurship.

In these molds, the High School reform and BNCC have created forming itineraries and have changed them into fertile fields for the development of computational thinking, reverberating in the construction of new curricula and new ways of learning and teaching. For instance, among specific skills in the structuring axis of Creative Processes – linked to the Sciences of Nature area and their Technologies – there appear the abilities to propose and test ethical, esthetic, creative and innovating solutions to real problems, considering the application of design of solutions and the use of digital technologies, computational programming and/or thinking to support the construction of prototypes, devices and/or equipment, aiming to better the quality of life and/or the production processes.

We perceive that computational thinking becomes a fundamental tool to attain such competencies and, up to certain extent, it facilitates the consecution and the attainment of the expected formation for this teaching level.

#### IV. CONCLUSION

The present world offers students unprecedented opportunities and powerful tools to develop various literacies [11]. The Computational Thinking began to influence on subjects and professions further to science and engineering, among which study areas one finds medicine, economics, finances, law, social sciences, archeology, arts, humanities and journalism.

Today's society has substantially changed its way of thinking and acting as regards its interaction with the social world. This interaction has been measured through digital technologies, on daily basis. However, projects for implementing Information Technology in Teaching (ITE) do not achieve the expected success because they concentrate all the effort on specific elements, not focusing on a systemic view that enables to enhance the use of that technology [12]. The teachers do not use digital technologies in their practice satisfactorily, but are constantly connected; are motivated by peers, pupils, official documents and pedagogical coordination; there are policies to promote the insertion of TDICs in the classroom and that the scientific literature on emerging technologies in education is still very recent, with no specifications of the technologies, their educational applications and objective evaluation criteria [13].

The computer has become a founding ally to the social interaction processes, as well as to the formative and productive ones. Yet, the school is in disarray with this change. In this direction, public policies for education need to take a proactive stance, fomenting a rethinking of attitudinal and procedural feature to attain the conceptual contents and, consequently, a wider formation.

Countries such as South Africa, Russia, Australia, New Zealand, and have already made room for CS in the K–12 curriculum [14]. In Brazil, the BNCC intends to unify and equalize the basic-school students' formative process, aiming to attain quality in Brazilian education. In this context, it brings an apologetic discourse to the use of digital technologies, as one of the paths capable of assisting to reach this quality. Computational thinking is not seen only as a static tool to be handled by teachers. On the contrary, it appears as a possibility of constructing a logical, articulated, systematized abstract thinking, capable of contributing for the growth of wide competencies, developed throughout the learning to learn, the integration and its conscious use and, in a reflexive way, the apprehended contents and applied to diverse daily situations. That is, if well developed since the first steps in basic education, computational thinking can contribute to break down barriers of cognitive order and to promote a more inclusive teaching.

We understand such a reality is not easy to be attained, and that computational thinking cannot modify Brazilian education in its more varied gaps, but believe we shall seek solutions to reach equity in the search for learning and allow a more qualified education, impacting on students of all the Brazilian regions. Thus, computational thinking can be contributory as one of the many links of this chain of good.

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# Fuzzy Logic Based Contactless Risk Dedication and Prevention System to prevent COVID-19 Suspect at Entrance

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Received: 23 Oct 2020;

Received in revised form:

03 Jan 2021;

Accepted: 11 Jan 2021;

Available online: 17 Jan 2021

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**Keywords**— COVID-19, Temperature  
Fuzzy logic, Contactless measurement,  
MIMO FIS.

**Abstract**— COVID-19 is a disease caused by a virus that can spread from person to person. The symptoms can vary from mild to severe illness for COVID-19. Body temperature plays an important role to detect COVID-19 symptoms. This article proposes Fuzzy Logic Based contactless risk dedication and prevention system at entrance. The proposed system measures the contactless body temperature of the individual at the entrance. Fuzzy logic takes the decision to allow the person inside at the entrance. Based on a fuzzy decision system open or close the gate. The system is automatic and does not need any human operator that helps to prevent further pandemic.

## I. INTRODUCTION

Nowadays coronavirus (covid-19) becomes a serious health concern causing severe health issues in human beings and it becomes a pandemic [1]. It may spread via polluted hands [2, 3]. Normal body temperatures for adults range between 36.1°C and 37.2°C. Time of the day can impact human body temperature. Human body temperature falls down at night and increases over the day. Increased human body temperature is one of the first symptoms of illness, and a fever is a sign that the human body is fighting some infection. Fever is also a common symptom of the coronavirus [4, 5]. The proposed system is able to measure non contact body temperature by using an infrared sensor module. Slightest differences and abnormal body temperature can be detected and will result in alarm. The fundamental block diagram of the system is shown in Figure 1. Circuit diagram of the Contactless Risk Dedication and Prevention System is shown in Figure 2.

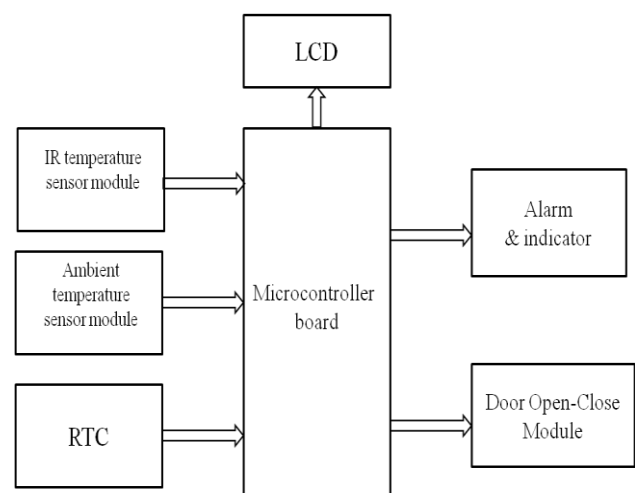


Fig :1 Contactless Risk Dedication and Prevention System

### II. NON-CONTACT INFRARED TEMPERATURE MEASUREMENT

Ambient temperature is also an important factor that affects human body temperature. Lm35 analog output sensor is used to measure ambient temperature. To measure human body temperature infrared temperature MLX90614 sensor is used that enables high accuracy of 0.5°C and resolution of 0.02°C over a wide temperature range. MLx90614 is an infrared based sensor, it measures the temperature based on infrared emitted by an object. It senses electromagnetic waves in the range about 700 nm to 14,000 nm [6]. The microcontroller board used is Arduino Uno that provides an open source hardware platform.

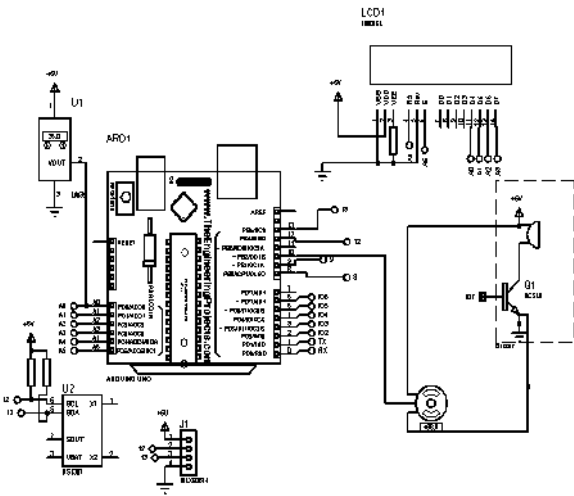


Fig. 2: Circuit diagram of the Contactless Risk Dedication and Prevention System

- Fuzzy logic inference Fuzzy logic allows taking precise decisions from input vagues data. Fuzzy logic allows to model complex, non linear dependency that exist between input and output variables of a system. A Fuzzy Logic inference consists of three-parts: fuzzification of input, defuzzification of output, and Knowledge representation in the form of IF-THEN rules. Input a real scalar value is converted into a fuzzy value in the fuzzification procedure. To detect the possible severity of COVID-19 the fuzzy inference system is designed as shown in Figure. 3. The fuzzy inference system consists of two inputs and one output namely body temperature, ambient temperature and factors Severity. Triangular shape membership functions are used to fuzzify the input.

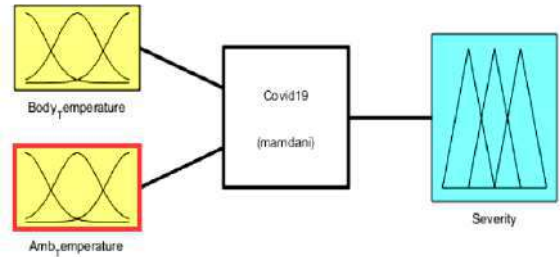


Fig.3: Structure of fuzzy inference system

Figure 4 shows the fuzzy sets of input linguistic variables labeled with Low, Medium and High. In present study typically two input variables have been considered temperature and ambient temperature. Similar to the input variable fuzzy memberships function is assigned to output variable. The fuzzy sets used for Severity are Low, Normal and Severity. The graphical interpretation of the membership function for output fuzzy variable is shown in Figure 5.

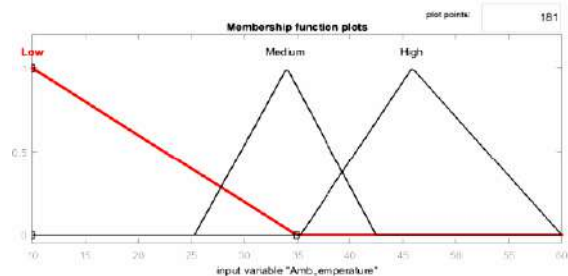
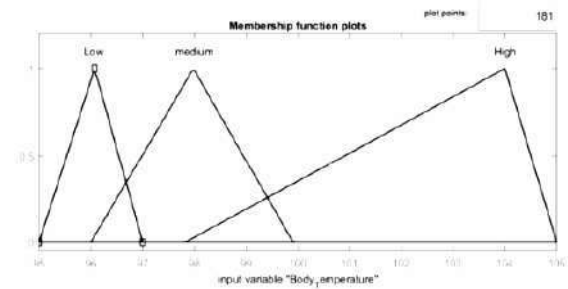


Fig.4: Triangular shape Membership Function for Input Linguistic Variables

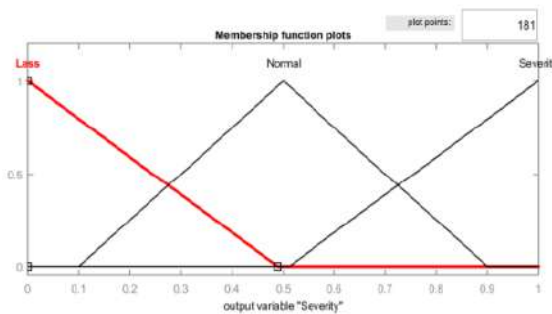


Fig. 5: Membership Function for Output Linguistic in three categories Less- Severe, Normal and Severe

After fuzzification of input variable next stage is deciding what will be the level of severity. The input situation is expressed after ‘IF’ while output situation is described after ‘THEN’ part. The Fuzzy rule policy for contactless risk dedication is structurally formulated as shown in Table 1.

Fuzzy Logic inference generates the output for different input conditions and is tabulated in table I to IV. From table I to IV it is observed that degree of severity is less for less infected suspect and it goes increasing as is more infected suspect. In the article [7] we have demonstrated how to synthesize Fuzzy inference in microcontroller using Embedded-C language without any spatial software tool. If Fuzzy Logic inference output i.e. degree of severity is in normal range then the system open the door by using electronics actuator else door is closed hence preventing COVID-19 suspect at Entrance.

Table 1: Fuzzy Rule base for Contactless Risk Dedication

Severity		Body Temperature		
		Low	Medium	High
Ambient temperature	Low	Less	Normal	Severity
	Medium	Less	Normal	Severity
	High	Less	Less	Severity

Table 2: Normal Severity level of the Suspect

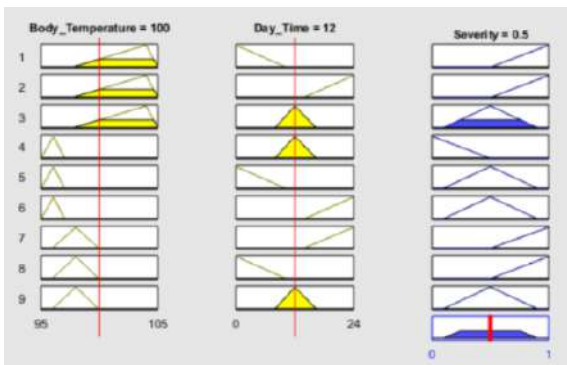


Table 3: Less Severe level of Suspect

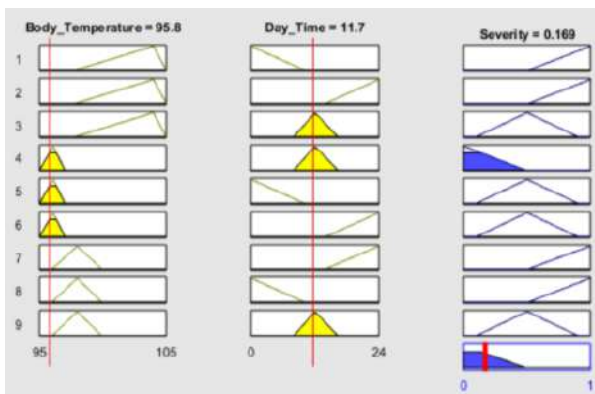
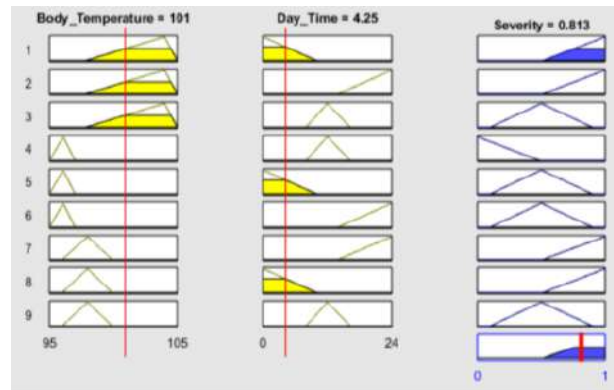


Table 4: Severe level of Suspect



### III. CONCLUSION

The proposed system can measure reliable body temperature without any contact to the body, it also evaluates and displays possible risk of COVID-19 in real time, and it is alarming at detection of risk and preventing the entry of the person. The system is automatic and does not need any human operator. This allows the proposed system to be useful to the risk dedication and prevent COVID-19 infected persons at entrance to prevent further pandemic.

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## New Trends in Improved Nitrogen Fertilizers

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Received: 30 Oct 2020;

Received in revised form:

05 Jan 2021;

Accepted: 09 Jan 2021;

Available online: 17 Jan 2021

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**Keywords—** *technology  
roadmapping, controlled release,  
slow release, fertilizers.*

**Abstract—** *The Technology Roadmapping (TRM) method is a decision-making tool that allows aligning market, product and technology within a defined time horizon through the mapping of scientific and technological trends. The present study aimed to identify possible research lines for implantation of a fertilizer development laboratory. The study focused on controlled or slow-release fertilizers, due to their improved performance in the gradual nutrient release in the soil and their lower environment damage ability than conventional fertilizers. The development of TRM was based on the mapping of the state of the art and the main technological advances reported in sources such as patent documents, patent applications and scientific articles. The construction of roadmaps allowed identifying the most important technological innovations in a short, medium and long-term timeframe. In the long-term, the trend is in the use of coating from biopolymers, mostly from chitin, starch and cellulose. In matrix case, the analysis pointed to the use of solids such as clay and zeolite, materials considered superabsorbent. In the short term, the concern about the environment indicates the search for less aggressive products, besides easy to handle and of low cost. In the mid-term, the use of biomass as support was evidenced.*

### I. INTRODUCTION

In order to increase sustainable agricultural productivity, the fertilizer industry continuously improves the use and production of nutrients from plant varieties in an efficient and responsible manner, benefiting the soil and preserving the environment. This avoids pollution of soil, surface and groundwater. In this scenario, improved efficiency fertilizers appear, capable of releasing nutrients more efficiently and minimizing adverse environmental impacts (TRENKEL, 2010). This group of improved fertilizers includes slow-release fertilizers (SRF) or controlled-release fertilizers (CRF) and stabilized fertilizers. The first group releases nutrients according to the needs of plants with a single application, as they are less water-soluble and more nutrient-rich materials. This characteristic reduces losses by leaching, immobilization and volatilization (nitrogen fertilizers' case), achieved by preparation techniques for

improving conventional fertilizers or through new types of specific fertilizers (TRENKEL, 2010).

Within the context of a globalized world, the chemical industries are driven to produce more diversified and innovative materials due to the new extremely competitive environment. This demand generates investments in research and development (R&D) as a source of innovation (WONGTSCHOWSKI, 2012). In this sense, competitive information is a fundamental and valuable tool in a digital age for helping to use knowledge in a systematic and targeted way (TAVARES et al., 2015). The main challenge of information management is to connect technological planning with business planning. One of the tools developed to address this issue is Technology Roadmapping (TRM). It integrates and communicates the market, product and technology development strategies with the business goal in a time horizon, in which the planning procedures depend on the technical expertise of professionals in the area



(ALBRIGHT & KAPPEL, 2003). Moreover, it is a simple methodology whose script is detailed in the literature.

1.1. Basic and fundamental concept

Roadmapping or Tecnology Roadmapping is a decision-making tool used mainly in the industry for the development of planning strategies in order to align the market, product and technology in three distinct layers within a defined time horizon (GARCIA and BRAY, 1997 A; LIZASO and REGER, 2004). Roadmapping must be driven by needs (needs-driven) or driven by a mission / objective (mission-pull). In addition, the method must:

- Integrate problem holders and solution providers in an integrated and cooperative team consensus.
- Be embracing in order to provide the means to identify, evaluate and select technological alternatives that can be used to meet short, medium and long term needs and objectives.
- Be reliable, defensible, and the reasons for decisions must be documented. This stage of the process will lead to a new stage, namely: extraction of control indicators.

1.2. Roadmap architecture, types and formats.

The most common architecture of the roadmap is a representation based on the time dimension and the relevant aspects of the business (market, product and technology), as shown in Figure 1.

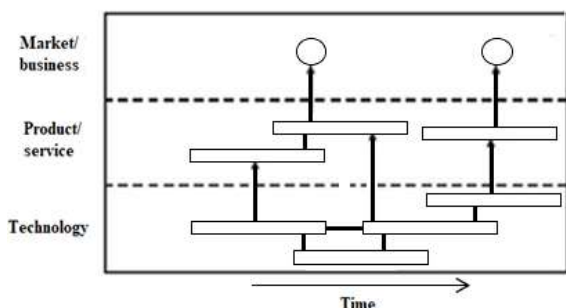


Fig.1: Common architecture of a roadmap.

Source: Adapted of Phaal et al. (2003).

The most common types and formats are: product roadmap, emerging technology roadmap, subject-oriented roadmap, corporate roadmap, industrial roadmap. According to Albright (2007), roadmappings define a future goal and answer a set of essential questions in order to develop an action plan to achieve the objective set. The first step is known as the “why” of a roadmapping. The second part is defined as the “what” stage of the roadmapping, where action plans are outlined. The third stage deals with the evolution of the technologies that will be used to achieve the objectives, being the “how” of a roadmapping. The

fourth part, known as the “tasks” stage of the roadmapping, defines the action plan and risks.

1.2.1. Methodology adopted by Garcia and Bray (1997)

This application consists of three phases. In the first one, preliminary activities are defined. It is during this phase that strategic objectives are explicitly outlined and relevant stakeholders are identified and management of the technological roadmapping is created. The second phase is a development in itself of the TRM divided into seven steps that can be applied both at the corporate level and at the industrial level. And the last phase is about continuity activities that also include their review and update. In this phase, there is the criticism, validation and approval of the roadmap elaborated through three steps.

1.2.2. Methodology adopted by Suzana Borschiver and Andrezza Rangel (2016)

This method consists in three steps, they are: pre-prospective, prospective and post-prospective. The pre-prospective stage is divided in four phases, they are: (1) identification of the theme to be studied, (2) bibliographic survey of the theme (state of the art/ technique), (3) establishment of goals and, (4) strategies outlined for the elaboration of the desired product roadmap. The prospective stage is divided in two phases: (1) driven research (for example, search on the basis of patents, patent applications and scientific articles) and, (2) analysis of the results generated by the search. The post-prospective stage is divided in two phases: (1) elaboration and analysis of the roadmap and, (2) conclusion.

In face of the scenario presented in this work, the present study aims to identify, through a decision-making tool, R&D investment opportunities for the next ten years, prioritizing possible lines of research for the implantation of a laboratory for the development of fertilizers. In this sense, this work was structured as follows: initially, the technology roadmapping (TRM) decision-making tool id presented. Subsequently, the tool is applied in the treatment of information related to the state of the art / art referring to improved efficiency fertilizers. Only supported controlled or slow-release fertilizers are focused, thus portraying an overview of the existing product, technology and market found in the literature review. At the end, the main possible lines to be covered for research and development in the segment of matrix slow or controlled release fertilizers are shown and pointed out.

## II. MATERIALS AND METHODS

The phases of the TRM method adopted in the organization of this work are an adaptation of the roadmap method made by Garcia and Bray (1997), which can be conducted in three phases: preliminary activities, development of the roadmap and continuity activities. In the present adaptation, the teaching used in the methodology developed by Suzana Borschiver and Andrezza Rangel (2016) was also considered, which can be conducted in three phases as can

be seen in the Figure 2 below. The Pre-prospective phase mentioned by Borschiver and Rangel (2016) is similar to the preliminary phase mentioned by Garcia and Bray (1997).

### 2.1. Strategy adopted for the construction of the Roadmap

Figure 2 illustrates the scheme applied in the research, from the identification of the theme to the conclusion, in which a proposal was developed to adopt measures / actions to be carried out.

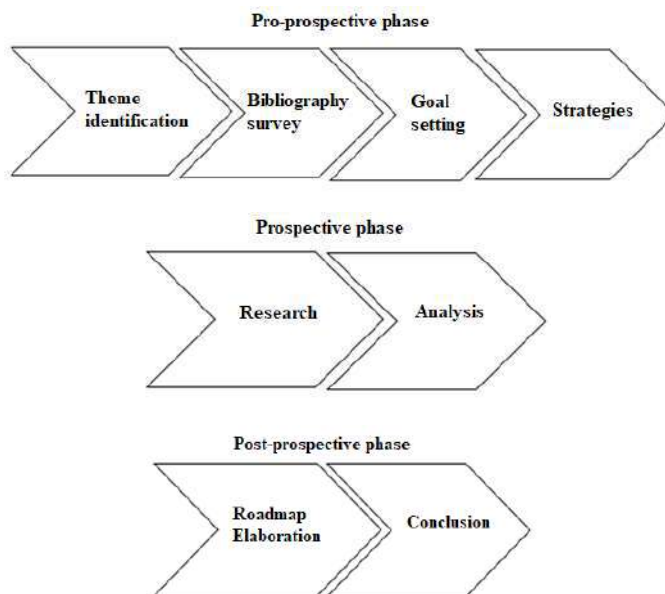


Fig.2: Methodology adopted at work.

Source: the authors.

### 2.2. Methodology applied to use the roadmap in the analysis of bibliography research

a) Search on the basis of granted patent documents (short term) was carried out by consulting the free online database of the United States Patent Trademark Office (USPTO) and Espacenet, of the European Union.

b) Search in the patent application documents database (mid-term) was carried out by consulting the USPTO and ESPACENET's free online database.

Both searches carried out in the patent databases adopted the search criteria: (i) keywords "fertilizer and release and (slow or controlled) and (matrix or coat) and (encapsulate or impregnate or entrap)"; (ii) the international patent classification codes specifically related to nitrogen fertilizers, which fall under the C05C code and its ramifications and; (iii) year of grant, in the case of patents granted, or year of publication, in the case of patent applications. For both cases, the period between 2008 and 2018 was adopted.

c) Research in the scientific articles database (long term) was carried out in the SCOPUS databases adopting the search criteria: (i) year of publication of the article in the period between 2008-2018 and, (ii) keywords "fertilizer and release and (slow or controlled) and (matrix or coat) and (encapsulate or impregnate or entrap)".

In the three surveys carried out above, only documents with the following technical characteristics were selected: matrix or coated controlled or slow release nitrogen fertilizers.

### 2.3. Taxonomies identification

The key parameters found for the taxonomies were identified through a careful analysis of all documents considered relevant in the stages of gathering technical and scientific data. These key parameters were interpreted as relevant aspects that define the object of the study: nitrogen fertilizers matrix or coated with controlled or slow release.

### III. RESULTS

#### 3.1 Improved efficiency or intelligent fertilizers

US patent application 2,016,340,265 reveals that different approaches have been proposed to reduce nitrogen loss. Among them, the encapsulation of the fertilizer delaying the release of fertilizer, so that the plants have more time for assimilation of nutrients. The use of the urease inhibitor and / or nitrification was also evidenced to delay the activity of the particular enzyme or microorganism. According to the depositor, both approaches have been extensively explored to develop improved efficiency fertilizers. However, the application of inhibitors is limited due to its instability in the soil under various conditions, such as pH, temperature, precipitation, among others.

In controlled release fertilizer (CRF), dominant parameters of nutrient release, such as, release rate, pattern and duration are known over a certain period of time (BORSARI, 2013; SHAVIV, 2005) and are a consequence of the CRF preparation step (SHAVIV, 2005). The release pattern of slow-release fertilizers (SRF), in turn, is dependent on the soil and climatic conditions. Therefore, it cannot be predicted over time (BORSARI, 2013). For Shaviv (2005), SRF involves the release of nutrients at reduced rates. But the nutrient release parameters (rate, pattern and duration) cannot be controlled.

Shaviv (2000) classifies SRF or CRF into three groups: (1) organic compounds with low solubility; (2) fertilizers with physical barrier control; and (3) inorganic compounds with low solubility. Inside the group 2, there are the coating and matrix fertilizers. Regarding matrices, they are divided into two subgroups of materials for their preparation: hydrophobic materials, such as polyolefins and rubber; hydrophilic materials, such as hydrogels. As examples of inorganic compounds with low solubility, metallic ammonium phosphates and partially acidulated phosphate rocks stand out (SHAVIV, 2000). Trenkel (2010) highlights three main groups of materials for preparing coated / encapsulated fertilizer coatings: (1) sulfur; (2) sulfur together with polymers, including waxy polymeric materials; and; (3) polymeric materials / polyolefin.

According to Borsari (2013), the main products manufactured in the current market with their different mechanisms are: (i) low solubility fertilizers with a complex chemical structure, dependent on microbial action, such as urea-formaldehyde; (ii) fertilizers with physical barriers, such as fertilizers coated with sulfur, minerals or organic polymers and; (iii) gel-based matrix fertilizers or organic matter with or without coating.

#### 3.2 Guiding taxonomies identified in the patent and scientific literature survey

Table 1 shows the identified guiding taxonomies of the referred trinomial (Market / Product and Technology):

Table.1: Adopted taxonomy.

Section	Key parameters
Market	NUE (nutrient use efficiency)
	Less aggressive to the environment
	Water retention capacity
	Water absorption capacity
	Swelling capacity
	Degradation capacity
	Mechanical properties and/or improved elastic ones
	Good quality in storage and transportation
	Cost reduction
	Easy handling
	Polymer and/or resin
	Biopolymers Synthetics
Product	Mixture of polymers and sulfur
	Mixture of polymers, biomass and others
	Biomass
	Mixture of biomass and others
	Sulfur
	Mixture of polymers and sulfur Mixture of sulfur and others

Product	Others	Clays Silica Zeolites Varied materials
	Polymers and/or resins	Single Combination
Technology	Biomass	Single Combination
	Coating	1 layer 2 layers Multiple layers
		Matrix
	Polymer matrix	Impregnation Mixture/combination

Source: the authors.

### I. DISCUSSION

In this topic, roadmap analysis is presented and discussed.

#### 4.1 Market-related aspects

Analyzing the results of surveys carried out in the short, medium and long terms (Figure 3) in relation to market aspects, it appears that the trend continues with the focus on

the nutrient use efficiency (NUE), on the environmental issue and on the water retention capacity. In other words, the researchers aim products with improved NUE, less aggressive to the environment, with good degradation and swelling capacity, as well as good water retention and absorption capacity, being this profile shown in Table 2.

Table.2: Market analysis. Source: the authors.

Sections	Key parameters	Mid-term	Long term
Market	Nutrient use efficiency	USPTO (21)/ESPACENET (36)	SCOPUS (61)
	Less aggressive to the environment	USPTO (18)/ESPACENET (36)	SCOPUS (61)
	Water retention capacity	USPTO (14)/ESPACENET (18)	SCOPUS (51)
	Water absorption capacity	Not found	SCOPUS (49)
	Swelling capacity	Not found	SCOPUS (21)
	Degradation capacity	Not found	SCOPUS (37)
	Mechanical properties or improved elastic ones	Not found	SCOPUS (49)
	Good quality in storage and in transportation	Not found	Not found
	Cost reduction	USPTO (20)/ESPACENET (33)	SCOPUS (50)
	Easy handling	Not found	Not found

### 4.2 Aspects related to product

According to Table 3, in the long term, there is an increase in the interest of researchers in biodegradable natural polymers, relatively non-toxic to the environment. For instance, the articles reveal an interest in superabsorbent hydrogel based on natural polymers. Duquette and Dumont (2018) define superabsorbent hydrogels as polymeric materials known for their ability to absorb and retain a large amount of water or aqueous solution. Sannino and co-authors (2009) show that hydrogels are capable of absorbing and releasing aqueous solutions in a reversible manner, in response to specific stimuli in the environment.

Some hydrogels mentioned in the articles are based on alginate, cellulose, among others. Alginate, a polysaccharide (natural polymer) derived from seaweed,

was mentioned in some of these articles as a biodegradable material applied as a raw material for coatings and polymer matrix (NI et al, 2010). Cellulose, a natural polymer, was mentioned as an abundant material in nature because it is the largest constituent of plants and natural fiber, besides being biodegradable and having low cost (SANNINO et al, 2009). Some researchers have focused their research on biopolymers derived from starch, which is abundantly available from renewable plant sources (Niu and Li, 2012).

The survey reveals that the researchers aimed at applying polymers or combining them with other materials. Or, even, a combination of polymers with biomass and other materials. To be more specific, many authors have combined polymers with materials, such as silica, clay, zeolite, biomass etc.

Table.3: Product analysis.

Sections	Key parameters	Short term	Mid-term	Long term
Product	Biopolymers	USPTO (2)	ESPACENET (4)	SCOPUS (18)
	Polymers or resins	USPTO (24)/ ESPACENT (34)	USPTO (5)/ ESPACENET (4)	SCOPUS (8)
	Mixture of polymers and others	Not found	Not found	SCOPUS (20)
	Mixture of polymers, biomass and others	Not found	Not found	Not found
	Biomass	USPTO(9)/E SPACENET (4)	USPTO (12)/ ESPACENET (12)	Not found
	Mixture of biomass and others	Not found	Not found	Not found
	Sulfur	Not found	Not found	Not found
	Mixture of polymers and sulfur	USPTO(6)/E SPACENET (22)	Not found	Not found
	Mixture of sulfur and others	Not found	Not found	Not found
	Clays	USPTO(10)/ ESPACENE T (7)	ESPACENET (13)	SCOPUS (10)
	Silica			
	Zeolites			
	Varied materials			
	Single	USPTO (25)	ESPACENET (8)	SCOPUS (31)
	Combination	ESPACENE T (48)	USPTO (3)	Not found
Single	Not found	Not found	SCOPUS (7)	
Combination	USPTO (8)	USPTO(11)/SPA CENET (7)	Not found	

### 4.3 Aspects related to the technology

For technology analysis, it was regarded three taxonomies, they are: coating, matrix and polymeric matrix. Within coating category, are the coating fertilizers and the mixed-type ones. The last ones involve the use of a coating around the matrix holding the fertilizer; therefore, it is characterized by a combination of two types of physical barrier. The analysis in long term identified the number of layers the coating fertilizer has of raw material (resin and /or polymer) (Table 4). In the articles, it is reported that this fertilizer type has one or more layers of protection formed through the encapsulation or covering step of the fertilizer.

As well as reported in the search for patents and patent applications, the articles took to the understanding that the majority number of studies about coated fertilizers is based on encapsulation having a single layer. In the short and mid-term, patents and patent applications indicated that the predominant quantity of coating fertilizers are the ones encapsulated with a single layer. This is due to the increase in production costs when applying larger quantities of high-

value raw materials (in general, polymers) to obtain two or more layers. Coatings are obtained by immersion, emulsion, spraying, precipitation, etc.

Regarding the form of holding the fertilizer in the solid raw material (biomass, silica, clays, zeolites), in the case of the non-polymeric matrix type and mixed systems, the articles revealed the authors' preference for physical mixing/combining technique. In general, they reported physical mixing through granulation, melting, extrusion, among others. Some articles reported the use of binders or additives in this mixing stage. Regarding the polymeric matrix, all the cases found had used the mixing method as a preferred technique, such as, extrusion, emulsion and fusion and the raw material may be composed only of polymers (single or combination of two or more); combination of polymer and biomass; combination of polymer and others (for example, silica, clays and zeolites) and; still, combination of polymer, dry biomass and others. The predominant fertilizer used in all studies was urea.

Table.4: Technology analysis.

Sections	Key parameters	Short term	Mid-term	Long term	
Technology	Coating	1 layer	USPTO (32)	USPTO (3)/ ESPACENET (14)	SCOPUS (18)
		2 layers	Not found	Not found	Not found
		multiple layers	ESPACENET (40)	Not found	Not found
	Matrix	Impregnation		USPTO (12)	Not found
		Mixture/combination	ESPACENET (4)	ESPACENET (11)	SCOPUS (8)
	Polymeric matrix	Impregnation	Not found	Not found	Not found
Mixture/combination		Not found	Not found	SCOPUS (24)	

## IV. CONCLUSION

Roadmaps, mainly of medium and long term, showed a tendency towards slow or controlled release fertilizers, using mainly materials such as clays, silica, zeolite, biomass, biopolymers or combinations of these. Regarding the mixed materials, the documents showed that multiple layers form more efficient slow or controlled release fertilizers. In the matrices, the mixture of the supports with the fertilizers is more common than the impregnation of the fertilizers in the supports. Thus, research lines exploring different solid types and/or combination of them, besides the application of biopolymers in the synthesis of new SRF and CRF seem to be promising lines for a fertilizer development laboratory.

The market analysis points to the interest in products that are less aggressive to the environment, as well as products

with low cost. These two aspects, in addition to nutrient use efficiency (NUE), are the aspects most addressed in patents and scientific articles. Roadmapping technology, although widely used in the corporate sector, proved to be an interesting tool for prospecting ideas and strategic planning also in the area of Research and Development. It therefore becomes useful in gathering information to foster entrepreneurship at the academic level.

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## Nursing assistance in Congenital Syphilis: A bibliographic review

## Asistencia de Enfermería en Sífilis Congénita: Una revisión bibliográfica

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Received: 26 Oct 2020;

Received in revised form:

02 Jan 2021;

Accepted: 12 Jan 2021;

Available online: 17 Jan 2021

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**Keywords—** Women's health,  
Syphilis, Nursing care.

**Abstract—** Syphilis is a sexually transmitted infection caused by *Treponema pallidum* tracked by the VDRL non-treponema test and should be treated as early as possible. The objective of the research is to analyze the role of nurses in assisting patients with congenital syphilis. The methodology is a narrative review study with an exploratory, observational, retrospective study approached in 15 articles in the databases (PUBMED, LILACS, BVS, SciELO, REBEN) between 2010 and 2020. Results: Since pregnant and infected women if their sexual partners are diagnosed during prenatal care and treated in time, congenital syphilis can be prevented. About two-thirds of children living with congenital syphilis are asymptomatic. The diagnosis of these diseases is relatively easy and of low cost, therefore, it should not be an obstacle to promote the early diagnosis of these patients. It can be concluded: The nurse is the professional with prominence in the attendance of the basic health units, because the role is delegated and extremely important in the care and prevention of patients. It is up to the health secretaries to delegate training with nurses in the consultation and treatment of congenital syphilis. More attention should be paid to the role of screening during prenatal care, to carry out the treatment in a qualified manner.

**Resumo:** A sífilis é uma infecção sexualmente transmissível causada pelo *Treponema pallidum* rastreado pelo teste não treponema do VDRL e deve ser tratado mais precoce possível. O objetivo da pesquisa é analisar o papel do enfermeiro na assistência do paciente com sífilis congênita. A metodologia trata-se de um estudo de revisão narrativa com abordagem de estudos exploratórios, observacionais, retrospectivos pesquisados em 15 artigos nas bases (PUBMED, LILACS, BVS, SciELO, REBEN) entre 2010 a 2020. Resultados: Desde que as gestantes infectadas e seus parceiros sexuais sejam diagnosticados durante o pré-natal e tratados a tempo, a sífilis congênita pode ser prevenida. Cerca de dois terços das crianças vivas com sífilis congênita são assintomáticas. O diagnóstico dessas doenças é relativamente fácil e de baixo custo, portanto, não deve ser um obstáculo para promover o diagnóstico precoce desses pacientes. Conclui-se: O enfermeiro é o profissional com destaque dentro dos atendimentos das unidades básicas de saúde, pois, o papel é delegado e de extrema importância no cuidado e prevenção dos pacientes. Cabe as secretárias de saúde a delegação das capacitações



com os enfermeiros na consulta e tratamento da sífilis congênitas. Deve-se atentar mais ao papel de rastreamento durante o pré-natal, realizar o tratamento de forma qualificada.

**Palavras-chave - Saúde da Mulher, Sífilis, Cuidados de Enfermagem.**

**Resumen:** La sífilis es una infección de transmisión sexual causada por *Treponema pallidum* rastreada por la prueba VDRL sin *treponema* y debe tratarse lo antes posible. El objetivo de la investigación es analizar el papel de las enfermeras en la asistencia a los pacientes con sífilis congénita. La metodología es un estudio de revisión narrativa con un estudio exploratorio, observacional, retrospectivo abordado en 15 artículos en las bases de datos (PUBMED, LILACS, BVS, SciELO, REBEN) entre 2010 y 2020. Resultados: Desde mujeres embarazadas e infectadas si sus parejas sexuales son diagnosticadas durante la atención prenatal y tratadas a tiempo, se puede prevenir la sífilis congénita. Aproximadamente dos tercios de los niños que viven con sífilis congénita son asintomáticos. El diagnóstico de estas enfermedades es relativamente fácil y de bajo costo, por lo que no debe ser un obstáculo para promover el diagnóstico precoz de estos pacientes. Se puede concluir: El enfermero es el profesional con protagonismo en la atención de las unidades básicas de salud, porque el rol es delegado y de suma importancia en la atención y prevención de los pacientes. Corresponde a las secretarías de salud delegar la formación con enfermeras en la consulta y tratamiento de la sífilis congénita. Se debe prestar más atención al papel del cribado durante el cuidado prenatal, para realizar el tratamiento de manera calificada.

**Palabras-clave— Salud de la mujer, Sífilis, Cuidado de enfermera.**

## I. INTRODUCTION

In Brazil, the number of reported cases of syphilis in pregnancy is increasing every year. Worldwide, syphilis still affects many pregnant women (DOMINGUES & LEAL, 2016).

Syphilis is a systemic and sexually transmitted infection caused by infection by the Gram-negative bacteria *Treponema pallidum*. Despite the existence of effective and low-cost treatments, it is still a serious public health problem in Brazil. Considering that it is an easy pathology to treat and that other more complex infectious diseases have been controlled (CARVALHO & BRITO, 2014).

The congenital form of syphilis (or congenital syphilis, SC) occurs when *Treponema pallidum* is transmitted by the placenta (or vertically). According to reports, the transmission of CS occurs from an infected mother (untreated or undertreated), and transmission can occur at any stage of pregnancy or during childbirth (CAMPOS et al., 2012).

Estimates of the number of cases of congenital syphilis are even more inaccurate. In the absence of treatment, the rate of vertical transmission of syphilis is high, reaching a value close to 100% in the most recent form of the disease. However, timely diagnosis and treatment are very effective and vertical transmission can be reduced in up to 97% of cases (BLENCOWE et al., 2011).

Congenital syphilis is divided into two periods: early (until the second year of life) and late (appearing

after the second year of life). Most congenital syphilis is asymptomatic (about 70%), but newborns may have premature delivery, light weight, hepatomegaly, splenomegaly, skin lesions (pemphigus syphilis, flat acuminate condyloma, petechiae, purple, cracks around the cheeks), periostitis, osteochondrosis, pseudoparalysis of the limbs, difficulty breathing with or without pneumonia, serum rhinitis, jaundice, anemia, systemic lymphadenopathy, nephrotic syndrome, epilepsy and meningitis, thrombocytopenia, leukocyte decrease or leukopenia. In late congenital syphilis, clinical manifestations are rare and are caused by the cure of an early systemic disease, which can involve multiple organs (ANDRADE et al., 2018; MORAES, D'ALMEIDA & CONDE, 2019).

The legitimacy and relevance of the research, in addition to emphasizing the purpose of comprehensive evidence, which can assist nurses in making decisions about the effective implementation of the tool, promoting the adherence of health professionals and integrating it into practice. This study justifies the dysfunction, which leads to the lack of preventive habits to prevent infectious diseases, highlights the importance of guiding syphilis problems in adolescents, young people and pregnant women and warns that it is a sexually transmitted infection (STI) related to sexually transmitted diseases communicable diseases. And that when diagnosed, your treatment should be as early as possible.

The objective of the research is to analyze the role of nurses in assisting patients with congenital syphilis.

## II. MATERIALS AND METHODS

The present work is a narrative review of the literature carried out through a bibliographic review focused on describing the role of nurses in assisting patients with congenital syphilis.

The bibliographic research had the following question: What is the role of nurses in assisting patients with congenital syphilis? Articles that sought to explain the role of the nurse in assisting the patient with congenital syphilis from scientific articles in Portuguese, English and Spanish were selected. The translator available on the website <https://www.translate.google.com/> was used to translate the articles into another language.

The organization of this review took place between the months of June and December 2020, thus providing guidance for researchers in relation to the subject addressed, so that they can formulate hypotheses in an attempt to solve frequent problems related to the assistance provided in previous studies.

For data collection, the bases (PUBMED, LILACS, BVS, SciELO, REBEN) were used, searching for keywords such as: Women's Health; Syphilis; Nursing care. 15 scientific articles containing publications between the years 2010 and 2020 were analyzed, which dealt with the chosen theme.

## III. RESULTS AND DISCUSSION

The nurse is one of the most important primary care professionals. Your participation is not only essential for disease prevention, but also for the comfort provided to children and their families during treatment - this can be a factor in determining clinical outcomes. Nursing starts even before delivery, when the nurse must guide the pregnant woman about the characteristics of this phase to ensure safety and tranquility during pregnancy. Topics covered include methods to prevent sexually transmitted infections (SECAD, 2019).

As long as infected pregnant women and their sexual partners are diagnosed during prenatal care and treated in time, congenital syphilis can be prevented. It is worth mentioning that despite the increase in prenatal coverage, the effectiveness of the operation is still low and the average number of cases in the period proves preventive measures in Brazil (ARAÚJO et al., 2012; NONATO, MELO & GUIMARÃES, 2013).

It is suggested that the reduction of SC infection is related to the implementation of anti-syphilis policies. Obviously, examples of policies include an increase in the number of rapid tests that track cases and several itinerant operations aimed at fighting the disease to allow early

diagnosis and treatment (SILVA et al., 2019). Congenital syphilis can cause, miscarriage during pregnancy, fetal and neonatal death, premature birth and harm the health of newborns through psychological and social influences. It is estimated that 40% of pregnant women with untreated syphilis will develop fetal abortion (GASTALDI, FREITAS & MENDONÇA, 2016; SILVA et al., 2019).

Currently, the Ministry of Health proposes for professionals in the basic network to request at least two serological tests for syphilis. According to the determination of the performance of prenatal care in the public health system, in addition to the delivery examination, the non-treponemal examination (VDRL) should be performed in the first and third trimester of pregnancy (TAVARES et al., 2012).

About two-thirds of children living with congenital syphilis are asymptomatic. The diagnosis of these diseases is relatively easy and of low cost, therefore, it should not be an obstacle for nurses to promote the early diagnosis of these patients (GASTALDI, FREITAS & MENDONÇA, 2016).

You can see the incidence of syphilis from 2010 to 2019. During this period, the incidence of congenital syphilis reached 9.0 cases per thousand live births in 2018, increasing to 8 cases. There are 2 cases per 1,000 live births in 2019. The rate of syphilis detection in pregnant women reached 21.5 cases per 1000 live births in 2018 and dropped to 20.8 cases per 1000 live births in 2019. Although there was a drop in cases of syphilis in almost the whole country, it is important to highlight that part of this fall may be related to the identification of data transfer problems between SUS management areas, which can lead to SUS, municipal, state and federal syphilis databases (BRASIL, 2020).

Between 2007 and 2016, the city of Cacoal-RO reported 20 cases of congenital syphilis. Among the reported cases, the incidence was higher in 2007, 2015 and 2016, and the year of 2016 (MAEDA et al., 2016). Symptoms may appear soon after birth, in the first two years after the child's birth, or afterwards. The largest appear in the first two stages of the disease, when it is most contagious. Symptoms may or may not appear in the third stage, giving the wrong impression of a cure (BRASIL, 2019).

Prenatal care is the responsibility of the nurse at the basic health unit, and when pregnant women test positive for syphilis, it is up to them to start treatment with benzathine penicillin as soon as possible as recommended by the Ministry of Health. Sexual partners should also be tested and treated to prevent pregnant women from being infected again. Adequate treatment is for pregnant women,

benzathine penicillin is administered, treatment is started 30 days before delivery and the treatment plan is formulated according to the clinical stage of syphilis and the recommended interval between two to three doses is respected (OLIVEIRA, 2011 ; BRASIL et al., 2019).

The nurse must pay attention to treatment with any medication other than penicillin; incomplete treatment; less time than recommended; error due to insufficient clinical stage of the disease; performed within 30 days before birth; without previous treatment documents; after the correct treatment, the titer does not decrease; untreated partner, inappropriate treatment or no information (BRASIL, 2016).

All confirmed or suspected NB infections must be treated and monitored properly. Crystalline penicillin is the drug of choice and 50,000 IU / kg / dose should be taken, 12/12 in the 1st week; and 8 / 8h, after 7 days. If normal cerebrospinal fluid is checked, procaine penicillin can be used 50,000 IU / kg / dose, single daily dose, 10 days. As this medication has a low permeability to cerebrospinal fluid, benzathine penicillin is used in cases where the infection is unlikely at a dose of 50,000UI / kg / day, single dose (FEITOSA, ROCHA & COSTA, 2016; EBSERH, 2019).

If treatment is interrupted for more than 24 hours, treatment must be restarted. After starting penicillin treatment, standard exposure precautions for up to 24 hours should be developed for all cases of congenital syphilis. It is up to the nurse to carry out the monitoring of every newborn with a mother with syphilis must be followed for at least two years. The non-treponeme test (VDRL) should be performed at 1, 3, 6, 12 and 18 months of age until two consecutive negative results occur at least 30 days apart (FEITOSA, ROCHA & COSTA, 2016; SBP, 2016).

The role of nurses in the development of strategies for the prevention of congenital syphilis is extremely important, including guidance on condom use, reduction in the number of sexual partners, nursing consultations with help and guidance, early diagnosis, treatment of patients and search for preventive measures to reduce the rates. Drug users and other preventive measures to improve quality of life. Pregnant and congenital women with syphilis must be notified for epidemiological surveillance, and the form must be completed and sent to the epidemiological surveillance service. This warning is very important to control the case (RAMPAZIO, SOUZA & CARVALHO, 2019).

#### IV. CONCLUSION

The nurse is and always will be a professional with prominence in the attendance of basic health units, because the role that is delegated to him and of extreme importance in the care and prevention of patients. It is up to the health secretaries to delegate training to nurses working in the consultation and treatment of congenital syphilis.

Carry out, in partnership with the local population, orientation campaigns regarding the disease, and seek to resolve all doubts and curiosity, providing guidance on the use of condoms and seeking care in case of presenting any symptoms.

The nurse must pay more attention to the role of screening during prenatal care, carry out the treatment in a qualified and correct way both from the partner to avoid recontamination and from the pregnant woman to avoid aggravating the case.

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## Clinical and epidemiological profile of patients undergoing treatment for cervical CA at the Oncology and Hematology Center of Cacoal-RO

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Received: 03 Nov 2020;

Received in revised form:

03 Jan 2021;

Accepted: 08 Jan 2021;

Available online: 17 Jan 2021

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**Keywords—** Cervical cancer.  
Prevention. Clinical and  
epidemiological profile.

**Abstract—** Cancer is the name given to a set of more than 100 diseases that have in common the disorderly growth of cells that invade tissues and organs, and can spread (metastasize) to other regions of the body. Cancer of the cervix is caused by persistent infection by some types of Human Papillomavirus - HPV (called oncogenic). With approximately 530,000 new cases per year worldwide, cervical cancer is the fourth most common cancer among women, with the exception of non-melanoma skin cases. Describe the epidemiological profile of patients affected by cervical cancer undergoing treatment at a Cacoal oncology center, identifying the related risk factors. It was a field research, carried out in a descriptive and analytical manner, of a quantitative nature. The research was conducted with patients undergoing treatment for cervical CA at the Oncology and Hematology Center of Cacoal-RO. Participated in the research 5 patients diagnosed with cervical cancer, attended from 18 to 22 February 2019. The age of onset of early sexual activity was notable in this research where it was observed that all participants said they had had sex between 10 and 18 years old and also that 80% of the interviewees reported having had three or more sexual partners during their lifetime. The results indicate that women are exposed to several risks for the development of cervical cancer, such as: multiple sexual partners, premature intercourse, history of (STIs), multiparity and smoking, with sexual transmission by HPV being the main cause of cancer in women in developing countries. It was found that permanent health education, expansion of screening programs, greater commitment to primary prevention for an early diagnosis and rapid treatment are the strategies chosen to face the disease.

**Resumo:** Câncer é o nome dado a um conjunto de mais de 100 doenças que têm em comum o crescimento desordenado de células que invadem os tecidos e órgãos, podendo espalhar-se (metástase) para outras regiões do corpo. O câncer do colo do útero, é causado pela infecção persistente por alguns tipos do Papilomavírus Humano - HPV (chamados oncogênicos). Com aproximadamente 530 mil casos novos por ano no mundo, o câncer do colo do útero é o quarto tipo de câncer mais comum entre as mulheres, excetuando-se os casos de pele não melanoma. Descrever o perfil epidemiológico das pacientes acometidas pelo câncer de colo de útero que fazem tratamento em um centro de oncologia de Cacoal, identificando os fatores de riscos relacionados. Tratou-se de uma pesquisa de campo, realizada de forma descritiva e analítica, de cunho quantitativo. A pesquisa foi realizada com pacientes que realizam tratamento para CA do colo uterino no Centro de Oncologia e Hematologia de Cacoal-RO. Participaram da pesquisa 5 pacientes diagnosticadas com câncer de colo uterino, atendidas no período de 18 à 22 de fevereiro de 2019. A idade de início da atividade sexual precoce foi notável nesta pesquisa onde se observou que todas as participantes afirmaram terem tido a sexarca entre 10 e 18 anos e também que 80% das entrevistadas relataram ter tido três ou mais parceiros sexuais durante a vida. Os resultados indicam que as mulheres estão expostas a vários riscos para o desenvolvimento do câncer de colo uterino, tais como: múltiplos parceiros sexuais, prematuridade da coitarca, histórico de (ISTs), multiparidade e tabagismo, sendo a transmissão sexual pelo HPV a principal causa de câncer em mulheres de países em desenvolvimento. Constatou-se que uma educação em saúde permanente, ampliação dos programas de rastreamento, maior empenho na prevenção primária para um diagnóstico precoce e rápido tratamento são as estratégias eleitas no enfrentamento da doença.

**Palavras-chaves—** Câncer do colo de uterino. Prevenção. Perfil clínico e epidemiológico.

**Resume:** Cáncer es el nombre que se le da a un conjunto de más de 100 enfermedades que tienen en común el crecimiento desordenado de células que invaden tejidos y órganos y pueden diseminarse (hacer metástasis) a otras regiones del cuerpo. El cáncer de cuello uterino es causado por una infección persistente por algunos tipos de virus del papiloma humano - VPH (llamado oncogénico). Con aproximadamente 530.000 casos nuevos por año en todo el mundo, el cáncer de cuello uterino es el cuarto cáncer más común entre las mujeres, con la excepción de los casos de piel no melanoma. Describir el perfil epidemiológico de las pacientes afectadas por cáncer de cuello uterino en tratamiento en un centro de oncología Cacoal, identificando los factores de riesgo relacionados. Fue una investigación de campo, realizada de manera descriptiva y analítica, de carácter cuantitativo. La investigación se realizó con pacientes sometidas a tratamiento por AC cervical en el Centro de Oncología y Hematología de Cacoal-RO. Participaron en la investigación 5 pacientes diagnosticadas con cáncer de cuello uterino, atendidas del 18 al 22 de febrero de 2019. La edad de inicio de la actividad sexual precoz fue notable en esta investigación donde se observó que todas las participantes dijeron haber tenido relaciones sexuales entre los 10 años. y 18 años y también que el 80% de los entrevistados refirió haber tenido tres o más parejas sexuales durante su vida. Los resultados indican que las mujeres están expuestas a varios riesgos para el desarrollo de cáncer de cuello uterino, como: múltiples parejas sexuales, relaciones sexuales prematuras, antecedentes de (ITS), multiparidad y tabaquismo, siendo la transmisión sexual por VPH la principal causa de cáncer en mujeres en países en desarrollo. Se encontró que la educación permanente en salud, la ampliación de los programas de cribado, un mayor compromiso con la prevención primaria para un diagnóstico temprano y un tratamiento rápido son las estrategias elegidas para enfrentar la enfermedad.

**Palabras-claves—** Palabras clave: cáncer de cuello uterino. Prevención. Perfil clínico y epidemiológico.

## I. INTRODUCTION

Cancer is the name given to a group of more than 100 diseases that have in common the disordered (malignant) growth of cells that invade the tissues and organs, and can spread (metastasize) to other regions of the body. Dividing rapidly, these cells tend to be very aggressive and uncontrollable, determining the formation of tumors (accumulation of cancer cells) or malignant neoplasms. On the other hand, a benign tumor simply means a localized

mass of cells that multiply slowly and resemble their original tissue, rarely constituting a risk to life (BRASIL, 2018).

World Health Organization data released indicate that 8.8 million people die of cancer each year (WHO, 2017). An estimate from the National Cancer Institute (2015) points to an increase in the occurrence of about 600 thousand new cases of cancer in Brazil in 2016 and 2017. Percentually speaking, in addition to prostate tumors

(28.6%), the most common types of cancer tumors in men lung (8.7%), intestine (8.1%), stomach (6.3%) and oral cavity (5.2%). However, in women the main ones are cancers of the breast (29.5%), intestine (9.4%), cervix (8.1%), lung (6.2%) and thyroid (4.0 %) will be among the main ones (BRASIL, 2018).

Cancer of the cervix is caused by persistent infection by some types of Human Papillomavirus - HPV (called oncogenic). Genital infection with this virus is very common and does not cause disease most of the time. However, in some cases, cellular changes may occur that may progress to cancer. These cell changes are easily discovered through the preventive exam (Pap smear), and are curable in almost all cases (BRASIL, 2018).

According to the 2013 Ministry of Health Protocol, the first two exams must be performed at an annual interval and, if both results are negative, the next should be performed every 3 years. The beginning of the collection must be at 25 years of age for women who already have sexual intercourse or active sexual life, following up to 64 years of age for women who have no previous history of the disease (BRASIL, 2013).

More than 90% of women who have cervical cancer have been exposed to HPV. With approximately 530,000 new cases per year worldwide, cervical cancer is the fourth most common cancer among women, with the exception of non-melanoma skin cases. It is responsible for 265 thousand deaths per year, being the fourth most frequent cause of cancer death in women (BRASIL, 2018).

Subclinical and asymptomatic forms are manifestations that cannot be seen with the naked eye, and may affect the same sites as the clinical manifestation, however, not generating any signs or symptoms. The cervix is the place of greatest concern because of the close association with cancer there. Initial lesions, which reflect only the presence of the virus in the cervix, are called low-grade intraepithelial lesions / grade I neoplasia (CIN I); more advanced lesions and cancer precursors, in this place, are considered of high degree - NIC III (PINHEIRO et al., 2013).

Marana et. al., (2009) claim that due to its high prevalence, mainly in subclinical and asymptomatic forms, and its high effectiveness, the spread of HPV cases tend to be universal among sexually active individuals. Allied to these factors, the high rates of recurrence, confusing and making treatment difficult, and the marked association between verrucous lesions and cervical carcinoma (CA) have further increased the concern and interest in the evaluation of women infected by the virus.

The diagnosis of HPV is usually performed through clinical examination (Inspection). The wart has a raised,

papillomatous surface, or a curly surface. Initially, the lesions are small (1 to 5 mm in diameter), but they can progress to larger, pedunculated lesions and, eventually, take the shape of cauliflower, particularly in immunocompromised patients. In addition to the vulva, the perineal body and the anogenital region, these lesions can also grow in the canal of the anus, on the walls of the vagina and on the cervix (CALLAHAN and CAUGHEY, 2010).

This article aimed to describe the clinical and epidemiological profile of patients affected by cervical cancer undergoing treatment at a Cacoal Oncology Center, identifying the risk factors related to the onset of cervical cancer, identifying the socioeconomic profile and checking the past routine of Pap smear of these patients.

Given the above, as it is a high-rate infection with serious consequences, it is important to know more deeply about the pathology, as well as to identify the clinical and epidemiological profile of women affected by cervical cancer, so that both managers and professionals in the area can plan, implement and / or implement preventive actions in an attempt to reduce the impact on the health of the general population.

## II. MATERIALS AND METHOD

It was a field research, carried out in a descriptive and analytical way, of a quantitative nature. The research was carried out at the Oncology Center of the municipality of Cacoal-RO, which is located 476 km from Porto Velho, capital of the state. It has an estimated population of 88,507 inhabitants (IBGE, 2017).

The population meeting the criteria to participate in data collection was a total of 05 women. Using an interview form developed by the researchers themselves containing 31 objective questions and one open question.

As inclusion criteria, it was established to evidence patients with a diagnosis of cervical cancer and to be under treatment, agreeing with the research and signing the Informed Consent Form (ICF), patients who are being treated for cervical cancer. uterus in outpatient follow-up and hospitalization and also patients aged 18 years and above. Patients discharged due to cure and patients who did not attend treatment during the proposed period of research were excluded from the research.

Data collection was carried out in February 2019, during two visits to the hospital unit. Initially, a search was made in the hospital admission book and records of the treatment outpatient clinic to identify patients who would be present at the time, during the collection variables were raised regarding age, race, marital status, monthly income,

paid activity, education, religion, place of birth, place of residence and origin, profession, age at which sexual activity started, number of sexual partners, use of condoms, if you have had any STIs, if you use contraception, age of first pregnancy, number of children, smoking history, if you have knowledge about HPV, if you have already had a preventive exam, when the exam was performed, how long ago you were diagnosed with cervical cancer, age at diagnosis, assessment of risk factors, history of cervical cancer in the family, if he had any chronic pathology, what type of treatment he was undergoing, presence symptoms before and after the treatment session, duration of treatment, and finally, he was asked to describe his feelings about the disease and the treatment.

After data collection, the information obtained was tabulated in an Excel® 2016 spreadsheet, presented in tables and graphs, and a database was built. Subsequently, this information was distributed according to the objectives of each stage of the research, such as Describing the clinical and epidemiological profile of patients affected by Cervical Cancer undergoing treatment at a Cacoal Oncology Center. Identify the presence of risk factors related to the appearance of cervical cancer and Identify the socioeconomic profile of patients undergoing treatment for uterine cancer;

In order to carry out the research in accordance with Resolution 466/12 of the National Health Council, it was necessary to approve the Ethics and Research Committee (CEP) of the Faculty of Biomedical Sciences of Cacoal-UNIFACIMED, under protocol number: 3.066.608 and signature of the consent form.

### III. RESULTS AND DISCUSSION

Participated in the research 5 patients diagnosed with cervical cancer, attended at the Oncology and Hematology Center of Cacoal, Rondônia. It was analyzed on religious issues, questioning whether or not you practice any religion, and what is the religion. According to table 1.

Table 01: Sociodemographic data in patients undergoing treatment for cervical cancer at an Oncology Center in Cacoal / RO

Variable	answer	Percent
Age range	20 to 29 years	20%
	30 to 39 years	20%
	40 to 49 years	20%
	50 to 59 years	40%

Ethnicity	White	40%
	Parda	40%
	Black	20%
Marital status	Married	100%
Per capita income (in minimum wages - SM)	De 1 a 1½	20%
	De 1½ a 2	40%
	De 2 a 3	20%
	More than 3	20%
Education	Illiterate	20%
	Incomplete Elementary School	20%
	Complete high school	40%
	Post graduate	20%

Source: BATISTA, MILITÃO and FERREIRA, 2019.

As shown in Table 1, in relation to the socio-demographic data found in the survey, the average age of 40-year-old cancer patients, ranging from 20 to 59 years, was observed. The dominant age group was 49 to 50 years old. Some studies also claim that this is the age group with the highest prevalence of this pathology. As an example, we quote Soares et. al (2010) who in his study describes the predominance of women aged 45 to 55 years. For Rodrigues and Ferreira (2010) the highest prevalence of cervical AC in women is in the 55 to 64 age group. They also corroborate the studies by Carvalho and Queiroz (2011) who claim that there is a predominance of women in the age group of 46 to 55 years.

Regarding ethnicity, the different characteristics were observed, such as the variation in the intensity of melanin in the skin, and the state of RO is mixed. The available data originated from surveys of races such as: white, mixed race and black, but the predominance in this research was white and mixed race, with 40%. Of those surveyed, 100% reported being married. In a survey carried out in the city of Rio Grande, in the south of Brazil, it was found that women without a steady partner have higher prevalences in relation to the non-performance of the preventive exam of cancer (Fonseca et al., 2010).

Per capita income also showed variability, concentrating between 01 and 03 minimum wages and 60% of the participants worked in formal salaried jobs



when the cancer was diagnosed. In the research by Fonseca et al. (2010), 47.6% of the participants performed professional activities with formal jobs until the moment of illness. Gomes et al. (2017) explain that the relationship between income and the prevalence of cervical AC occurs due to the fact that women with low income are more vulnerable to contracting sexually transmitted infections, since they have less access to health services to perform the exam and they are still the ones that generally face greater financial difficulties to follow up on treatments.

This research did not find a relationship between education and the prevalence of cervical AC, as the participants have a very diverse education. Since 20% are illiterate, 20% have incomplete basic education, 40% said they have completed high school and the other 20% even attended a postgraduate course. In other studies such as Thuler, Bergmann and Casado (2012) and Prado et al. (2016) could not establish the relationship between schooling and prevalence of uterine CA, as, as in the present study, in both of them, varied schooling was observed. However, there are reports of an inverse relationship between education and prevalence of cervical AC. The authors who affirm this nexus, explain that low education contributes to non-adherence to the treatment of precursor lesions and, consequently, to the increased incidence of uterine cancer (CARVALHO & QUEIROZ, 2011; FONSECA ET. AL, 2010). Conversely, Cavalcante et al. (2014) states that, among the sociodemographic aspects, schooling revealed to be the variable with the highest risk for women to be affected by cervical cancer. The authors found a predominance of cases in women with no to three years of schooling (84.17%) while in women with more than eight years of schooling there was a low incidence (14.83%) (BASTOS, 2007).

Regarding religious practice, the present study found that this factor does not interfere in the performance of the cervical cancer preventive exam, demonstrating that, unlike others, the religion factor does not constitute an obstacle in the performance of the exam. Among the literature that analyzed this relationship, there was a positive combination between practicing some religion and taking preventive measures (INCA, 2018).

When asked about the age of onset of sexual activity, the responses were notable, and it was observed that all participants said they had had sex between 10 and 18 years of age. Among those involved in the study by Prado et al. (2016) sexarche occurred before the age of 14 in 30.5%, while in 50.8% it occurred between 15 and 17 years. The sexarche has occurred more and more precociously. In Brazil, the average age of first sexual intercourse is 14 years for males and 15 for females (HUGO, et al., 2011). According to Ramos (2014), socioeconomic status and

education are the main factors associated with early sexual activity.

It should also be noted that 80% of the interviewees reported having had three or more sexual partners during their lifetime. In an investigation by Fonseca et. al (2010) in Roraima on the 330 patients with cervical cancer, the average was 4.2 of sexual partners during their lifetime. Soares et. al (2010) ensures that the greater the number of sexual partners throughout life, the greater the chances of developing cervical AC, since there is a greater exposure to HPV and other sexually transmitted infections.

Regarding the use of condoms, it can be seen that 60% said they never used it, 40% sometimes, and none of the participants answered that they always use it. Souza and Costa (2015) warn that the main risk reduction behavior for cervical CA is the use of female and male condoms in all sexual relations, as these decrease the risk of HPV contamination by more than 80%. And when faced with the presence of any STI, 100% denied it.

About the contraceptive method used by the participants, the research showed that 60% take hormones orally, also known as birth control pills, 20% have undergone uterine tube ligation surgery, also called tubal ligation and 20% do not use any type of contraceptive method. It is worth noting that the prolonged use of birth control pills has been associated as a risk factor for the development of cervical CA (MASCARELLO et al. 2012). Rafael and Moura (2012) explain that although there is no consensus on the consequences of using oral contraceptives in relation to the genesis of cervical cancer, some studies point out that hormonal contraception can lead to an increase in HPV infections.

Subsequently, through the analysis of the questionnaires, the number of children was assessed and then demonstrated that 60% said they had 3 children. The average fertility rate found among the interviewees was 2 children. According to the study by Prado et al. (2016), the majority of women affected by cervical CA have three or more children. Carvalho and Queiroz (2011) highlight the possibility that high-grade injuries are more frequent in women who have had one to three deliveries, and infiltrating carcinoma, in those who have had between four and six deliveries, highlighting the importance of the association between discharge parity and increased risk of developing cervical cancer. The authors also clarify that contemporary women increasingly seek to have fewer children. The fertility rate has been declining, which is also associated with socioeconomic factors in the Brazilian population (Rafael and Moura, 2012).

Smoking is one of the biggest risk factors to be considered regarding the incidence of cervical AC. The

study found a smoking history in 60% of the interviewees, with 40% ex-smokers and 20% passive smokers. Teles, Muniz and Ferrari (2013), observed that 48% of a total of 65 women with cervical changes were smokers. The authors point out that the number of smokers, among females, has increased worldwide, influenced by numerous economic and socio-cultural factors, especially in developing countries, making tobacco one of the major causes of this type of tumor.

When asked about knowledge about HPV, 80% of patients reported having information about this pathology. This information is antagonistic to the results generally found in analogous studies, which generally show a great lack of knowledge about the disease. This is what Morato et al. (2013) when analyzing 15 articles on the topic. The results of the present study are also in contrast to those described in studies by Fonseca et. al (2010) where 83.3% of patients reported total ignorance of HPV.

A survey by Costa and Goldenberg (2013) carried out with young people and adolescents in the state of São Paulo also revealed high levels of ignorance about HPV. The authors describe that although the majority of the interviewees have already heard about HPV, there is limited knowledge about specific issues related to transmission, the development of associated diseases and, correspondingly, the forms of prevention.

As can be seen in table 02, there was a predominance of the group of women who underwent the last preventive exam more than 01 year ago. Regarding the time of diagnosis, it was identified between those who were diagnosed less than 3 months ago and those who received the diagnosis more than a year ago. With regard to the age that the patients had when receiving the diagnosis, those aged between 40 and 59 years stand out.

Table 02: History of patients undergoing treatment for cervical cancer at an Oncology Center in Cacoal / RO

Variable	answer	Percent
Last time preventive	Less than 03 months	20%
	From 03 to 06 months	20%
	More than 01 year	40%
	Never did	20%
Diagnosed how long	Less than 03 months	40%
	From 03 to 06 months	20%
	More than 01 year	40%

Age of diagnosis	From 20 to 29 years	20%
	From 30 to 39 years	20%
	40 to 49 years	40%
	50 to 59 years	20%
Risk factors	Did not do preventive	60%
	Smoking	40%
Family History of Cancer	Yes	20%
	Not	80%
Treatment Type	Chemo + Radiotherapy	100%
	Brachytherapy	80%
	Surgery	40%
Symptoms before treatment	Pelvic pains	40%
	Bleeding	60%
	Discharge	
Symptoms during treatment	Pelvic pains	
	Weight loss	
	Other symptoms	
Treatment time	Less than 03 months	
	More than 01 year	

Source: BATISTA, MILITÃO and FERREIRA, 2019

According to family history, 80% answered that they did not have family members with such pathology. Regarding the proposed treatment, chemotherapy stood out with 100%, followed by brachytherapy and surgery. Before the treatment, the symptoms were concentrated in hemorrhages and discharge, and afterwards, the weight loss and pelvic pain that remained were highlighted. In the pursuit of the treatment, the time until the moment of the research, had been of 60% for those with more than 03 months.

#### IV. CONCLUSION

This research allowed us to observe that cervical cancer can be diagnosed early through a simple

examination such as the Pap smear, in sexually active women, predominantly between 25 and 59 years of age and easily available in the UBS. It is also understood that screening for cervical cancer must be performed periodically, maintaining high coverage to reduce incidence and mortality.

It proved to be important to know the reasons previously discussed and, since then, that Primary Health Care is defined as a primary component for the promotion and prevention of health, working on actions related to the theme, thus aiming at the possibility of increasing the number of women who regularly carry out preventive collection, and also actively search for missing patients. In fact, cervical cancer is known for its high mortality rate, but it is totally preventable, since there are several actions for its control, such as the technologies that detect in the initial stage and treatment for HPV injuries, enabling cure if diagnosed early.

Based on what was proposed in the objectives of this article, it was shown that the risk factors for the development of this type of cancer are related to the appearance of cervical cancer. Such as multiple sexual partners, prematurity of sexarche, multiparity and smoking, with sexual transmission by HPV being the main cause of cancer in women in developing countries.

According to the true hypothesis, which says "The risk factors with the highest prevalence among patients affected by uterine cancer and who are undergoing treatment at the Oncology and Hematology Center of Cacoal-RO differ from those found in other studies conducted in Brazil", was confirmed through education data, risk factors and knowledge about HPV.

It is believed that studies of this nature can provide more specific and targeted data about the clinical and epidemiological reality, which can support the development of strategies for the prevention of cervical cancer. Epidemiological research reports that in different demographic regions, records are an important source for studies, highlighting risk factors and injuries. Maintaining permanent surveillance of the entire population, especially those at risk, and the control of this type of cancer.

Considering the results obtained in the research, it is evident the importance of new studies on the theme addressed, as well as a greater involvement of health and government agencies, in order to reduce the number of cases of cervical cancer. Permanent health education, expansion of screening programs, greater commitment to primary prevention, early diagnosis and rapid treatment are the strategies chosen to face the disease. Women should be encouraged to know and prevent risk factors. Prevention is

also important among younger women who start sex earlier and earlier.

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# Risk Management, Hedge Disclosure Quality and Market Performance in B3's Novo Mercado Companies

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Received: 09 Nov 2020;

Received in revised form:

04 Jan 2021;

Accepted: 11 Jan 2021;

Available online: 19 Jan 2021

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**Keywords**— Risk Management, B3's Novo  
Mercado Companies, financial protection.

**Abstract**— The agency conflict is present in several aspects of management, risk management is inserted in this context because it requires agency costs related to the monitoring and control of the agent by the principal, the use of financial protection instruments, such as hedge accounting. Given its ability to preserve operations from a financial perspective, making it relevant to any business activity. In this context, the study aims to assess the relationship between risk management, disclosure of hedge financial instruments and market performance, in companies listed in the new market of [B] 3 - Brazil, Bolsa and Balcão. Thus, we conducted a documentary research in the period from 2017 to 2019. We analyzed 54 Brazilian companies classified on the Novo Mercado. The results suggest that risk management has a positive effect on the practice of hedge disclosure, however, contrary to expectations; this not repeat in the risk management relationship and the quality of accounting disclosure on organizational performance - market value. This study contributes to managers, regulators, auditors and consultants in the importance of assessing the risk management policies maintained by the company and its effect on the practice of hedge accounting.

## I. INTRODUCTION

In the 19th century, there was the advent of a change in the ownership structure of companies to a business organization model estimated by capitalism (Medeiros & Silveira, 2017). The IPO, with distance between the owner (principal) and the manager (agent), resulted in the transition from individual to shared ownership and a new organizational model. Berle and Means (1932) are instrumental in the study of conflicts of interest resulting from this separation, with the propensity of the manager to act in his own interest to the detriment of the interests of the shareholders (Saito & Silveira, 2008).

As a formal control mechanism, corporate governance is a set of control practices and incentives designed to reduce the costs arising from the agency conflict (John &

Senbet, 1998; Child & Rodrigues, 2003; Silveira, 2004). The aforementioned practices also have their role in substantiating and managing risks to enhance the performance of organizations that, according to Borman and Motowidlo (1993), represent actions or behaviors relevant to business objectives. Among these actions, the disclosure of risk management and financial hedge instruments, allows for a reduction in the asymmetry of relevant information between the company and its stakeholders.

Santos and Coelho (2018), when analyzing the informational relevance attributed to the disclosure of information about risk factors associated with the firm and the report about the existence of risk management, concluded that the disclosure of risks affects the perception of investors. As the risks are present in practically all

sectors and business operations, their management is a method of preventing losses (Dal Magro, Filipin & Fernandes, 2015).

The adoption of hedge accounting and its disclosure, exposes in a more appropriate, transparent manner, the risks that organizations run and the management policy of the entity, both contributing to a lower volatility of results, favoring more assertive decision making by managers on projections and the derivatives used (Galdi, Barreto & Flores, 2018). The disclosure of accounting information to the market in turn affects investors' perception of risks, also influencing them in their decision-making process (Cruz & Lima, 2010).

Studies such as those by Fernandes, Silva and Santos (2008) aimed to raise the risk disclosure practices adopted in the Annual information of companies listed on the BOVESPA Novo Mercado. The study by Fernandes, Souza and Faria (2010), on the other hand, investigated whether, Brazilian companies participating in BOVESPA's Novo Mercado, satisfactorily demonstrate the risks when launching securities offers in the capital market. The research by Dal Magro et al. (2015), in turn, proposed to identify the risks disclosed and analyze the content of disclosure of risk management in highway concessionaires listed on BOVESPA based on the COSO (Committee of Sponsoring Organizations) methodology of the Treadway Commission). Saprà (2002) aimed to investigate the consequences of hedge disclosures on a company's risk management strategy.

Thus, this study aims to contribute to the expansion of the literature on the topic of risk management and hedge instruments. Thus, the research objective was elaborated, which consists of evaluating the relationship between Risk Management, disclosure of financial hedge instruments and market performance (Market to book) by companies listed in the new market of [B]3. The guiding question of the study, therefore, is: What is the relationship between risk management, the quality of disclosure of hedge financial instruments and market performance in companies listed on B3's Novo Mercado?

We believe that the survey results are important for companies in assessing one of the effects to be related to risk management practices; for shareholders in order to certify effectiveness and implications in relation to agency costs and, finally, for the market when assessing whether the companies analyzed are actually adopting methods consistent with good corporate governance and transparency practices.

## II. THEORETICAL BACKGROUND AND RESEARCH HYPOTHESIS

In the modern company, the separation of ownership from control, now dispersed, is related to the general problem of agency (Jensen & Meckling, 1976). The divergence of interests between the interested parties generates agency costs, implying a reduction of the principal's interest because of the agent's action. Second, Jensen and Meckling (1976) costs are divided into monitoring, bonding and residual losses.

Among the difference in interest between the principal and the agent is the risk aversion problem. The shareholder, given the possibility of diversifying his investments, may not be against exposure to risks in a particular company, since the diversification itself already tends to protect them from an unexpected result. On the other hand, the agent tends to minimize his own risks (loss of employment, decrease in his prestige in the market) instead of taking risks in the quest to maximize the company's value. However, the theory of the Agency demonstrates the importance of a balanced relationship and agreement between the principal and the agent with the common direction of their interests and objectives (Cardoso, Mário & Aquino, 2007).

As a control and management practice aiming to reduce the costs arising from the agency conflict, risk management is gaining importance in the business environment. One finding is the relevance given to market risk management, which, from just one element of investment portfolio management, makes it a primary tool in cash flow management. Thus, any company in which its activities are subject to price variations, especially those that operate in activities that have the possibility of using financial instruments for protection, such as hedge (Fernandes et al., 2008).

The expectation about risk management is that it will be able to identify and reduce elements that may enhance possible negative effects on the equity of firms (Santos & Coelho, 2018). When companies present their report to the market, support their stakeholder investment decisions, enhancing business success opportunities (Solomon, Solomon, Norton, & Joseph, 2000). The study by Mapurunga (2011) concludes as one of the results of his research, that Profit is positively associated with the disclosure of information dealing with derivative financial instruments.

However, studies such as Fernandes et al. (2008) and Fernandes et al. (2010) concluded, respectively, when analyzing companies from Bovespa's Novo Mercado (B3) that organizations have relatively low levels of disclosure about risk management. In both studies, the authors

evidence the need to improve the quality of information for investors. The research by Dal Magro et al. (2015), when studying the disclosure of risks in the highway concessionaires listed on the Bovespa, found that the risks when disclosed by the observed companies, followed a certain homogeneity related to disclosure and also to the content of what was disclosed for them. In this way, we elaborated the first research hypothesis:

H1: There is a relationship between risk management and market performance in companies listed in the new B3 market.

With the frequent changes in the market because of financial crises caused by the lack of adequate management of financial instruments, hedge accounting and used for disclosure and control of these operations. When practicing hedging in Brazil, companies must present in the notes and financial statements the instrument used, the object of the operation and its effectiveness.

The term hedge relates to protection and resides in the structuring and contracting of financial instruments or in the alignment of commercial operations, safeguarding companies and investors from possible risk of losses related to changes in foreign currency values. For Silva (2003), the result for a given period is not affected by these factors, but results from operational causes. Hedge relationships are of three types: fair value hedge, cash flow hedge and net investment hedge in operation abroad and with its accounting it would be possible to reduce the instability of the accounting results of a business.

The companies that adhere to the “Novo Mercado”, according to B3 - Brasil, Bolsa, Balcão (2017), are the most transparent and with the highest degree of corporate governance and additional disclosure in relation to what is required by the regulator. To compose it, companies undertake to follow a set of rules that protect the minority investor through a contract and bylaws reform (Dubeux, 2001). Such rules ensure greater security for shareholders and positively influence the valuation and liquidity of shares in the market. The aforementioned arguments support the choice for this segment as a sample of our research.

Toigo, Brizolla and Fernandes (2015) demonstrate that organizations that used accounting disclosure practices to expose development in risk management had the characteristics of being large, with a large shareholder concentration and with the capital structure made up of foreign investors. They also found that the companies did not have superior results (ROA - Return on Assets) for carrying out hedge accounting and also that a high indebtedness index, low current liquidity, presence of institutional investors and a greater number of external

members on the board of management are factors that add little to the adoption of hedge accounting.

The study by Sousa (2014), which aimed to investigate whether, after companies joined the differentiated segments of corporate governance at BM & FBOVESPA, such as Novo Mercado, they obtained considerable changes in their market values, concluded that this change did not result in significant impacts. Even so, the author believes that the implementation of governance practices contributes to the improvement of a better business structure and to a higher dynamic of its activities, which, eventually, will allow the increase of organizational efficiency and the reduction of risks, resulting in a better assessment of companies by investors and the market. Fernandes, Dias and Cunha (2010) also found that, statistically, after adhering to BM & FBOVESPA's corporate governance levels, the companies in the sample had no changes in market value and nor in performance.

In this sense, we elaborate the second and third research hypothesis:

H2: There is a relationship between risk management and the quality of disclosure of financial hedge instruments in companies listed in the new market of B3.

H3: There is a relationship between quality disclosure of hedge financial instruments and market performance in companies listed on B3's new market.

### III. METHODOLOGY

#### Population and Research Sample

We work with the research population composed of public companies listed in Brazil, Bolsa, Balcão (B3), listed on the new market, and the sample is 54 companies. The data collection period was from 2017 to 2019, resulting in 162 observations (balanced data). Financial companies did not compose the sample, due to the sector having its own system of accounting standards that differentiates it from other sectors. Still, the sample includes companies that presented the necessary data to operationalize the study variables. Table 1 presents the total sample and the list of companies by sector with information available for analysis.

Table 1 - Sample of the survey segregated by sector of activity and number of companies per year

Sector	Companies	%
Real Estate	9	16.67
Basic Consumption	7	12.98
Discretionary Consumption	12	22.22
Energy	4	7.40
Industry	7	12.96
Health	3	5.55

Materials	4	7.41
Communication Services	3	5.55
Public Utility Services	3	5.55
Information Technology	2	3.71
<b>Total</b>	<b>54</b>	<b>100</b>

Source: Research data.

As shown in Table 1, the sectors that presented the greatest representativeness in the analyzed sample are those of discretionary consumption (22.23%), followed by real estate (16.67%) and basic consumption (12.98%). The data collected in B3 and Refinitiv Eikon (Former Thomson) are those related to the research variables, as shown in Table 2.

Table 2 - Research variables

Variables / Definition	Formula	Collect	Authors
Dependent variable	Quality of Hedge Disclosure (QHD)	Checklist according to Table 3	B3 Financial Statements Adapted according to CPC 40 requirements (R1) Sousa (2014)
	Market-to-book (MTB)	$\frac{\text{Market Value}}{\text{Net worth}}$	Refinitiv Eikon
Independent variables	Risk management (RM)	Companies with risk management committee, CRO and risk management council, as disclosed in the respective reference reports	B3 FRE * Internal risk and control management report Santos & Coelho (2018)
	Size (SI)	Total asset logarithm	Rosas, Leite & Portugal (2018)
Control Variables	Sales growth (SA)	$\frac{\text{Sales}_t - \text{Sales}_{t-1}}{\text{Sales}_{t-1}}$	Neto et al. (2019)
	Regulated Market (RE)	Regulated sector Dummy 1 if yes and 0 if no	Refinitiv Eikon Bandeira & Brito (2020)
	Big Four (BF)	Dummy 1 for companies audited by Big Four and 0 otherwise	Rosas et al. (2018)

Note: \* FRE - Reference Form.  
Source: Prepared by the authors.

Regarding the control variables, Rosas et al. (2018) in order to determine whether determinants such as size and

debt were capable of influencing Brazilian companies in the Novo Mercado segment the adoption of Hedge Accounting, found that the size and debt were not only strong and determining factors for the adoption of hedge accounting for companies. He also verified that the presence of large auditing companies (Big Four) with their wide levels of requirements did not result in a factor of great influence for the development of hedge accounting in Brazilian companies participating in the Novo Mercado sample.

Quality Variable of Hedge Disclosure

From the B3 website, it was possible to access the information opened in “Structured Reports” of the 54 companies belonging to the sample. The Comprehensive Income Statement, Statement of Changes in Shareholders' Equity and the Explanatory Notes were analyzed, being chosen this exercise because it is the most recent at the time of data collection.

The Checklist consists of 10 items of dichotomous responses, allowing yes or no as answers. The questions were extracted from “CPC 40 (R1)/IFRS 7 - Financial Instruments: Disclosure” (items 22 to 24) and adapted to allow the assignment of a grade. From the requirements of CPC 40 (R1) for the elaboration of the checklist, two items were excluded: 1 - the requirement to disclose “a description of any anticipated transaction in which hedge accounting was used, but which is no longer expected to occur”; 2 - the requirement to disclose “the amount that has been removed from equity during the period and included in the initial cost or other book value of a non-financial asset or non-financial liability whose acquisition or incidence has been a hedge of the anticipated operation and highly probable”. Both items do not apply to the checklist as they would only be answered if the company was in these situations, and it is inappropriate to score them negatively. In addition, none of the companies analyzed were in these two situations in 2018.

Questions 7 and 10, which deal with the disclosure of the hedge ineffectiveness recognized in the result arising from cash flow hedge and net investment in foreign operations, respectively, added the expression “If not, mention the effectiveness of the hedge?”. This adaptation is due to the possibility of the hedges having been highly effective and the inefficiency not recognize in the period, with no reason for a negative score, however, in the case of a highly effective hedge, the effectiveness needs to be reported. In these questions, only companies that did not recognize the ineffectiveness in the results and did not report on the effectiveness were scoring negatively. Table 3 shows the questions adapted.



Table 3 - Hedge disclosure requirements, in accordance with the requirements of IFRS 7 / CPC 40 (R1).

Requirements For The Disclosure Of Hedge Financial Instruments	
<b>QUESTIONS - Effects of Hedge Accounting on Financial Position and Performance</b>	
1	Item 22B - Do you disclose hedge instruments used (and how are they used) to protect risk exposures?
2	Item 24 - Do you disclose the nature of the risks covered separately?
3	Item 24A - Disclose separately, in table form, and by risk category for each type of hedge (fair value hedge, cash flow hedge or net investment hedge in operation abroad)?
<b>QUESTIONS - Value, Season and Uncertainty of Future Cash Flows</b>	
4	Item 23 (a) - Do you disclose the periods in which you expect cash flow to occur and when they should affect results?
5	Item 23 (c) - Do you disclose the amount that has been recognized in other comprehensive income during the period?
6	Item 23 (d) - Do you disclose the amount that has been reclassified from equity to income for the period, showing the amount included in each item in the statement of comprehensive income?
7	Item 24 (b) - Disclose the inefficiency of the hedge recognized in the result that arises from cash flow hedges? If not, does it mention the effectiveness of the hedge?
<b>ONLY FOR FAIR VALUE HEDGES</b>	
8	Item 22 – You disclose gains or losses on the hedge instrument. In fair value hedge?
9	Item 24 – You disclose gains or losses on the hedge object in fair value hedge.
<b>ONLY FOR NET INVESTMENT HEDGES IN OPERATIONS ABROAD</b>	
10	Item 24 (c) - Disclose the inefficiency of the hedge recognized in the result that results from net investment hedges in foreign operations? If not, does it mention the effectiveness of the hedge?

Source: IRFS7 / CPC 40 (R1) - Financial Instruments: Disclosure. Adapted. Self-elaboration.

The responses to the checklist is obtaining through a procedure for checking the Financial Statements and the Explanatory Notes. Level questions is apply to all companies in the sample. Level 2 questions were addressed only to companies that practiced the type of hedge to which the question refers. Thus, only companies that practiced cash flow hedging answered questions 4 to 7; questions 8 and 9, only companies that practiced fair value hedging; and question 10, only those companies that hedged net investment in foreign operations. Thus, if the company practiced only net investment hedge in foreign operations, it answered 4 questions; if you only practiced

fair value hedging, you answered 5 questions; if you practiced fair value hedge and net investment hedge in foreign operations, you answered 6 questions; if you only practiced cash flow hedging, you answered 7 questions; if you practiced cash flow hedge and net investment hedge in foreign operations, you answered 8 questions; if you practiced cash flow hedging and fair value hedging, you answered 9 questions; if you practiced the three types of hedges, you answered the 10 questions.

It should be noted that the score was attributed based on the number of requirements met in relation to the total requirements required for each specific hedge operation. So that if the company used only one type of hedge operation, its score is equivalence to meeting the specific requirements of this type of hedge. At the end, we perform the simple arithmetic average of the disclosure levels; we add the company scores and divide by the number of companies in the sample.

**Analysis of the model**

After collecting the hedge disclosure and risk management quality data and the control variables, we tested H1, using the following regression model:

**Equation 1**

$$QHD_{it} = \beta_0 + \beta_1 RM_{it} + \beta_2 SI_{it} + \beta_3 SA_{it} + \beta_4 RE_{it} + \beta_5 BF_{it} + \sum Effect\_fixed\_sector_t + \sum Effect\_fixed\_year_t + \epsilon_{it}$$

Onde:

QHD = Quality of hedge disclosure of company i in the period t;

RM = Risk management of company i in the period t;

SI = Size of company i in the period t;

SA = Sales growth of company i in the period t;

RE = Regulated Market

BF = Firm BIG FOUR.

**Equation 2**

$$MTB_{it} = \beta_0 + \beta_1 RM_{it} + \beta_2 SI_{it} + \beta_3 SA_{it} + \beta_4 RE_{it} + \beta_5 BF_{it} + \sum Effect\_fixed\_sector_t + \sum Effect\_fixed\_year_t + \epsilon_{it}$$

Onde:

MTB= Market-to-book of company i in the period t;

**Equation 3**

$$\begin{aligned}
 MTB_{it} = & \beta_0 + \beta_1 RM_{it} + \beta_2 SI_{it} + \beta_3 SA_{it} + \beta_4 RE_{it} + \beta_5 BF_{it} \\
 & + \sum Effect\_fixed\_sector_t \\
 & + \sum Effect\_fixed\_year_t + \epsilon_{it}
 \end{aligned}$$

In the tested models, we previously applied the regression to the assumptions: multicollinearity, autocorrelation of residues, normal distribution of residues and homoscedasticity. The regressions were performed by Least Squares Regression (OLS), using the Statistics Data Analysis software (Stata® 13.0), setting the year and sector and robust standard errors to capture innate and static characteristics that can affect the relationship tested in the study.

Figure 1 presents the theoretical model of the research, which highlights the relationship between risk management and hedge disclosure and organizational performance in companies in the new market.

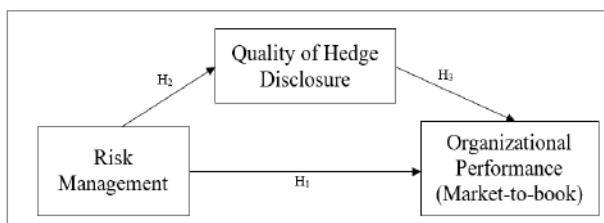


Fig.1: Theoretical research model  
Source: Own elaboration.

Previous studies have suggested the effect of risk management on hedge disclosure practices. In addition, it is clear that the risk management instituted by the organization can be decisive for the company's practices and impact on the highest market performance. In conjunction with organizational management, the higher quality of hedge disclosure can imply greater organizational performance. Thus, the argument underlying the proposed in this study is that risk management and hedge accounting disclosure practices maximize organizational performance.

#### IV. PRESENTATION AND ANALYSIS OF RESULTS

Table 4 presents the descriptive statistics of the analyzed variables, with the results encompassing the total sample, presenting the data that comprised the quality of the hedge disclosure, as well as the risk management, control variables, means and deviation standard, quintile 25% and 75%.

Table 4 - Descriptive statistics of the research variables

Variables	Mean	σ	25%	75%
QHD	0.5959	0.2893	0.43	0.80
RM	0.3844	0.4862	0.33	1
SI	2.0188	2.8617	0.3834	1.9801
SA	22.4223	4.6365	21.8812	24.1513
RE	0.1111	0.2127	0	0.1561

Legend: σ: Standard Deviation. QHD: Quality of Hedge Disclosure. RM: Risk Management; MTB: Market-to-book. SI: Size. SA: Sales growth. RE: Regulated Market. Source: Research data.

We notice that the quality of hedge disclosure has an average of 0.59. Thus, we infer that in the Brazilian scenario, companies meet more than 50% of the hedge disclosure requirements in their financial reports. With regard to risk management, the average was 0.3844, which suggests low disclosure of risk management policies.

Regarding the market-to-book, an average of 2.01 is perceived. This shows that the market performance of the companies analyzed is attractive.

Regarding control variables, the average growth of companies was 0.111, showing a low variation in sales. We notice that the Size (evaluated through the asset logarithm) presented the value of 22.42, which means the sample group demonstrated, on average, an expressive participation in the composition of the total assets of the sample group.

Then, in Table 5, it describes the correlation matrix between the variables analyzed.

Table 5 - Spearman correlation

V	1	2	3	4	5	6	7
1	1.00						
2	0.03	1.00					
3	-0.06	0.18*	1.00				
4	0.02	0.11	0.25*	1.00			
5	0.05	0.10	0.05	0.11	1.00		
6	0.05	0.17*	-0.08	0.10	0.13*	1.00	
7	0.03	-0.03	0.03	0.21*	0.03	0.06	1.00

Legend: 1.MTB; 2.QHD; 3.RM; 4.SI; 5.SA; 6.RE; 7.BF  
Notes: Levels of significance: \* p < 0.1.  
Source: Research data.

There are positive and significant correlations between the QHD and the RM (0.1822) and MR (0.1728). We noticed that RM has a positive relationship with the SI (0.2542). In turn, we noticed that the size has a positive correlation with BF (0.2105). Finally, SA has a positive correlation with RE (0.1387).

In general, the data in Table 5 demonstrate that there is no high correlation between the variables analyzed, which allows to rule out possible multicollinearity problems in the following regression models. Table 6 shows the

regressions to measure the relationship between risk management, hedge financial instruments and market performance by companies listed in the new market of [B]3 - Brazil, Bolsa and Balcão, according to Equation 1, 2 and 3.

Table 6 - Regression Result

Var.	Sign	QHD	MTB	MTB
		(H2)	(H3)	(H1)
		Coef.	Coef.	Coef.
		(Test t)	(Test t)	(Test t)
Con.	+/-	1.699 (0.57)	-0.134 (-0.45)	-0.166 (-0.55)
QHD	+	-	0.001 (0.19)	-
RM	+	0.087** (1.78)	-	-0.004 (-1.09)
SI	+/-	4.246* (1.68)	-0.520** (-2.67)	-0.456** (-2.51)
SA	+	8.367 (0.69)	1.178* (1.81)	1.208* (1.83)
RE	+/-	-91.961* (-1.66)	14.705*** (3.55)	13.286*** (3.45)
BF	+	-3.771 (-0.75)	0.346 (0.66)	0.330 (0.64)
Sector and Year Fixed Effects		Yes	Yes	Yes
Model Significance		0.000	0.000	0.000
R <sup>2</sup>		17.56	29,07	29.52
VIF		1.15 a 1.37	1.15 a 1.25	1.15 a 1.37
DW		1.80	2.23	2,25
N		162	162	162

Legend: QHD: Quality of Hedge Disclosure. RM: Risk Management; MTB: Market-to-book. SI: Size. SA: Sales Growth. RE: Regulated Market. BF: Firm Big Four. VIF = Variance Inflation Factor; DW = Durbin-Watson; N = number of observations. Notes: Levels of significance: \* p <0.1, \*\* p <0.05, \*\*\* p <0.01.

Source: Prepared by the authors.

As shown in Table 6, for the regression models ordinary least squares (OLS) regression we robust estimators, controlling sector and year. The Durbin-Watson tests do not reveal problems of self-correlation (statistic close to 2.0 in all regressions). In addition, multicollinearity is not a problem in any of the regressions tested in the survey.

### V. DISCUSSION

In Model 1, the dependent variable is the organization's performance proxy, in the sense of expression of market value (MTB), the independent variable of interest is risk management (RM). The performance estimates of the operations are not significant

in relation to a possible influence of risk management (-0.0046; p <0.05). So hypothesis 1 (There is a relationship between risk management and market performance in companies listed on the new B3 market) we do not confirm.

In Model 2, the dependent variable is the Quality of Hedge Disclosure proxie (QHD), the independent variable of interest is risk management (GR). The estimates of the quality of hedge disclosure are significant and positive for the analyzed model, coefficient of (0.087; p <0.05). The positive and significant index shows that the best risk management practices are related to the higher quality of hedge disclosure, as determined by the H2 research hypothesis, confirming H2.

In Model 3, the dependent variable is the organization's performance proxies (MTB), the independent variable of interest is the quality of disclosure of hedge accounting (QHD). The performance estimates of the operations are not significant in relation to a possible influence of the quality of the disclosure, presenting a coefficient (0.0011). Thus, Hypothesis 3 (There is a relationship between the quality of disclosure of hedge financial instruments and the market performance of companies listed on the new B3 market) we do not confirm.

Still in Model 1 and 3, it is noted that both the company's growth and the presence of a regulated market are positively related to MTB (1.2089 and 1.1780; p <0.1) and (13.28 and 14, 70; p <0.01) respectively, which means that the greater the growth and influence of the regulated market, the better the organization's performance in terms of market value. In addition, regarding control variables, size has a significant and negative relationship in both models. These results indicate that smaller companies, as well as those from regulated sectors tend to perform better in the market.

In Model 2, it is noted that the size of the company is positively related to the QHD (4.24; p <0.1), being convergent with results found in previous surveys such as those by Toigo et al. (2015) and Pereira et al. (2017), which means that the bigger the company, the better the hedge accounting disclosure. However, the regulated sector has a negative relationship with QHD (-91.96; p <0.05), revealing that the specific rules and procedures of these markets influence the reduction in the quality of disclosure.

As the indices are not significant, it is not possible to determine that risk management and the quality of disclosure and hedge have an effect on MTB, rejecting the research hypotheses H1 and H3, for the period and companies in the sample.

This fact may be related to the low percentage of Novo Mercado companies in B3 that evidence hedge accounting operations, as shown in Table 4, the average coefficient is 0.3844 companies that performed the disclosure in the sample period. This fact relate to the degree of importance attributed to these instruments and the lack of knowledge of the effects of these operations from the perspective of investors. In addition, under aspects of Agency Theory, the results may indicate a tendency for the agent not to expand the monitoring of the principal under the organizations' financial area, which would justify the low percentage of disclosure.

## VI. CONCLUSION

The contributions of this research refer to a complex field of the international financial structure, IFRS 7 - Financial Instruments. Studies on the subject, largely, adopt an introductory approach, assessing only the degree of disclosure of the regulatory requirements related to financial instruments. This research promoted a step forward, maintaining the quantitative perspectives, but with a deeper approach, seeking to understand the influence of other proxies such as size, growth, regulated market and the very existence of risk management established or not in these companies, which can influence the disclosure of financial instruments.

The non-financial companies of the Novo Mercado of B3 established a procedure to verify compliance with the hedge accounting disclosure requirements. We use the service coefficient as a basis for carrying out hypothesis tests. We assume that the attribution of a degree of disclosure by itself is incipient and does not result in a broader understanding of the influence of other variables on the effects of disclosure of hedge accounting and on the market value of companies. In addition, as companies under the concept of risk management they can increase their market value (Market-to-Book).

However, the study obtained results that demonstrate that both risk management, evidenced by the reference reports. As for the quality of accounting disclosure, they did not influence the organization's performance for the period and segment contained in the sample. However, it revealed that growth (revenue variation) and the condition to operate in regulated markets increase the market performance of these organizations.

In addition, the survey indicated that the size of the company constitutes a factor inversely related to market performance. Small companies performed better than large companies in this market segment did. Finally, based on the objective of the study, it was found that despite the low coefficient of companies that declared to have risk

management, it has a direct relationship with the quality of disclosure of financial hedge instruments. Thus, there is a significant adoption of risk management by companies in the sample segment. This will result in an increase in the quality of disclosure of hedge financial instruments, which may reinforce the importance of these instruments in the preservation of financial resources.

As a suggestion for future research, the increase in the analyzed period may influence the tested relationships of the study. Still, we suggest the evaluation of all the companies that comprised B3, as the sample of the research would increase allowing a greater generalization of results.

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# Culture of the organization: Facilitating or resistance factor to computerization?

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Received: 16 Nov 2020;

Received in revised form:

06 Jan 2021;

Accepted: 16 Jan 2021;

Available online: 23 Jan 2021

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**Keywords**— *Organizational culture; Work  
overload; informatization; psychodynamics  
of work.*

**Abstract**— *This case study was based on the clinical psychodynamics of work and aimed to analyze the influence of the organizational culture on the informatization process, as well as the subjective mobilization of managers. We conducted collective discussions with five managers of an education network in Goiás. The results indicated five traces of the culture: hierarchical rigidity, political mismanagement, lack of participation in the decision-making process, lack of acknowledgment. These factors generate experiences of pleasure of suffering for managers. Pleasure experiences highlight the freedom, agility, and precision of real time information. This limited freedom generates acceleration, alienation, and imprisonment by the organizational culture reflected on the management.*

## I. INTRODUCTION

The computerization of organizational processes can be seen as a problem of cultural change, since the success of an organization may depend on the application of a given technology. To use it, the organization must develop work strategies and methodologies, in addition to redefining very ingrained cultural elements, aiming at its implementation (Santos, 2016).

The increasing ease of access to technology makes innovation a constant challenge.

According to the production models proposed in contemporary society, organizations must be able to replace the knowledge that has become obsolete and develop ways to manage change. They must learn to develop new knowledge through ideals of continuous improvement of their activities; of creating new applications based on their own successes, and of continuously innovating in an organized way (Santos et al, 2014).

The history of computer science in Brazil has been little discussed in academic spaces. However, some dissertations and theses have built a detailed work on this discussion, such as Mendes (2013) and Tavares (2001).

There are also some articles, such as those by Valente (2003), Teruya (2009), Tomaz (2005), and Barreto (2004, 2013), which analyze how information technology began to acquire space when it extends to a large number of individuals, who can access it daily by using it as a source of information. The transformations that have occurred throughout history, whether technological or organizational, were not based on the assumptions of the centrality of work and its importance for the development of subjects, institutions, and culture.

Several factors influence the success or failure of processes computerization initiatives in institutions. Authors such as Ajmal et al. (2010), Liu (2011), and Braquelais et al. (2017) concluded in their studies that the critical success factors of organizational computerization are mainly determined by cultural factors, in terms of their values, because these often point to corporate identity.

Technological revolutions, bypassing through traditional dimensions to social values in the organization, have gained renewed interest in the theme of organizational culture. Such transformations generate insecurity and build symbolic dimensions in organizations (Gajanigo & Souza, 2014). The contemporary management model is intended to

eradicate the values and knowledge of work by intending to increase profitability, even if degrading the quality of work and, more often than not, of the product or service itself (Macêdo et al., 2016).

Because it is a vital element in the life of an individual in society, numerous failures have as a direct consequence the lack of sensitivity not to take into account the cultural reality in which workers are inserted. Culture is one of the most important influences of society on individuals (Oliveira, 2016).

For the constitution of organizational strategies, organizational culture is an essential concept. It is not a static construction; it is dynamic and, in part, constructed and reconstructed by social actors in presence, in the perspective that social reality is subjective. (Bilhim & Correia 2016). Culture assumes the role of legitimizing the value system, expressed through rituals, myths, habits, and beliefs common to the members of an organization, which thus produce norms of behavior generally accepted by all (Macêdo, 2018).

Contemporary research presents results in which organizational culture has implications on innovation (Faria & Fonseca, 2014), people management policies practiced in organizations (Santos et al., 2016), the degree of concern of organizations with their social/environmental responsibility, and the very management of knowledge in organizations (Angeloni & Grotto, 2009).

The focus on continuous learning in the culture of public and private companies in Brazil, and its consequences on employee attitudes and behaviors, is a theme not yet explored in this field of knowledge (Cavazotte, Moreno Jr. & Turano, 2015).

Expanding the aspect of subjectivity in culture, authors such as Dejours (2012) Macêdo (2015, 2016, 2018) Santos and Macêdo (2018) have presented the issue of the dichotomy of pleasure and suffering at work, identifying factors in interpersonal relationships and organizational culture. Experiences of suffering are evidenced associated with the way the work organization is constituted.

The present study presented in this article considered the importance of understanding the values that guide organizational policies and structure in this process. We sought to contribute to the theme examined through the psychodynamics of the work, a method adopted for the application and analysis of this research.

The psychodynamic approach of the work allowed analyzing the implications of computerization processes in the organization, and culture is an evidenced element that facilitates or resistance. According to Dejours (2015), the constitution of collective spaces makes it possible to

broaden the perception of itself, favoring its emancipation process and the consequent intervention in what the group identifies as necessary to improve the organization of work.

In this sense, this article is intended to answer the question: how is the implementation of computerized processes influenced by organizational culture?

## II. METHODOLOGICAL DESIGN OF THE STUDY

The psychodynamics of work uses a specific method that is based on the principles of action research. Its premise is that the universe of the subjects' meanings can only be understood and analyzed psychodynamically when the subjectivity at work is investigated, resulting from the mutual influence between the worker and his work context.

The following steps are proposed according to the method used: pre-research, research, demand analysis, analysis of poll material, clinical observation, interpretation, validation, and refutation.

### Field for data collection

The research was carried out in a network of educational institution that promotes higher education and technology in Goiás.

### Participants

The criterion for the composition of the group of participants in this study was intentional, having been elected the manager category. At the time of the study, the institution had 33 managers in its staff, all of which had graduated and had graduated.

Twenty-nine managers were invited, according to the criteria adopted for this study: having ten years of employment; have a working regime of forty hours per week and exclusive dedication; belong to the staff of effective managers in the institution and have an interest in participating in the research. Of these, fifteen accepted the invitation, and individual interviews were conducted in order to meet the criterion of demand constitution, as established in the pre-research phase.

After this phase, the demand was constituted that indicated the possibility of performing the work clinic, proposed by Dejours (2015). Five fortnightly meetings were held for collective discussion, with the spontaneous participation of five managers, characterizing the research phase itself. After this phase, the demand was constituted that indicated the possibility of performing the work clinic, proposed by Dejours (2015). Five fortnightly meetings were held for collective discussion, with the spontaneous participation of five managers, characterizing the research phase itself.

All participants emphasized that they did not have

the role of manager until the position of the position and did not receive training to assume the management positions, developing the skills necessary for management with practice and experience. They also reported that they sought to train themselves in improvement courses on their own initiative, but with funding from the institution. Of the participants of the collective discussion space, three had the first opportunity for effective work at the institution, being there until now.

The justification presented for the non-participation of the other guests to the research was due to the difficulty due to agenda conflict or distance between municipalities. However, all invited participants justified the absence by telephone or electronic means, praised the initiative, and considered the research theme relevant, reinforcing the demand presented.

### III. PROCEDURES

In the pre-research stage, as recommended by the theory, the institution was asked to accept and support the activity, making it possible to access formal and formal institutions, visits and meetings with the workers (strategies for approximation of the research collective) in which the workers were selected according to the availability to volunteer to the research.

A documental analysis was carried out, consisting of the institution's historical memorial, norms and rules, institutional evaluation and management reports, produced by the Human Resources Management, aiming at the analysis of the work organization.

Analysis of organizational diagnosis and individual interviews with fifteen managers, lasting approximately one hour, pointed out data on work organization, subjective mobilization and work-related defenses.

The space of collective discussion with the managers was coordinated by a pair of clinical-researchers and a controlling collective was established to perform the interpretative exchanges of the field diary, which served to constitute the memorial of the sessions. The meetings between the pair of research clinics and the control collective were held periodically.

The analysis and interpretations of the work situations given by the researchers and workers ensured the validity of the collected material, as a group of researchers who permanently confront the content of the sessions with each other and with the group of workers at the time of the research participated in this study.

The research was carried out in the organization itself. The dates for the meetings occurred in a place chosen

by the workers themselves, during the working day, at possible intervals of periodicity, according to the specificities of the work.

The proposal also involved observing how work is organized in the institution, as well as its effects and consequences on the psyche of workers. As the focus was on collective formulations, there did not impede that, from one meeting to another, there was variation in the participation of the constituent elements of the group, often by demands and particularities of the work itself.

The participants' consent was obtained, with the guarantee of the preservation of privacy and use of their data specifically for this research, through a free and informed consent form submitted to the Research Ethics Committee, and the participant is free to refuse to participate, withdraw his consent or interrupt participation at any time.

From trigger questions, the discussions began, and comments from the participants triggered by the interpretation of the researchers gave rise to new reports and comments. The discussion of the experiences of pleasure-suffering derived from the dynamics of work situations was constructed throughout the sessions.

The principle that organizes reflection during research is the discussion about difficulties at work, that is, real work situations. Throughout the discussion, it is necessary to understand how real work is and how the subjective experiences of workers are organized to account for the real.

### IV. RESULTS

Based on the psychodynamics of work, when analyzing how computerized work is organized and its implications on workers, cultural elements considered important for the organizational development in which technology is inserted were identified. The results are presented below and the computerization of the processes in the institution is discussed, considering the categories proposed for this study, defined a priori: **Category 1** - Organizational culture and management; **Category 2** - The experiences of pleasure and suffering; **Category 3** - The strategies for coping with suffering from work.

#### **Category 1 - Organizational culture and management**

Relevant aspects of the culture of the researched institution, according to analyses, generate factors of suffering and illness to workers related to the computerization process.

The space of collective discussion as a proposal of the action research of this work has unseen implications between the insertion of the computerization of



organizational processes and the dominant culture, by identifying the reactions resulting from the active actors in

the process. The results were condensed in **Figure 1**.

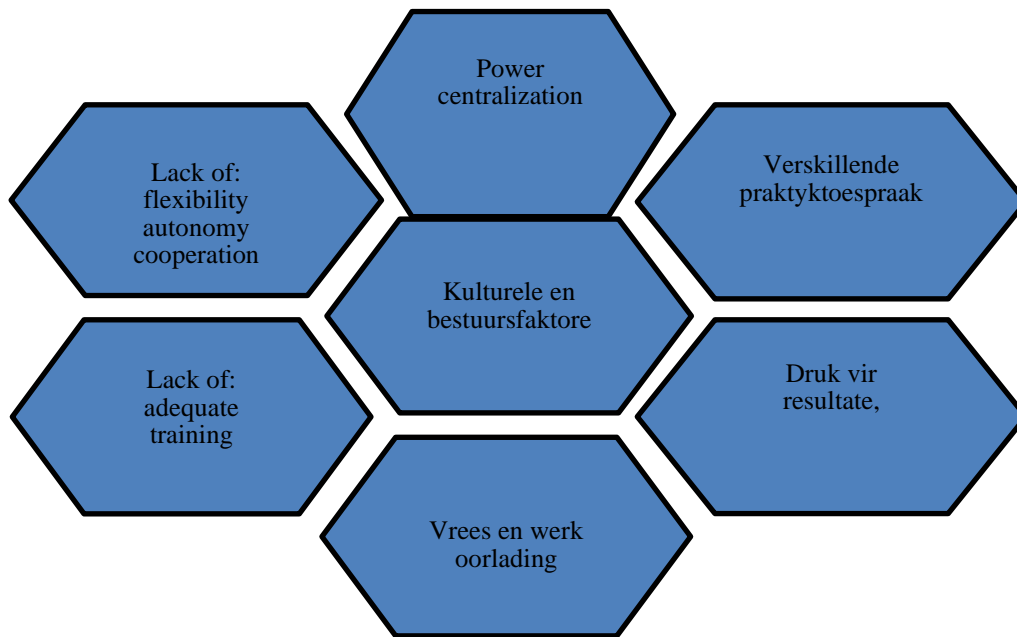


Fig.1: Emerging cultural and management factors in research

According to the analyses, the lack of involvement of the departments and units of the institution in the acquisition or development of computerized programs, being to decisions based on political and centralized factors, produce conflicts between departments and units, which proved to be an indicator of high turnover.

centralization of information, lack of participation in decisions, and non-recognition. The analyses of the experiences of the managers reflect the context of computerized work, elements of the institution's culture highlighted in the Framework.

Five traces of culture in the researched organization prevailed: hierarchical rigidity, political interference,

Chart 1:

Table 1: Indicative reports of cultural elements

Emerging themes	Excerpt from the participants' speech
Lack of flexibility	[...] we have a centralizing management profile, because we have audits, the Court of Auditors [...] some things that make us insecure. "[...] here we have to adapt our activities to controls, and this is terrible, [...]". S1
Power centralization	[...] it is centralizing, we are afraid to give information, or someone or some who do not take the information, saying that it is true if it is not given by the manager, then it bothers me [...]. [...] it bothers me [...]. S2
Lack of autonomy	[...] we do not know much to deal with conflict, we have a lot of difficulty, so in groups, to deal with professional conflicts. So it turns out, how do we deal with it? [...] it's not because we don't want to do it, we have difficulty doing [...] we're trying to get stone milk [...]. S3
Different practice speech	[...] sometimes you attack? [...] it's not assaulting, you can't question, you can't ask, you can't say "no, I don't agree. S4
Lack of cooperation	[...] if I need in the area of it [...], for example, and there is an area that the hierarchy is extremely [...] glaring, I can not pass this information without my manager [...] validate, for example, and I deal a lot with information and I need for now, because I have to meet something usually at the last minute and I suffer many times with it. S5
Pressure for results	
Fear	
Work overload	

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[...] it's one thing for me to have 200 employees for 5,000 enrollments and it's another thing to have 150 employees for 15,000 enrollments [...] a lot of difference in terms of pace [...]". [...]. production collection, agility [...], in the last five years increased all controls and we doubled the production [...]. S1.

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These cultural factors are identified to prove the studies of Ajmal et al. (2010), which point to various influences for the success or failure of process computerization initiatives in institutions and conclude that the lack of incentives and the absence of adequate information system are the most significant barriers.

Even after 60 years of existence in the market and 40 years after starting the process of computerization, there are still non-computerized processes in the institution. Until the time of the research, which occurred in 2015, there was no online payment of slips in schools and did not accept cards, procedures that, at the time, we're in the implementation phase. It can be related to the fact that the senior management of the research field does not use computerized processes, and these are the responsibility of the middle management and other workers.

The lack of training to perform computerized activities in the organization of work was marked. Do not attentive to the fact that each computerized program has its peculiarity and needs training. However, as a mandatory requirement to be admitted to the institution, proof of computer knowledge is required for all positions.

The basic knowledge in informatics is presented to the institution studied as a satisfactory item for the operation of computerized systems, which causes errors in the processes and indicates factors related to turnover. In addition to the importance of having adequate training, it is important to promote a space for collective discussion with those who operate computerized processes, to identify the difficulties that cause factors of suffering in employees, as well as possibilities for improvement.

The effective workers, as well as the new ones, learn the computerized systems in the daily practice of activities, and the orientation is to go "doing until learning", "lift the ass of the chair and run after", according to reports experienced. The belief that, if the worker knows computer science, learns the program alone, appears as a cultural element of the institution, which legitimizes values and produces norms of behavior.

## **Category 2 - Experiences of pleasure and suffering**

The feeling of valorization and recognition produces, in the worker, pleased with their work, enabling the construction of creative arrangements in the organization of their daily activities, through which they feel accepted and valued by what they do and produce

individually and collectively (Macêdo, 2015). Suffering can both assume a role as a mobilizer of the subject's health since it helps him to think critically about his work, as it can be an instrument used to increase productivity and to alienate the subject (Dejours, 1996).

Among the questions raised by the participants, the contradictions presented between discourse and practice in the organizational management of the institution are identified as cultural elements. The referenced studies, this fragmented discourse, and the permanent internal conflict seem common among organizations.

Among the participants, ideological mediation is identified, which generates the identification between the individual and the organization, when he absorbs the ideology elaborated by the individual; psychological mediation, which allows the privileges and restrictions (coertions) imposed by the organization to become the pleasure and anguish of the people who work in it, highlighted by the identification with the positive image of the company; considered by all participants as a good company.

The experiences of pleasure related to the identification with the positive image of the company also enter into the aspect of identity evidenced in the research participants. The organization, in its economic and political reality, proposes to individuals an image of strength and power; the size of the organization, its worldwide character, its effectiveness, its objectives of conquest (profit and expansion), constitute an aggressive image of omnipotence (the world character is important in this case), which favors the projection of individual dreams of omnipotence, while maintaining the anguish that feeds them (Mendes, 2013).

Recognition, when linked to pleasure, is not limited to rewards, allowances, but also refers to the connection between the organization of identity and the social field. The interaction between the individual and the other provides the construction of this identity, coming from dynamics that imply exchange with the environment, with the historical, personal, and social context, in which the worker is inserted by implying a collective work (Mendes, 2013).

Regarding the experience of pleasure in relation to freedom at work, it is also noted that it is provided in view of the computerization of processes and the insertion of technology in the organization of work, thus promoting a

feeling of freedom (Morschel, 2013). The indicators of experience related to pleasure at work can be seen according to

Chart 2:

Table 2: Indicators of pleasure experience at work

Indicators of pleasure experience	Snippets
<b>Freedom to perform work anywhere</b> <b>Collective discussion space</b> <b>Positive sense that the institution presents socially</b>	[...] is freedom, for example, I don't need to be in my job to be working, to do things, to rotate, I go to Brasilia, I work, I don't come to work [...]. S3 S2: [...] wow, when we have fun or see time go by [...]. S3: [...] ah I also didn't even see the weather, when I looked at the time I said: our [...]. if I'm a manager of a good company, I'm good. S1

The collective discussion spaces, carried out as suggested by Dejours (1996) provided the participants of this research with experiences of pleasure. All were unanimous in saying that they did not see the time pass and how the discussion had mobilized the meanings of the work.

The computerization of processes, while facilitating the role of the manager, also generates work overload, invited by private life, outlining a way of living in

which it does not recognize the limits between working time and not work.

The high subsidies in the analyses point to a culture of lack of recognition by senior management, seeming to the participants that only what happens wrong is evidenced. Corrections to be made are mentioned, not having positive feedback in relation to work, which generates experiences of fear and the feeling of distrust perceived by all participants, as confirmed in the excerpts of Chart 3:

Table 3: Reports of experiences of suffering

Experiences of suffering	Snippets
Fear and the feeling of mistrust	[...] you guys are trying to tell me something, between the lines [...]. [...] Are you filming? [...] Oh, I'll talk [...] the direction does not have the perception that we have of the schedule, a day of rest is all the time [...] and also we are not comfortable, the unit is not comfortable because a lot happens, so we have a problem [...] that happens all the time [...]. S1  [...] will sneeze on me, [...] so I wanted to say so "it's this, I'm not satisfied with the middle area", or "I'm satisfied with the middle area", what is the climate that has between the unit and the middle area, this is important for the institution to know and sometimes, and I realize the following, the terrible way that the institution is going through. Well, if the weather is bad, that evaluates that the weather is bad for us to be able to treat something, because if everything is very mixed there is no way to treat anything and the profile that we know [...] and is filming too? [...] here it comes [...]. 're? Write what I'm telling you, you're going to put everything the same japanese and we're going to look bad, and who needed to, and where you could identify, you're going to point your finger still, oh, so you need to have that closeness and I don't know what, I'm expecting it, okay? Read the questionnaire, then I was reading the questionnaire and I was thinking so, at the time that compiles this result, a percentage that lacks this, or the staff there go down the stick, it is this issue that we are living here [...]. S3 [...] yes, that's a thing of time [...]. S2

It is possible to perceive, in the analyses performed, an experience of suffering in relation to feelings of fear regarding exposing their opinions; pressures; work overload and invasion in private life; in addition to the lack of perception of senior management in the face of the real work of managers. The fear of incompetence is described

by Dejours (1996) as coping with the irreducible lag between prescribed and real work.

The suffering of workers is exploited to increase the productive system. To achieve this, companies encourage the continuity of the vicious circle that involves nervous tension and productivity. This process takes place

so that the tenser, more aggressive, more anxious, and more fearful they are, the more workers become productive (Macêdo, 2018).

The characteristics of the work of managers in the organization generate a charge to perform the prescribed

that conflicts with the actual work, with the practical experience of the activities, thus generating an experience of suffering. The elements of culture related to experiences of suffering, indicated by lack of autonomy among other elements of the organization of the work of the organization studied, can be seen in some excerpts in Chart 4:

Table 4: Elements of culture related to experiences of suffering

Emerging themes	Excerpt from the participants' speech
<b>Lack of autonomy, excessive control, bureaucratization, work overload pressure by result.</b>	[...] we have to adapt our activities to controls, and this is terrible, [...] production collection, agility and you have all this ties that we have, it's terrible, it's one thing, in the last five years has increased all controls and we doubled the production [...]. [...] we spend a lot on these controls, and it is an element of stress for us [...]. S1
<b>External and internal collections and requirements</b>	[...] the huge, huge responsibility [...] we get very tense [...] with the size of the responsibility, in my area [...]. this worries [...] it takes agent off the axis [...]. S2
<b>Various authority figures in the institution</b>	[...], I have about four immediate bosses, so, right away [...] if he asks for something I have to go and sometimes he contradicts two other managers [...] and still has the president, [...], it's complicated [...], because sometimes I have different determinations and that someone keeps giving me different priority and with a lot of people sending it fucks you know when you can [...]. S5  [...] very boss, okay? [...] from time to time you have to have a waist set, or you burn yourself [...]. S3
Do more with less	[...] it's one thing for me to have 200 employees for 5,000 enrollments and another thing is to have 150 employees for 15,000 enrollments [...] a lot of difference in terms of pace [...]. S1

Receiving demands from various authority figures in the institution and experiences of pressure for results in the organization of work generate feelings of self-collection. Suffering due to external and internal demands evidenced stems from pressures for results. In addition to the rapid pace of the organization, there is also difficulty in finding people you can trust. The work overload and pressure for results are also revealed by the dupinge of the number of employees and by the increase in the company's goals and demands, and the responsibility attributed to the manager is indicative of experiences of suffering (Mendes, 2013).

As for the workload and demand pressure related to this new reality, they are perceived as harmful to health by the imperative to do more in limited time, which is lived in a tense and singular way. This situation generates stress, anxiety, tension, worry, impotence, frustration, malaise, and bad mood, situations most often not framed as occupational diseases by Social Security (Macêdo et al., 2016).

The management of work also contributes to the lack of autonomy, since the way controls are viewed takes

away freedom at work, making professionals hostage to the norms and taking away the right to adapt their activities according to their subjectivity.

According to Dejours (2015), it is a management model that neglects the complexity of the activity, neglects the characteristics and diversities of workers and intensifies the control of time and results, among other aspects that enhance the existence of experiences of suffering at work.

The new organizational forms require intense vertical and horizontal interaction for the acquisition of new knowledge, with organizational culture having a relevant role in sustaining these structures. The new values incorporated into the organization can be of two types: revolutionary, when antagonistic to the previous ones, which generates the destruction of symbolic elements and the redefinition of organizational practices; and gradual, when complementary (Santos, 2018).

The attitude of each subject towards technology will always depend on all the agents that condition the performance and the system of values that guide the conduct (Pires & Macêdo, 2006). It is important to analyze, in a

specific way, the attitudes of the subject and the organization towards new technologies, resulting in the impact between change and the dominant culture by identifying the reactions resulting from the active actors in the process (Tomas, 2005).

All participants presented anxiety symptoms related to work overload generated by the insertion of computerization technology, with influence on the organizational culture of doing everything very quickly: "[...] and I'm here, agonized to authorize, as if I had an obligation [...]" (S1).

The essence of an organization's culture is expressed by the way it does its business, by the way, it treats its customers and workers, by the degree of autonomy or freedom that exists in its units, and by the degree of loyalty expressed by its employees in relation to the organization (Souza et al, 2014). It represents the perceptions of managers and workers of the organization and reflects the mentality that prevails in it. For this reason, it can be affirmed that it conditions the management of workers and thus goes through a process of constant modification.

Depending on the pressures and demands to which he is subjected to performing his professional activity and the psychological resources available to face adversities, the worker may become ill. (Mendes, 2013). According to Anchieta & Cols (2011) work has a constitutive character of the identity and subjectivity of the worker.

It was understood, according to the analysis, that the institution, despite developing information systems and having it as one of its business strategies, has no specific interest in the computerization of processes. It was inserted in the context of the work without specific planning according to the need presented because of the new global context and the advances of computerization technology.

The phenomena and situations portrayed reflect the point of view of the survivors of the technological

innovation process, individuals who have been able to go through a relatively long period of adaptation and may have come to perceive as personal some of the values strategically incorporated into the organizational culture, after restructuring, which has the effect of enhancing the mechanisms of domination and regulation of conflicts of the organization (Vieira, 2014).

The experiences of pleasure-suffering are considered by the psychodynamics of work as a dialectical construct and there may be a preponderance of one over the other. The work context, in its three dimensions (work organization, working conditions, and work relations), influences pleasure and suffering, which are constitutive of subjectivity at work (Mendes, 2013).

The worker expended energy, individually and collectively, in the search to account for the performance of the activity, being subject to experience pleasure and/or suffering. These are experiences that portray the meaning given to work as resulting from the interaction between subjective (subjects) and objective (work reality) conditions. By predominating experiences of suffering, workers can use coping strategies (Mendes, 2013).

### **Category 3 - Coping strategies**

The application of collective mobilization strategies implies the reduction or elimination of suffering and change in the work situation in which the group shares suffering and jointly finds solutions to deal with demotivating situations (Heloani, 1996). Collective mobilization seeks to promote the predominance of experiences of pleasure through the creation of a public space of discussion, built on the basis of the mutual cooperation and trust of workers in the work environment. Thus, the context influences the strategies to be adopted and that will prevail among workers (Dejours, 2015).

Table 5 presents the synthesis of the sources of pleasure and suffering and the elements related to strategies to face suffering in the face of computerization of processes.

Table 5: Sources of suffering and pleasure versus coping strategies

<b>Computerization</b>		
<b>Experience of suffering</b>	<b>Experience of pleasure</b>	<b>Coping strategies</b>
Sudden system changes	Challenges	Addiction
Divergences with internal and external audits	Agility	Resistance
Lack of cooperation between computerised processes and colleagues	Ease of information	Fights
Lack of recognition in efforts to operate systems and solve technical problems	Speed in information	Conflicts
Direction of machine type	Relative autonomy and freedom	Anxieties
Work overload	When it is suitable for the processes	Inadequacy
Length of workload		Jokes
Invasion in private life		Rationalization
Absence of spaces for collective discussion		Trading
Autocratic management		Communication
		Search for means of adequacy
		Stress
		Isolation
		Individualism
		Distrust
		Fear
		Psychosomatization
		Submission
		Take A Vacation
		Resignation

Considered as a form of coping strategy, the chistes was the one that was most evidenced in the group surveyed, both the individual and the collective. Originated from the German Witz, which mean jokes, the term jokes, was defined by Freud (1930) as a kind of escape valve of our unconscious, which uses it in a joking tone, as what he thinks. Coping strategies were also identified to deal with the institution's computerized processes, leaving the institution, asking to take a vacation, negotiating, looking for other possibilities to solve problems, hiring other services, and rationalization.

A common perception to the members of the organization in relation to work in the position of the Brazilian worker in the face of the new challenges imposed by technology. As an expression of strong assimilation of new organizational values, or even from a peculiar point of view to technological professionals, the adoption of new technologies is seen only on the positive side. For them, technological updating is a natural occurrence, indispensable and deferred, and it is up to the worker to

strive to adapt to the new times and the new market impositions.

As for the difficulty of people adapting to the constant changes resulting from computerization in organizational processes, individuals show resistance, extending the use of the tool and causing work overload (Faria, 2014). Technologies contribute to the predominant individualization in contemporary work environments and to changes in the way of relating. Experience of suffering due to changes in the organization of work resulting from the computerization of processes trigger strategies, distrust, anxiety, addiction, and psychosomatic diseases in the researched group (Mendes, 2013).

For the group surveyed, the perverse side of technological innovation, which disconsiders the structural issue of work in the country, the cultural limitations of the Brazilian worker and their shock at the new paradigms of production, which invariably standardize attitudes, reaped jobs and excludes greater possibilities for creation, is less important. The way managers and workers will respond to

the automation or computerization alternatives proposed by new technologies will determine whether there will be a new conception of organization, work, and power, depending on the management that will be exercised by their managers.

The hope of recognition influences the strategies used by managers to face adversities at work. Managers seek to resignify their suffering through the recognition of their teams. They also invest in activities in which recognition is possible. In any case, the defenses against suffering at work influence the work context and the experiences of pleasure and suffering of managers.

## V. DISCUSSION

The factors presented related to organizational culture generate experiences of pleasure and suffering in managers. The management of people by the organization is directly linked to the development of an integrated and coherent set of economic, political, ideological, and psychological mechanisms, which, once associated, can influence people's behavior (Santos, 2016).

It is observed in the reports that the experiences of suffering in the organization of work can come from the culture of the autocratic management style, motivating high turnover, dissatisfaction, lack of commitment to the company, and lack of perception of a high future. According to the reports, participants indicate that, when afraid of losing their positions, many managers are "whipping" workers.

The suffering of workers is exploited to increase the productive system. To achieve this, companies encourage the continuity of the vicious circle that involves nervous tension and productivity. This process takes place so that the tenser, more aggressive, more anxious, and more fearful they are, the more workers become productive (Macêdo, 2018).

Detours (1999a) considers that, at a time when the triumph of robotization, computer science, and automation should bring the emancipation of men about work, the opposite occurs. Maintenance tasks should have decreased, as well as the work disappeared, and everything would be done by the machines, however, in reality, there is an explosion of pathologies of overload.

Psychic suffering caused by fatigue, tension, nervousness, anxiety, depression, among others, enhances production and is used by managers as a people management technique (Mendes, 2013). The worker, by crediting for himself the causes of the suffering experienced, considers himself ineffective, fragile, and

powerless and does not relate them to the real confrontation of dangers and risks of tasks (Dejours, 2015).

Given the difficulty of complying with the request, managers feel incompetent in the organization of their work, more specifically about the computerization of processes. The problem acquires a large proportion for the manager, who needs to use his practical intelligence to adapt the rules to the local and organizational culture.

Attitudes that foster critical thinking in the face of the prescribed work represent an important way of coping with workers' mental health. This potential is the most effective way to deal with suffering or channel energy to maintain mental health and can be practiced in several ways (Vieira, 2014).

The organization's regulatory system is translated into the set of operating structures of its objectives methods, norms, sanction system, which activates unconscious coping strategies of workers. The structures of the organization both hierarchical and functioning represent an essential role in coping with unconscious collective feelings felt by the members of the organization (Macêdo, Silva & Mendonça, 2018).

The analyses showed that the computerization of processes in the institution is influenced by organizational culture. It was concluded that, even in a computerized process, based on a structured and formalized methodology through controlled vocabularies, standardization of standardized procedures, and sources of information, subjective aspects produce differentiated results.

The study showed great relevance in presenting the method of work psychodynamics in the development of the subjective mobilization of workers in the face of institutional pressures and the understanding of culture for the insertion of new technologies in organizations. The insertion of new technologies can influence the experiences of pleasure and suffering of managers, depending on the culture instituted in the organization.

When considering the accumulated information and knowledge, the importance of organizational culture during the process of implementation of computerized systems is highlighted, emphasizing that these systems have good acceptability in the market, but often diverge from cultural aspects, showing resistances that were sometimes relevant.

According to the research participants, the fact that there is a lack of cooperation between the areas of the institution is considered serious, compromising the development of the activities of everyone in the organization, especially with regard to computerized processes.

Despite the lack of cooperation and the use of defensive strategies to face the suffering coming from the work organization, there seems to be no risk of paralysis, because social recognition resignifies suffering and mobilizes managers to engage in the development of solutions to the problems faced in their work context.

The obstacles presented constituted data that pointed to the use of individual coping strategies such as self-centrism and isolation to deal with work overload, productivity collection, computerized systems, insertion of new technologies, and conflicting interpersonal relationships.

It was understood that the collective discussion spaces, carried out as suggested by Dejours (1996), provided the participants of this research with experiences of pleasure, therefore, their implementation in the institution would mobilize the collective strategies of these workers.

There is the possibility of future research to evidence the applicability of work psychodynamics for better cultural adequacy of technologies. Due to scheduling conflict and lack of availability of managers' time, or distance between municipalities, there were a large number of absentees from collective discussion space sessions.

The limitation of this study refers to the difficulty of reconciling the managers' agendas, which made it impossible for a greater number of participants. Even in view of the limitations, this research brought again to the academy, for the researcher and for the professionals who participated in this study, by identifying that many of the obstacles were related to conditions established by the culture of the institution and without understanding and taking it into account there will be resistances and conflicts as revealed.

Further studies are suggested with the implementation of the collective discussion space in order to mobilize collective strategies, characterizing the collective way of action of workers with the objective of transforming the work context for better productivity and mental health of workers. The continuity of research in relation to the applicability of psychodynamics of work continues to expand widely in Brazil and France.

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# Structuring Strategic Planning in a Public Organization: Application of the balanced Scorecard Method

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Received: 11 Nov 2020;

Received in revised form:

09 Jan 2021;

Accepted: 18 Jan 2021;

Available online: 23 Jan 2021

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**Keywords**—Strategic planning. Public sector.  
Professional Practice Management.

**Abstract**—Objective: this research aims to describe the process of implementing the Balanced Scorecard Method (BSC) in the Strategic Planning of Fundação Santa Casa de Misericórdia do Pará (FSCMPA). Method: qualitative, descriptive and exploratory study of document analysis. Result / discussion: it was possible to achieve with the BSC-based planning the definition of indicators and goals for management, construction and implementation of the institutional vision of mission, vision and value. Conclusion: the BSC presented an ordering of preexisting concepts and ideas in a logical, objective and intelligent way to increasingly strengthen the quality and patient safety policy and the hospital care policy with a focus on the constant search for excellence in care centered on person.

## I. INTRODUCTION

Organizations are implanted in a sphere characterized by transformations in which it becomes an essential point for understanding the progress of society, in general, and of organizations <sup>1</sup>. These environmental changes prepare these institutions to outline and institute strategies in order to guarantee the provision of quality services and enable organizational survival itself<sup>2</sup>.

The Strategic Plan can be understood as a process in which the organization, after establishing its objectives and purpose, projects what to do to achieve them and what it needs for that purpose <sup>3</sup>. It is an instrument widely applied in the management of organizations, considered

essential to provide the institution with the concentration of efforts in favor of a common benefit <sup>4</sup>.

In addition, strategic planning is focused on the broad, global and far-reaching view of the organization<sup>5</sup>. However, results-oriented strategic management focuses on tracking performance indicators to measure these results. This form of management is provided by the Balanced Scorecard - BSC <sup>6</sup>. Considered a strategic management alignment and control system based on the premise that the integration between the indicators will take the organization to a high level in relation to the established strategies <sup>7</sup>.

The significance of this theme is in the perception of the versatility of the method in being able to be adjusted

and structured by models aimed at public management, for conceptualizing considerable factors in addition to the financial aspect, for example, the perspective of internal processes, which aims to achieve excellent operations<sup>9</sup>. In addition, it is understood that the present study can contribute to debates on the applicability of the Balanced Scorecard in the public sector.

Thus, the object of study of this research is to analyze the application of this tool, of strategic management, carried out at Fundação Santa Casa de Misericórdia do Pará (FSCMPA), in order to know the agency's experience with the adoption of the Balanced Scorecard - BSC. Given the above, this study aims to describe the process of implementing the Balanced Scorecard Method (BSC) in FSCMPA's Strategic Planning.

## II. METHODOLOGY

It is a qualitative, descriptive and exploratory study of document analysis. Initially, a bibliographic search on the topic was carried out to gather information, based on evidence, in which it offers greater coherence to the final result of the study. Then, at the institution, meetings were held with health professionals of all hierarchical levels, in addition to people responsible for strategic planning, at various times, to build the process of implementing and using the BSC tool together with the institutional strategic map.

In addition, documentary exploration was used to collect secondary data from various sources made available by the FSCMPA, in an effort to make a historical reconstruction, through a deeper analysis of the documents related to the institutional development plan, on creation and development department, as well as its organizational structure.

The study aims to solve concrete problems by using an adaptation of the strategic management tool known as the Balanced Scorecard to the reality of management in a segment (hospital department) of a public institution. For this, the methodology of the BSC and its classification in the public sphere were investigated with the proposal of objectives to be used in the elaboration of a strategic planning.

As this is secondary data and literature review, the present study was exempted from the Informed Consent Form (ICF) by the institution's Ethics and Research Committee (CEP).

## III. RESULTS AND DISCUSSIONS

### CONSTRUCTION AND IMPLEMENTATION OF THE BSC METHOD AT FSCMPA

The beginning of the construction of planning based on the BSC began with the process of involving health professionals from all hierarchical levels, at different times, through workshops and debates, with the aim of thinking about the use of the strategic map as a management tool to be used in the organization's sustainability, in the qualification of management practices and in the resolution of both management and actions and services provided to the population.

In 2012, the Institution promoted the training of 05 senior management employees, who participated in the strategic planning course in the Balanced Scorecard - BSC method at the National School of Public Administration (ENAP) in Brasília / DF, who, upon returning, met with the collegiate hospital manager in order to expose the new methodology which was later adopted.

Soon after this achievement, the institution was called by the State Secretariat for Public Administration (SEAD) to participate in a meeting with the PUBLIX Institute, a company hired to consult with public hospitals in the planning area, among other areas.

PUBLIX held several meetings at both SEAD and FSCMPA with all interested parties and started what they "called" a review of the mission, vision, values and validated strategic map, where discussions were held about strategic perspectives and their respective indicators that made up the strategic map.

With PUBLIX leaving unexpectedly from the institution, the Planning Advisory in partnership with the Quality Management Advisory, took the lead in the process avoiding the discontinuity of the workshops.

According to Martins (2017), the strategy should not be an isolated management process in the organization, it must be continuous with a broader beginning in the mission, which translates individual actions into operational terms, aligning and providing support, as well as helping employees to understand why and how to support organizational efforts.

### CONSTRUCTION AND IMPLEMENTATION OF THE INSTITUTIONAL VISION OF MISSION, VISION AND VALUE.

At the beginning of 2016, under new management, committed to the Strategic Planning process and with a more mature view of strategic management, the current president supported the planning and quality teams to continue the process and together with the collegiate

manager and other managers and advisors, carried out the final review and validation of the institutional strategic map, where the main strategic objectives of the institution were defined. After this moment, in an innovative and participative way, the collegiate manager and the entire management body met in a place outside the institution, with a total of four meetings totally dedicated to reflection and debate, defining the strategies and tactical plans that make up the structure that balances the strategic map and defines the value for the institution

The tactical plans were aligned and management indicators and targets were subsequently defined,

components of extreme importance for the monitoring and evaluation of Strategic Planning.

Regarding the definition of the Institutional Vision, there were several debates to choose it. It points to where you want to go, what the organization wants to become (what will the company be?). Subsequently, the Organizational Values were defined which define the basic rules that guide the employees' behaviors and attitudes, they are rules so that, when executing the mission, the vision is reached (Figure 1).

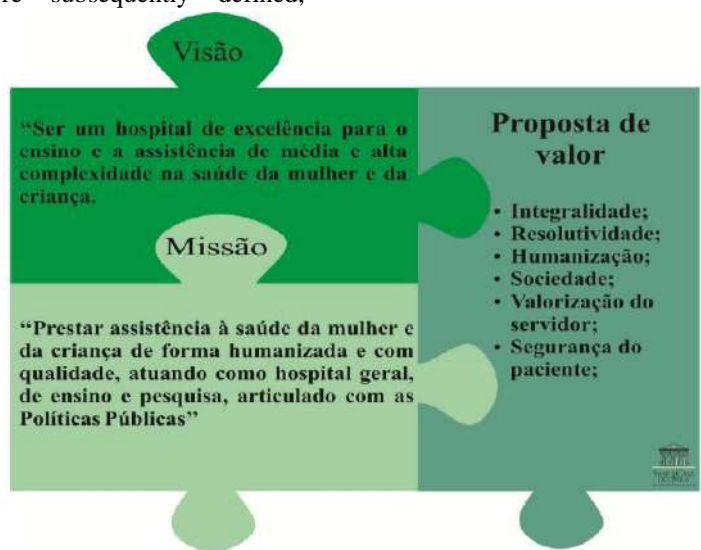


Fig.1: Institutional vision, Mission and Value.

Source: FSCMPA

### CONSTRUCTION AND IMPLEMENTATION OF THE STRATEGIC MAP

According to Filho et. Al. (2014), the map facilitates the communication of the strategy for the entire organization and the understanding by the employees that the objectives are interconnected and impact on each other with a cause and effect relationship. It also allows employees to easily understand how they can contribute to the execution of the strategy.

The strategic map is a visual management tool that is part of the Balanced Scorecard (BSC) method, created by researchers Kaplan and Norton with the aim of helping organizations to put their strategy into practice <sup>8</sup>.

In the general model, the strategy analysis is grouped into four major abstract perspectives: results, internal processes, learning and growth, thus including tangible and intangible assets (Figure 2).



Fig.2: Strategic Planning Map

Source: FSCMPA

The main objective of strategic planning is in the development of strategies that will guide the organization to obtain a better performance and, consequently, a better result; it is to guide and reorient the organization's business and products so that it generates satisfactory results <sup>11</sup>. The FSCMP chose to work on its map from the perspective of Results, Internal Processes, Learning and Growth. In addition to including economic sustainability as a strategic objective within the perspective of results, as it understands that, being a public administration body, it does not aim at the top, profitable growth or economic profitability, working intrinsically in the financial perspective with a focus on results and society.

The great challenge is to be able to generate results with impacts that justify public investments in this area, with investments of resources in the face of health demands, effectively contributing to the improvement of the population's living conditions <sup>12</sup>. The public institution faces problems in implementing and implementing a management tool such as Strategic Planning, aligning institutional policy and its guidelines as a health organization, government policies, whether Federal, State or Municipal, within the scope of SUS and ratifying that as public health managers.

#### MONITORING SYSTEM

At the end of 2016, a Strategic Management - MV system was acquired with the modules: BSC, KPI, project management, documents, risks and occurrences, essential to develop an integrated management policy, where the actors involved will do the feeding, monitoring and real-time evaluation of its indicators, projects and action plans, which according to Silva and Gonçalves (2011) will provide subsidies for the integration and standardization of information, interaction of processes and services and transparency in results.

The system covers all the information necessary for the step-by-step of strategic planning to be fulfilled, that is, it is possible to have on hand through access with individual login and passwords, in real time, the deployment of qualitative and quantitative results and the status of these results, with information in percentages of execution and with the warning light, which indicates whether the result of the indicator and / or the projects are within the favorable (green), stable (yellow) or unfavorable (red) range.

#### COCKPIT

System for monitoring the performance of both strategic and operational indicators, previously agreed with the directors and managers.



Fig.3: Strategic and Operational Indicators

Source: FSCMPA

CONSTRUCTION OF THE STRATEGIC MAP WITH LIGHTING MONITORING

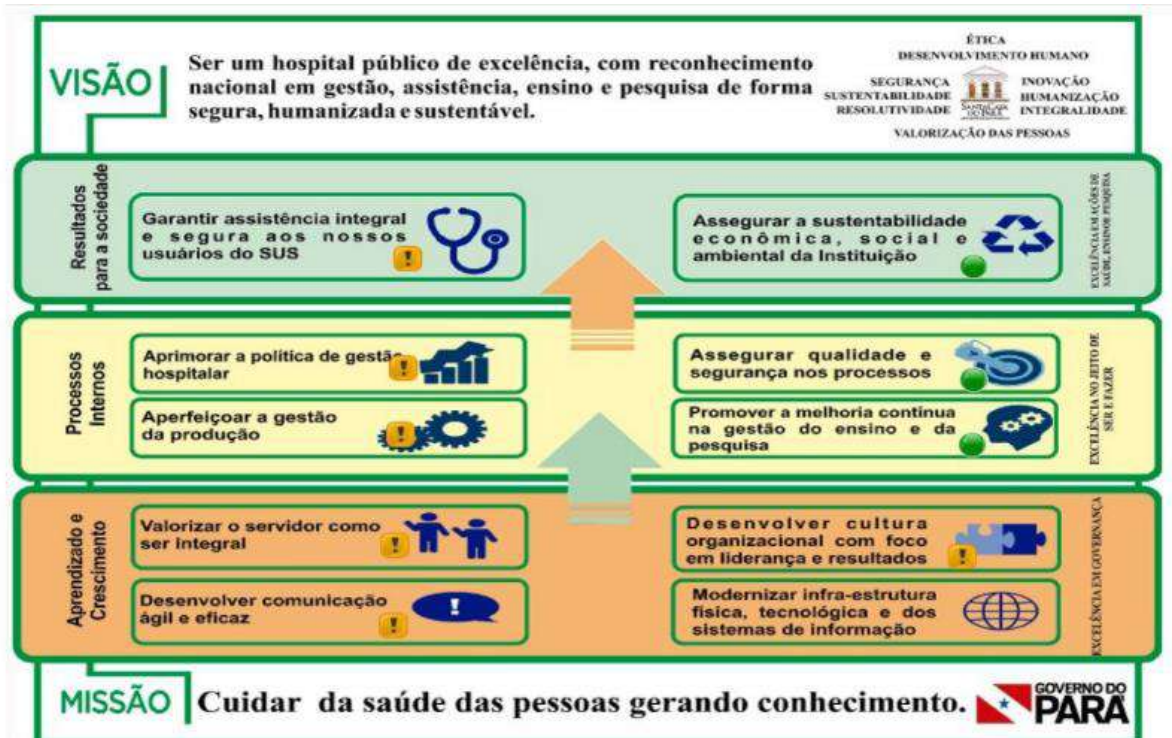


Fig.4: Strategic map with monitoring beacon.

Source: FSCMPA

STRATEGIC PANEL CONSTRUCTION

Strategic panel was developed with the objective of monitoring the progress of projects in real time through the

system. According to Almeida (2018), this allows greater agility in decision making, as well as improving the monitoring of the execution of the agreed projects.



Fig.5: Project Monitoring.

Source: FSCMPA

IV. FINAL CONSIDERATIONS

Strategic planning is a challenge for all types of organizations, in the health sector this challenge is even greater, aligning strategic objectives with the principles and guidelines of the Unified Health System - SUS, considering the country's financial reality, seems something intangible, however we observe This is not impossible, as we have found that a team that is properly prepared and makes use of appropriate planning tools is able to overcome the most exorbitant obstacles.

The Santa Casa de Misericórdia do Pará Foundation - FSCMPA has always sought to overcome difficulties in order to offer the population of Pará safe and quality assistance, using different means and strategies. Since 2015, FSCMPA, under the responsibility of the Planning, Budget and Management Directorate, has acted with a strategic management model based on patient quality and safety, deploying its strategic planning using the Balanced Scorecard method tool.

With that, it can be said that the BSC presents an ordering of pre-existing concepts and ideas in a logical, objective and intelligent way. Its correct application implies a series of benefits, such as the integration of financial and non-financial measures, communication and strategy feedback, linking the strategy with planning and budgeting, ensuring focus and organizational alignment, among others. However, it cannot be considered as a

Panacea and as the only alternative to all the evils of strategic planning and strategic management.

Over the years, FSCMPA has been investing in its human capital, mainly in those responsible for management, permanent education is a goal that must be pursued by all organizations that aim at the process of continuous improvement. Currently, senior management, assistance and technical staff are involved in training related to hospital certification by ONA, Strategic Planning Revisitation workshop aligned with PPA 2020/2023, discussions include the organization's ideology (mission, vision and values), in line with the health policy of the Unified Health System - SUS.

For this quadrennium, the institution has been emphasizing the proposal to work efficiently, doing more with less. The proposed strategic projects ensure objectives in order to optimize hospital costs, reduce electricity and water consumption, standardize the use of technical materials and medicines, improve hospital billing and fundraising.

In addition, to reinforce building maintenance and refrigeration in the centenary building, increase security in the hospital, carry out the sizing of personnel, implement the management policy by competence with a focus on valuing and developing people.

However, the strengthening of the institution becomes increasingly stronger in the quality policy, patient

safety and hospital care policy with a focus on the constant search for excellence in person-centered care.

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# A Review on Structural Wood I- Joists Section

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Received: 18 Nov 2020;

Received in revised form:

11 Jan 2021;

Accepted: 15 Jan 2021;

Available online: 24 Jan 2021

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**Keywords**— I-joists, buckling capacity, FEM models

**Abstract**— In this review paper to analysis of the structural wood –I joist section also determine the bearing capacity of I – Joist section. In a circular holes in the webs of wood I – Joists for the remediation techniques used for evaluation. In this review study also investigation of elastic tensional Buckling capacity of wood I –Joists.

## I. INTRODUCTION

Wood composite I-joists represent a sizeable portion of new residential construction floor systems. I-joists are created from solid sawn, or more commonly, structural composite lumber (SCL) flanges connected with an oriented strand board. As the complexity of residential housing increases, wood I-joists are being used in various configurations, including longer span distances and continuous and cantilevered beams. The OSB web element constitutes a thin walled structure.

## II. LITERATURE REVIEW

**1. Rémi St-Amour, Ghasan Doudak (2017):-** In this paper the elastic lateral torsional buckling capacity of wood I-joists. A sensitivity analysis determined that the orthotropic material properties that affect the critical buckling load of wood I-joists are the longitudinal modulus of elasticity, The transverse shear modulus of the flanges and the elastic modulus of the web.

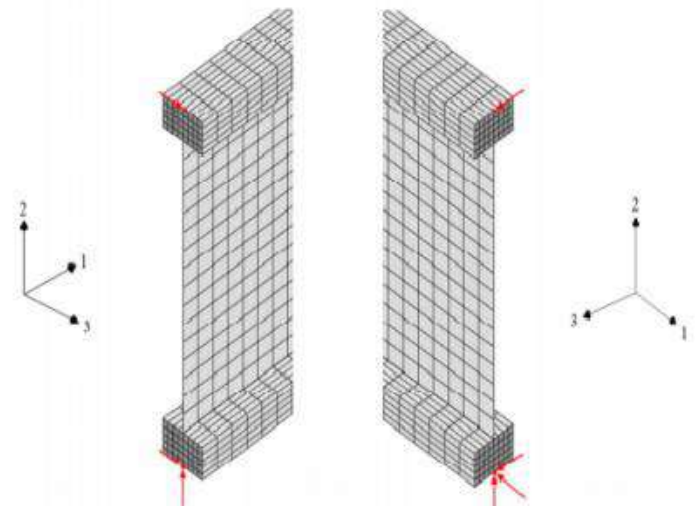


Fig. 1: Inactive Translational Dofs (Red Arrows) at Each End of A Simply Supported Wood I-Joist, Rémi St-Amour, Ghasan Doudak, 2017



Fig. 2: I-Joist Torsional Rigidity Test Configuration for Whole I-Joist, Rémi St-Amour, Ghasan Doudak, 2017

**2. Amjad Islam, Tatek Debebe, Stephen U. Nwokoli (2011):-** In this research study the bearing capacity of wood based I-joists was analyzed. To determine the

bearing capacity of I-joists by using the finite element software.

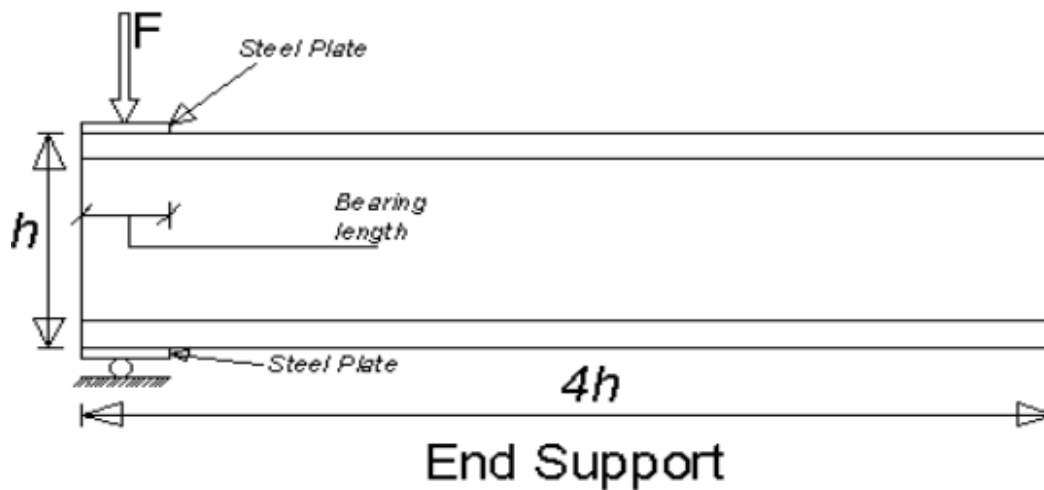


Fig. 3: Support And Load Conditions, Amjad Islam, Tatek Debebe, Stephen U. Nwokoli, 2011

**3. Rémi St-Amour (2016):-** In this study on experimental investigation on material properties and critical buckling load of 42 wood I - Joist. FE model is used to reproduce

the nonlinear buckling behaviour of the wood I- joist and provide an accurate estimate of the lateral torsional buckling capacity using the linear buckling analysis.

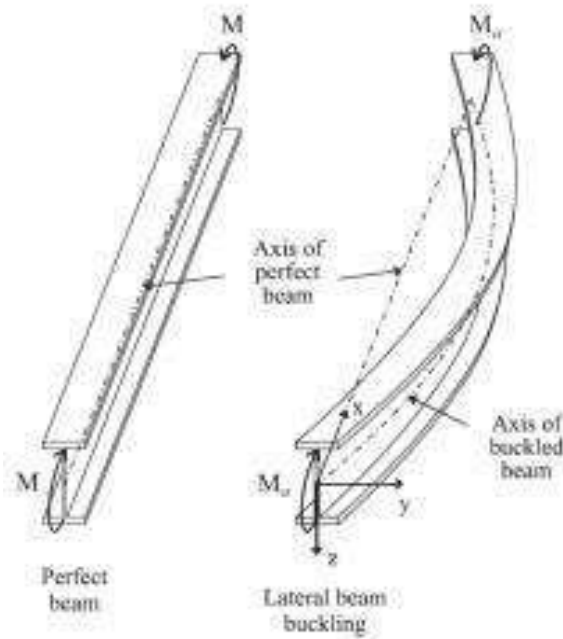


Fig. 4: I- Section Undergoing Lateral Torsional Buckling, Rémi St-Amour, 2016

**4. Tiberiu Polocoser, Thomas H. Miller, and Rakesh Gupta (2013):-** In this paper was to Evaluate of Remediation techniques for circular holes in the webs of wood –I Joists. Seven remediation techniques was

investigated initially and remediation effectiveness was evaluated on the basis of Strength, Stiffness and ease of installations cost.



Fig. 5: Examples of Holes In Wood I-Joists, Tiberiu Polocoser, Thomas H. Miller, And Rakesh Gupta, 2013

**5. Benoît Pelletier (2017):-** To investigate the lateral torsional buckling of wooden I-joists. In a numerical 3D model was also developed using commercially available

finite element program ABAQUS to determine the buckling loads and associated mode shapes of joists similar to those tested. In a FEM model was capable of

predicting the buckling load of wood I-joists with various end conditions and initial imperfections with reasonable accuracy.

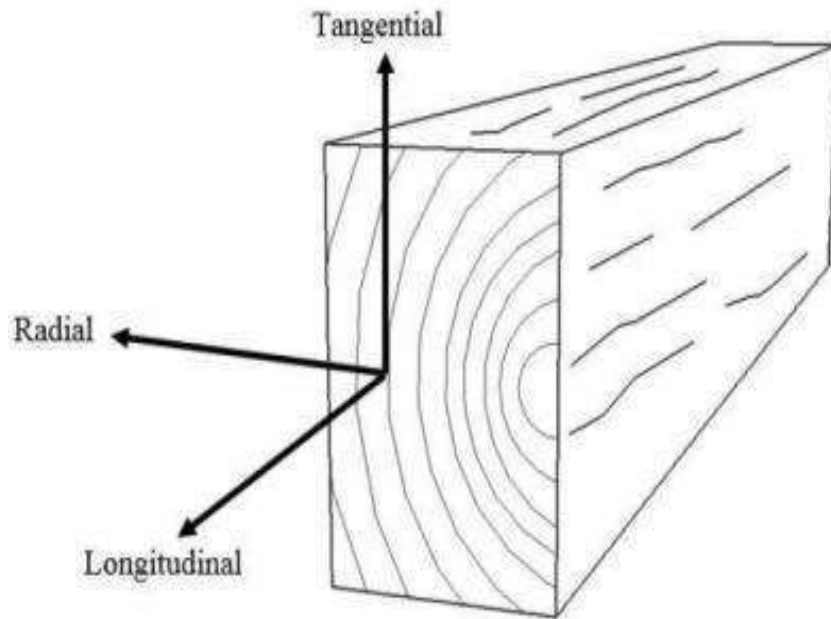


Fig. 6: Wood Orthotropic Principal Axes, Benoît Pelletier, 2017

**6. Joseph A. Yura (2001):-** In this paper is to be provide a fairly comprehensive view of the subject of beam stability bracing. The following factors that are affect bracing

requirements will be discussed and Proposed design method.

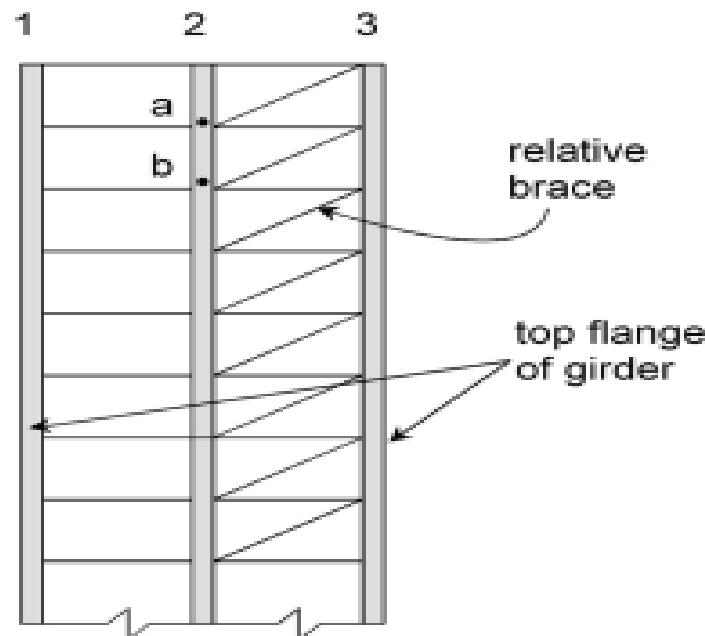


Fig. 7: Relative Bracing, Joseph A. Yura, 2001

**7. Patricio quintana gallo and david carradine (2018):-** In this review study to cover experimental / Numerical research and built applications connection between

element and design methodology related to hybrid timber structures.



Fig. 8: Single Hybrid Frame Type, Patricio Quintana Gallo and David Carradine, 2018

### III. CONCLUSION

In these review studies of structural wood I- joists section to analyze the behaviour of Wood –I Joist Member and also the properties of Wood I- Joists Section.

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# Dentistry biosecurity during the SARS-CoV-2 pandemic: What should we know?

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Received: 06 Nov 2020;

Received in revised form:

13 Jan 2021;

Accepted: 19 Jan 2021;

Available online: 24 Jan 2021

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**Keywords—** Containment of  
Biohazards, Coronavirus, Cross  
Infection, Dental Offices.

**Abstract—** The new coronavirus infection, also known as SARS-CoV-2, affects especially the respiratory tract and it has been a challenge to face it in a lot of countries, since the disease has no specific treatment and leads to a multidisciplinary care for those infected. Health professionals are classified at high risk, as they are in close contact to these patients. Among those professionals, dental surgeons represent the professionals at most risk, due to their work area being in close contact with the respiratory tract and the production of aerosol generated by the office equipment, which dissipates microscopic virulent particles through the air. In this review, instructions issued by health institutions were collected in order to inform health professionals, especially the dental surgeon, about the correct dressing and hygiene that must be performed in the dental office. Finally, it was concluded that professionals are well supported and receive the necessary guidance to continue working during the pandemic. In addition, following biosafety protocols and regulatory guidelines has shown positive results against the spread of the new coronavirus, protecting professional and patients.

## I. INTRODUCTION

In December 2019, cases with clinical symptoms of pneumonia, of unknown origin, were reported in Wuhan, province of China [1]. Analyzes carried out through the collection of biological materials from the respiratory tract of those infected showed that the infection was being caused by a new virus of the Coronavirus family [2].

Coronaviruses form a group of viruses encapsulated with genetic material formed by non-segmented, single-stranded RNA in positive direction, known to cause infections in both animals and humans [3].

SARS-CoV-2, which causes the Covid-19 pandemic, is zoonotic and also pathogenic, making it one of the coronavirus species that can potentially be transmitted from an animal to a human host. These properties, as well as long period of time that humans and animals spend close to each other, allow the virus to spread to different

hosts at a rapid rate, resulting in global or regional outbreaks [3].

The first cases identified as caused by the new coronavirus were linked to Wuhan food sector market and, after the collection of biological materials, it was suggested that the city may have been the source of the pandemic or played a crucial role in its spread. After performing the genetic sequence analysis, it was found that SARS-CoV-2 originates from bats, with no evidence of laboratory manipulation, since its genomic sequence would show the fusion of previously known viral elements [1].

Although, in the beginning, the virus was confined only to China, after 3 months it had already spread to 157 countries. Therefore, in order to contain the further spread of the disease, several countries have banned travel, social gathering and ordered the closure of schools [4].

During the onset of the disease, the most common symptoms are fever, dry cough, myalgia of fatigue, in addition of the appearance of less common symptoms, such as sputum, headache, diarrhea and the presence of blood in the sputum [2]. In more severe cases, organ dysfunction, cardiac and renal damage occurs and, in some cases, the patient dies [5].

Due to the high spread of SARS-CoV-2, health professionals are at a greater risk of becoming infected [6], especially dentists [7]. Dental offices present a high risk of transmission of the virus, as they have high-speed instruments that can generate aerosol [6,8]. Therefore, the dentist and his team are placed in a high category regarding the chance of exposure, as they work close to the respiratory tract [9].

Official institutes, such as the Federal Council of Dentistry (CFO) and Regional Councils (CROs), issued a series of instructions in order to assist the dentist during the service, informing about the personal protective equipment (PPE) that must be used and instructing on the correct hygiene of the instruments and the dental office, in addition to adding new topics to be performed during the anamnesis correlated with signs and symptoms related to the infection by the new coronavirus [10,11].

Thus, this study aimed to review scientific works, handouts and manuals of the Brazilian dental councils, as well as regulations of the Ministry of Health in Brazil, showing the importance of care regarding biosafety in dentistry, targeted care in facing the new coronavirus pandemic and changes in regulations and biosafety of dental clinics.

## II. METHODOLOGY

An electronic literature search was performed using PubMed, Google Scholar, Scielo and Lilacs. The search was limited to article published from 2012 to 2020, including articles about other coronavirus and SARS-CoV-2, especially those about dentists and cross infection with SARS-CoV-2, using keywords such “coronavirus origin”, “coronavirus transmission”, “coronavirus and dentistry” and “cross infection dentistry”.

## III. RESULTS AND DISCUSSION

### SARS-CoV-2 origin

As mentioned before, coronavirus are viruses enveloped with RNA with simple strips and in positive direction [12]. According to the genome structure of each virus in the family, they are subdivided into alpha, beta, gamma and delta, which are the main groups. Thus, alpha

and beta coronaviruses are capable of infecting only mammals, with clinical respiratory symptoms common in humans and symptom of gastroenteritis in animals [13].

Of all the coronaviruses, before the start of the pandemic in late 2019, only six of them were known for their ability to cause infections in humans, so HCoV-NL63, HCoV-229E, HCoV-OC43 and HKU1 are capable of causing clinical symptoms similar to colds in patients with immunological chances and the other two viruses were previously known to cause pandemics, namely the Severe Acute Respiratory Syndrome coronavirus (SARS-CoV) and the Middle East Respiratory coronavirus (MERS-CoV) [4].

The first pandemic caused by this group of viruses occurred in November 2002, with SARS-CoV as the etiological agent, which originates in the Chinese horseshoe bat and the civet as an intermediate host and, finally, reaches humans [14]. SARS-CoV has an incubation period of 4 to 6 days, with the appearance of symptoms similar to those of pneumonia, such as fatal respiratory failure and acute respiratory distress syndrome [15]. This virus infects multiple organs, causing systemic disease and the symptoms worsen as the virus is eliminated, which suggests an alteration of the immune system due to the pathogenesis of the SARS-CoV [16].

MERS-CoV, also caused by a coronavirus, emerged in 2012 in Saudi Arabia, with symptoms similar to SARS-CoV, in addition to also originating in bats, it uses dromedary camels as intermediate hosts and, finally, reaches humans [17]. In this case, the transmission from person to person is more limited, however, MERS-CoV caused major outbreaks in Saudi Arabia and South Korea, presenting more than 2,000 cases worldwide and with a mortality rate of 35% [18]. The elderly and patients with some type of comorbidities usually develop more severe and more fatal conditions of the disease [19].

Previously to the Covid-19 pandemic, all other coronaviruses that caused infections in humans had animal origin, usually bats and rodents [20]. SARS-CoV were transmitted from civet cats to humans, while MERS-CoV was transmitted from dromedary camels to humans [21].

Coronaviruses in the human body spread through the mucosa of the respiratory tract to other cells in the body. SARS-CoV-2, specifically, affects peripheral blood and immune system cells, especially the lymphocyte, as most patients have reduced lymphocyte numbers [22].

SARS-related coronaviruses are covered by spike (S) proteins that contain a variable receptor binding domain (RBD). RBD binds to the angiotensin-2 converting enzyme receptor (ACE-2), which is located in the lungs, gastrointestinal tract, kidneys and heart. Thus, the virus

binds to human cells [21,23]. The phylogenetic evaluation of SARS-CoV-2 showed that spike (S) protein binds weakly to the ACE-2 receptor, unlike SARS-CoV, which binds to the human cell receptor more strongly. And despite that, the link between the SARS-CoV-2 spike protein and ACE-2 is still much higher than the threshold needed to cause the infection [22]. However the RBD present in the SARS-CoV-2 spike (S) protein causes weak connections with ACE-2 receptor of human cells, demonstrating that the virus needs an intermediate host before reaching the human, which causes a reduction pathogenicity and reproduction number [23].

It is believed, therefore, that SARS-CoV-2 also originates from bats, once it has mutated and become unable to use other animals as hosts. This mutation increased the interaction between RBD and ACE-2 enzyme in humans, as well as in animals such as the pangolin. Therefore, it is believed that pangolin is the intermediate host of SARS-CoV-2 [24].

**Relation between dentists and cross-infection with SARS-CoV-2**

Coronaviruses are usually disseminated through respiratory droplets and there is a difference in relation to the size of droplets and their spreading radius [25]. According to the same authors, larger droplets tend to fall to the group near the individual who eliminated them, being potentially contagious if intercepted by another healthy individual before reaching the ground or surface,

their area being limited to a distance of 2 meters. However, as stated by RABI *et al.* [4] smaller droplets can float and move according to drafts.

Transmission through droplets, according to the World Health Organization [1], occurs through close contact of at least 1 meter between individuals and, therefore, there is a great risk of exposure. In addition, there are reports of transmission by indirect contact, that is touching inanimate surfaces contaminated with the subsequent act of bringing the hands to the nose and mouth [26].

The mouth is an environment full of microorganisms that can be transferred, through fluids, for other places and cause infection in other individuals [27]. The pathogen microorganisms route is called cross infection, which will occur by the transference of contaminated blood, saliva and instruments [28]. In dentistry, the infection risk with the new coronavirus is high, since the virulent particles present in the patient’s oral fluids can cause infection in other individuals, mainly by spreading through the aerosol [6].

Thus, when performing dental care, numerous saliva particles can come off, such as during friction between the tooth, which makes it necessary to use water cooling [29] and consequently the possibility of a cross infection. GE *et al.* [30] outline the routes of transmission of aerosol particles that can occur during dental care, demonstrating the path that particles potentially contaminated by SARS-CoV-2 can follow (Figure 1).

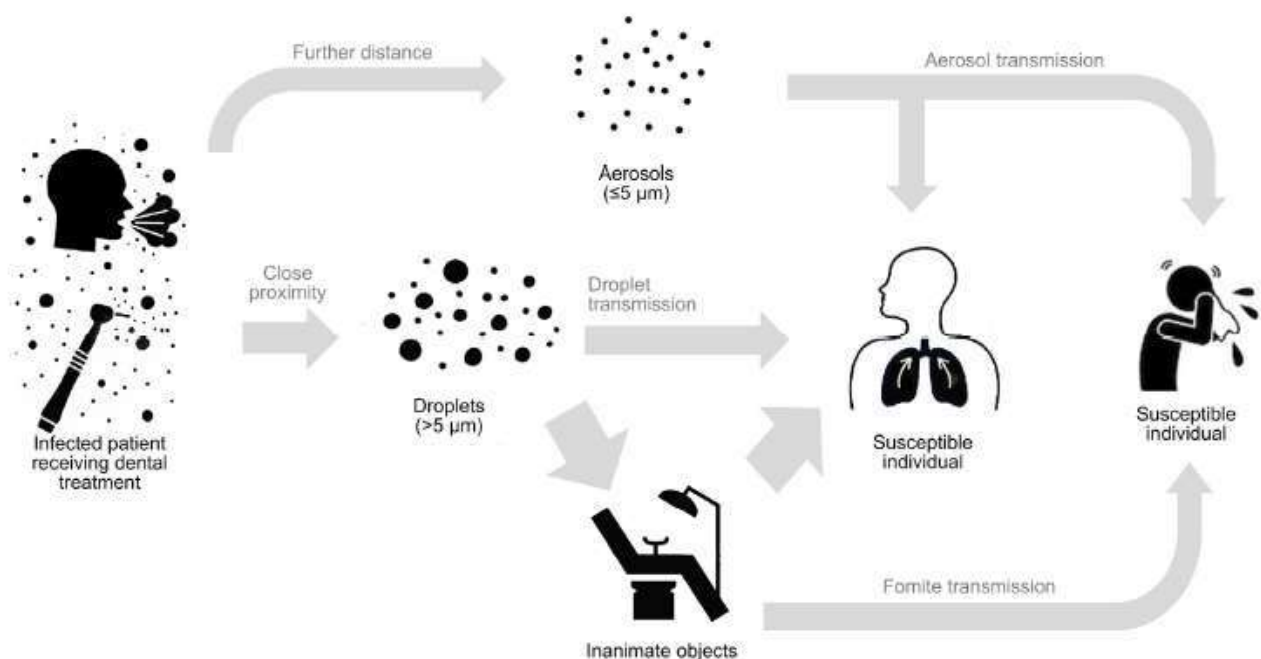


Fig.1: Aerosol droplets routes, coming from oral cavity and instruments, that reach inanimate objects and susceptible individuals [30].



According to Jones and Brosseau [31] water can generate aerosol, which turns to be are suspended in the air and carry pathogens [32]. The greatest sources of aerosol generation in dental clinic are ultrasonic devices, high-speed hand pieces, air turbines, triple syringes and air and water syringes [33]. And all of those can be sources of cross-infection and lead to the spread of the new coronavirus. The study of FEARS *et al.* [34] indicates that the new coronavirus survives 16 hours in the aerosol, which reinforces the need for protection using mask and air filtration.

Thus, dentists during the service are great risk of cross infection, since there is the possibility of virulent particles being floating in the air, which demands even more attention in relation to air filtration and the correct

use of personal protection [35]. WU *et al.* [36] also states that there is a change in the behavior of patients and a change in the need for care in face of the pandemic.

The SARS-CoV-2 incubation period has been reported between 2 to 10 days, which promotes dissemination through body fluids, droplets or contact with contaminated surfaces [26]. Besides that, studies report that human coronaviruses can persist on inanimate surfaces for up to 9 days [26] and SARS-CoV-2 can remain on contaminated saliva for up to 24 days [37]. In addition, there is the persistence of the virus on patient's saliva, which indicates that the dentist should treat all patients as potentially contaminated [10]. Table 1 shows the average persistence time and survival of the new coronavirus in different locations.

Table 1: Persistence of Covid-19 in different kinds of surfaces, saliva and blood.

Surface and fomites	Persistence	Reference
Plastic	3 days	van Doremalen <i>et al.</i> [38]
Cooper	4 hours	van Doremalen <i>et al.</i> [38]
Stainless steel	3 days	van Doremalen <i>et al.</i> [38]
Glass	2 days	Chin <i>et al.</i> [39]
Cloth	1 day	Chin <i>et al.</i> [39]
Surgical mask-inner layer	4 days	Chin <i>et al.</i> [39]
Surgical mask-outer layer	7 days	Chin <i>et al.</i> [39]
Paper	30 minutes	Chin <i>et al.</i> [39]
Cardboard	1 day	van Doremalen <i>et al.</i> [38]
Saliva	24 days	Federal Council of Dentistry (CFO) [10]
Blood	16 days	Liu <i>et al.</i> [40]

Therefore, it is essential to perform disinfection of surfaces of the clinical environment [8], so that the dental clinic does not become a source of dissemination of the new coronavirus.

**Biosecurity protocols in dental office after pandemic**

As countermeasures against Covid-19, the regional (CRO) [11] and federal (CFO) [10] dentistry council, as well as the Ministry of Health [41], established a set of biosafety rules, such as use foot and hair protection, surgical masks and N-95 or FFP-2 mask, eye protection and gloves (Figure 2). Barroso Vilarinho *et al.* [42] showed the importance of correct vesting during procedures in health area, covering most of the body and mainly the face, preventing particles

from entering in the respiratory tract. N95 and FFP-2 masks contain a particulate filter and it is used to protect the individual from inhalation of particles contained in aerosol [43]. The Federal Council of Dentistry and the Ministry of Health [10,44] point out that it is essential to use the correct attire of all dentists, not only the traditional personal protective equipment, but also including N95 or FFP-2, as well as face shield, goggles, foot protection, lab coat and gloves.

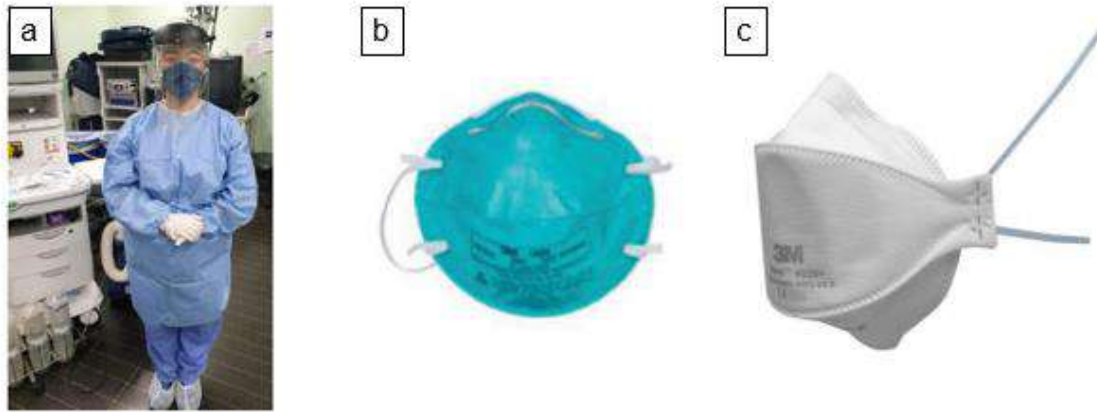


Fig. 2: a: Professional wearing protection for health area service. Mask N95 or FFP-2, gloves, face shield, vestments and foot protection <sup>[42]</sup>; b: Mask N95 <sup>[45]</sup>; c: Mask FFP-2 <sup>[46]</sup>.

According to CFO <sup>[10]</sup>, dentists must use personal protective equipment (PPE) suitable for any type of care. Therefore, a cap, goggles, gloves, surgical mask and N95 mask, surgical gowns, visors and properly closed shoes are necessary <sup>[47]</sup>. However, as stated in literature <sup>[6,8,30,35,36,48]</sup>, PPE use is already mandatory in several dental procedures, as they are measures of biosafety and control of various cross-infection.

Hand hygiene is of paramount importance and must be done before and after contact with patients <sup>[10]</sup>. This measure became the standard biosafety procedure, along with sterilization of instruments and cleaning of inanimate surfaces <sup>[6,26]</sup>. Using 70% to 90% alcohol-based gel is recommended in addition to cleaning with alcohol-based handrub (ABHR) or soap and water <sup>[49]</sup>.

Another point that was noted by the CFO <sup>[50]</sup> is that there was a change in the way patients were treated in dental clinics after SARS-CoV-2 pandemic. According to the same council, the new measures adopted must be extended beyond the period of control and eradication of the virus.

For dental care, several rules have been determined by regulatory institutions, such as before they attend the clinic in person, the need for telephone screening was established, to seek as much information about patient's general health and habits, as well as family members <sup>[47]</sup>. According to PENG *et al.* <sup>[37]</sup>, when a patient arrives at clinic, some initial care is performed, such as the measurement of body temperature and if it is higher than 37.3°C, it is recommended to reschedule the appointment. The Ministry of Health <sup>[44]</sup> states that the newly cured patients of Covid-19 should wait 10 days for the return of dental treatments and thus avoid the transmission of SARS-CoV-2. This information is collaborative with the guidelines issued by the same agency, which guides the

transmission of new coronavirus within 14 days after infection.

The American Dental Association (ADA) <sup>[51]</sup> recommends that the waiting room remains empty, without magazines and avoiding consultations that allow meeting between patients. To avoid possible disorders, it is important for the patient to sign the agreement of treatment and his/her responsibility regarding the information provided during screening <sup>[7]</sup>.

Another biosafety standard adopted by competent institutions in dealing with pandemic is using mouthwash before treatment, which reduces the amount of oral microorganisms <sup>[30]</sup>. This procedure has long been advocated in dental care, as stated by KOHN *et al.* <sup>[52]</sup>, that mouthwash is a microbial control measure and it is extremely important to prevent cross-infection. PENG *et al.* <sup>[37]</sup> presented studies reporting the efficacy of mouthwash made with 1% hydrogen peroxide or 0.2% iodine-povidone against SARS-CoV-2.

As a coping measure, procedures that can stimulate salivation or cough should be avoided, such as using triple syringe and intraoral radiographic examinations <sup>[53]</sup>.

Some chemicals are capable of inactivating SARS-CoV-2 from surfaces. Studies have shown that propanol, sodium hypochlorite and ethanol have an efficiency percentage of 80% to 95% <sup>[26]</sup>. Besides, other studies cite substances that are also effective but inferior to those previously mentioned, which are 0.05-0.2% benzalkonic chloride and 0.02% chlorhexidine digluconate <sup>[54]</sup>. QUEIROZ *et al.* <sup>[55]</sup> carried out a study that states a possible application of photodynamic therapy on decontaminating surfaces and coping with SARS-CoV-2. To remove and filter contaminated air from environment, there is high efficiency particulate air (HEPA) a suppressor

filter that removes 99.97% of particles with 0.3 micrometers in diameter and can be used in dental environment [56].

Therefore, care with dressing and hygiene in dental office are essential to minimize chances of a cross-infection of Covid-19. Dentists must ensure his team and patient's safety, analyzing the needs of each case and advising patients about forms of protection [44].

### **Involvement of dentists in Covid-19 pandemic: what is happening**

A survey carried out in the first half of 2020 by the Federal Council of Dentistry [57], which included around 40 thousand dentists from all over the country, reported that 82% of the professionals interviewed continue to exercise their clinical activities during the pandemic period. In general, of all professionals interviewed, 72% attend according to the guidelines prescribed by the health agencies, 10% of them continued their care without any type of extra restriction and 18% stopped working during this period. The CFO also emphasizes the importance of taking biosafety measures in addition to those already performed routinely to ensure professional, team, and patient's safety, to avoid spreading the virus [57].

In addition, according to CFO, dentists, dental assistants and technicians in oral health are health professionals who work on the front lines fighting against coronavirus who have the lowest rate of infected. In July 2020, Brazil had a total of 1,603,055 people infected, which 2,737 were dentists and 1,852 were technicians and assistants in oral health. This occurred due to issuance of recommendations written by CFO and Ministry of Health, in order to provide information about necessary biosafety, measures and also to instruction to attend only urgencies and emergencies in dental clinic [50].

The dental practice, therefore, puts professionals and patient at risk, since there is an amount of body fluids in oral cavity, such as blood and saliva [58], which can be contaminating sources of the new coronavirus [59]. According to WU et al. professionals must pay attention to the real need to perform procedures that generate aerosol, since these procedures can increase the chances of cross-infection. According to the same author, professionals must keep in mind the possibility of carrying out pharmacological treatment, in cases where there is no seriousness and urgency, to avoid possible sources of contamination [36].

Furthermore, according to MARET *et al.* [60], telemedicine should be applied to dentistry during this period, since professionals in the field are those at most

risk of infection. Therefore, according to the author, sending images of photographs of lesions present in patient's oral cavity becomes a way to make a diagnosis and assist the patient, besides this format can assist in more severe treatment due to communication between dentists and referral in urgent and emergency cases.

## **IV. CONCLUSION**

The infection caused by the new coronavirus or SARS-CoV-2 impacts society and scientific world, since there is still no effective therapy for its treatment. Protective measures of social distance and biosafety protocols prove to be fundamental to prevent spreading the virus, especially during clinical and dental treatments. Thus, guidelines from responsible institutions are of paramount importance in guiding dentists and other related professionals.

The dental surgeon, being the professional most exposed to a possible infection during the exercise of his profession, must be well informed about the new rules that must be followed during the service, not only for dressing, but also for cleaning equipment. So that all working professionals pay attention to care that must be taken during clinical procedures and protect themselves, their team and patients. And with all of that, help to interrupt the transmission of SARS-CoV-2.

## **ACKNOWLEDGMENTS**

The authors wish to thank Universidade Estadual do Norte do Parana - UENP, Jacarezinho, Parana.

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# Changes in the Chemical Characteristics of Latosol Associated with the Application of Ash and Organic Compost in an Area under Cultivation of Sugarcane

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Received: 19 Nov 2020;

Received in revised form:

07 Jan 2021;

Accepted: 17 Jan 2021;

Available online: 24 Jan 2021

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**Keywords**— residue, fertilization, nutrient.

**Abstract**— The aim of this study was to evaluate the transport of metals in three different depths of a vegetated soil with cane sugar, organic compost as fertilizer using and bagasse ash. The experiment was conducted in areas of a sugarcane mill in the central state of Goiás, Brazil. Six areas were sampled at five points each and at different depths (0-60 cm). Were evaluated the concentrations of metals in the soil, such as P, K, Ca, Mg, Cu, Mn and Cr, beyond the parameters of soil fertility, P, organic matter, pH, H + Al, K, Ca, Mg, CEC, sum of bases (SB), base saturation (V) and aluminum saturation (m Al). At the end of these analyzes, the data were subjected to analysis of variance and regression. The results for the fertility of the soils indicated that in general nutrient levels were higher for the topsoil. The application of gray promoted significant ( $P < 0,05$ ) in total concentrations of Cu, Mn and Cr in soil at three depths studied and Mg at intermediate depth (20-40cm). Different years of application of organic compost influenced only the total concentrations of P and Cu in the topsoil. While in subsequent layers, there are significant differences only for K and Ca in layers 20-40cm and 40-60cm, respectively.

## I. INTRODUCTION

According to Conab (2020), the area cultivated with sugarcane in the Brazilian crop 2020/2021 is estimated at approximately 9.87 million hectares and is expected to grind 630.71 million tons of sugarcane, distributed in all producing states. For each ton of sugarcane are generated about 260 kilos of bagasse which, when burned in boilers, produces approximately 6 kilos of ash, which contains about 77% of quartz sand and coal powder. Thus, there are approximately 3.78 million tons of ash available in the sugar and alcohol industry of the country.

Several studies report that sugarcane ash is rich in macro and micronutrients such as K, Ca, Mg, P, S, Fe, Mn, Zn and Cu (ANGUISSOLA *et al.*, 1999; OLANDERS & STEENARI, 1995; OLIVEIRA *et al.*, 2010; FARINELLI, MUSSI, MANCINI, 2017). In this context, ash can replace all or part of mineral fertilization and liming, depending on

the nutritional balance of the soil and the need for a given crop, according to its level of productivity (SALEQUE *et al.*, 2004; LEE *et al.*, 2006; FERREIRA *et al.*, 2012).

However, this agro-industrial waste can also cause environmental problems related to its inadequate disposal in the soil. Elements such as Zn, Cu, Cd, Cr and Pb, when applied to the soil, can become potential sources of contamination of terrestrial and aquatic ecosystems. Therefore, in recent years, several studies on the leaching of metals from soil and ash mixtures have been carried out (EDIL *et al.*, 1992; CREEK e SHACKELFORD, 1992; BILISKI e ALVA, 1995; ZHAN *et al.*, 1996; GUSTIN e THOMES, 1997; GHOSH e SUBBARAO, 1998; KAMON e KATSUMI, 1999; HEEBINK e HASSETT, 2001; NISTI, 2016; MARTINS *et al.*, 2019).

The hypothesis of this work is that the concentration of metals from the application of ash and compost decreases with the time of application in soil

cultivated with sugarcane. Following this line, the objective of the study was to evaluate the transport of metals at three different depths of a vegetated soil with sugarcane, using as fertilizer organic compost and bagasse ash.

## II. MATERIAL AND METHODS

The experiment was carried out in commercial areas of a sugar-ethanol plant in the central region of the state of Goiás. The soil of the studied areas is classified as RED LATOSOL (EMBRAPA, 2018). According to Köppen's climate classification, the climate in the place is classified as Aw, rainy tropical, savannah, having sub-humid character, with two well-defined seasons: a drought, lasting four to five months, and another rainy, usually occurring between late September and April. The maximum temperature is between 34°C and 36°C, and the minimum between 0°C and 4°C. Annual isotherm ranges from 20°C to 22°C, with average annual rainfall ranging from 1,500 to 2,000 mm.

The experimental design used was randomized complete blocks, with six treatments and five replicates. The treatments consisted of different years of consecutive applications of organic compost based on filter and ash cake, and one year of ash application, in areas cultivated with sugarcane, as described in Table 1. Areas of native forest adjacent to the areas fertilized with compost or ash were also studied, as well as sampling performed in forest area, to serve as a control area.

The organic compost was obtained by the composting process and consisted of the mechanical mixing of horizontal cells, using a tractorized "mixer" periodically with control of the temperature and humidity of the mixture. The composting process lasted approximately 30 days. The area of the plots studied ranged from thirty to forty hectares. Ten tons per hectare of ash or organic compost were applied each year, both using a tractorized cultivator after sugarcane regrowth/cutting/planting.

Table 1. Treatments performed in the experiment.

Treatments	Description
1	Control Area (forest area)
2	Area with 1 year of application of organic compost
3	Area with 2 years of application of organic compost
4	Area with 3 years of application of organic compost
5	Area with 4 years of application of organic compost
6	Area with 1 year of ash application

Soil samples were collected using Dutch auger, at depths of 0 to 20, 20 to 40 and 40 to 60 cm deep. Samples were randomly collected in each plot. For each sample, five distinct points were collected, and after homogenized by depth in a plastic container. Subsequently, the soil samples were air-dry and sieved in a 2 mm sieve.

The total concentrations available to the plants of P, K, Ca, Mg, Cu, Mn, and Cr were determined, following the methodologies described by USEPA (2012) and Nurmesniemi *et al.* (2008), respectively. Soil fertility parameters such as pH,  $H^+ + Al^{3+}$ , sum of bases (SB), cation exchange capacity (CEC), organic matter content, base saturation (V) and aluminum (m(Al)), as well as available concentrations of P, K, Ca and Mg, were also determined, according to the methodology described by Embrapa (2009).

The results obtained were submitted to variance analysis and when the F test was significant, the means of treatments were compared by the Tukey test to 5% probability of error.

## III. RESULTS AND DISCUSSION

### 4.1 Fertility

Non-significant differences in fertility parameters were found only for the variables Mg, Al, OM, and m% for the depth of 0-20cm (Table 2). The results indicated that in general the nutrient contents were higher for the soil surface layer and that the application time did not interfere in the concentration of some nutrients for the different depths.



Table 2. Soil nutrient contents at depths of 0-20, 20-40 and 40-60cm after application of treatments, at depths of 0-20, 20-40 and 40-60cm.

Treatment	P m g dm <sup>-3</sup>	MO g dm <sup>-3</sup>	pH CaCl <sub>2</sub>	H+Al	Al cmolc dm <sup>-3</sup>	K
<b>0 to 20 cm</b>						
Ash	18,31 b	0,37 b	4,17 a	1,97 a	0,00 a	25,43 a
1year compost	73,24 b	0,48 b	2,60 ab	1,88 a	0,03 a	20,23 a
2 years compost	15,12 b	0,71 ab	2,23 b	1,42 a	0,10 a	15,13 a
3 years compost	264,60 a	1,16 ab	4,13 ab	1,56 a	0,00 a	21,05 a
4 years compost	98,47 ab	0,58 ab	3,88 ab	2,00 a	0,05 a	18,68 a
Control area	4,12 b	0,57 ab	3,08 ab	1,18 a	0,15 a	22,21 a
<b>20 to 40 cm</b>						
Ash	9,94 a	0,20 b	4,64 a	1,86 a	0,02 b	14,69 a
1 year compost	21,41 a	0,20 b	1,80 b	1,01 a	0,55 a	15,72 a
2 years compost	48,08 a	0,33 b	2,43 b	1,28 a	0,31 ab	11,48 a
3 years compost	117,80 a	0,89 a	3,31 ab	1,45 a	0,00 b	10,26 a
4 years compost	27,52 a	0,46 b	3,34 ab	1,59 a	0,17 ab	12,3 a
Control area	2,53 a	0,39 b	3,05 ab	1,24 a	0,25 ab	19,14 a
<b>40 to 60 cm</b>						
Ash	1,84 a	0,11 b	3,00 a	1,16	0,23 b	7,18 c
1 year compost	17,66 a	0,09 b	0,64 b	0,38	87,00 a	11,28 abc
2 yearscompost	26,09 a	0,53 ab	1,55 b	0,71	0,81 ab	10,39 abc
3 yearscompost	14,73 a	0,81 a	1,42 b	0,84	0,00 ab	19,43 a
4 yearscompost	2,15 a	0,43 ab	1,22 b	0,75	0,08 ab	8,66 bc
Control area	1,99 a	0,39 ab	1,47 b	0,74	0,50 ab	18,05 ab

Average followed by the same letter in the column do not differ statistically by the Tukey test at 5% probability.

Potassium varied in relation to the applications of compost and ash. In general, the highest values were obtained in the surface layer (0-20 cm), decreasing with depth, and were lower in the application of ash. Since ashes are largely susceptible to losses by leaching and/or erosion (PONS *et al.*, 2016; MAGALHÃES *et al.*, 2018). Or because the higher concentrations of K are related to natural organic matter or incorporated by the compost, since the k concentration value was lower for the soil under ash application.

This result can be partially explained by the characteristics of thecompost. According to Rossetto *et al.* (2008) the benefit of the presence of organic radicals in the decomposition filter cake can occupy phosphorus fixation sites, protecting this nutrient from the reaction with clay minerals and iron oxides and thus making it available and

better used by the plant. In relation to the amount of P in the treatment with ash, this factor can be attributed to the amount of the same in its composition 25,175 g kg<sup>-1</sup>.

Phosphorus is considered an essential element for plants and is in low quantity in Brazilian soils (BASTOS *et al.*, 2008; NODARI & GUERRA, 2015). The main factors that affect the availability of P in the soil are the organic matter content, the content and type of clay, the capacity to change cations, the buffer power, the calcium, iron and aluminum contents and the humidity, consequently interfering in its absorption by plants (KORNDÖRFER & MELO, 2009).

In the present study, the amount of MO was probably not the relevant factor in phosphorus availability, but rather the quality of the materials of the compost and

ash (Table 2). It is observed that availability increases with the applied number of treatments with three and four years. Therefore, the application of ash with high P content leads to an increase in the concentration of this in the soil because a small amount will be available for consumption by the plant. Thus, explaining the high P values in such treatments. The phosphorus in the compost is organic and its release is gradually occurring by mineralization and attack of microorganisms in the soil.

For the nutrient calcium, there is a tendency to maintain the amount of the same with application of ash in depth, a fact that may have occurred by the migration of ash, being more significantly in depth (40-60) compared to the other treatments (Table 3).

Table 3. Soil nutrient contents at depths of 0-20, 20-40 and 40-60cm after application of treatments, at depths of 0-20, 20-40 and 40-60cm.

Treatment	Ca	Mg	SB	CTC	V	m(Al)
	cmolc dm <sup>-3</sup>					%
<b>0 to 20 cm</b>						
Ash	5,70 ab	4,55 abc	6,42 ab	12,10 a	61,48 ab	0,00 a
1 year compost	5,60 b	3,79 bc	5,14 ab	9,86 ab	60,54 ab	0,73 a
2 years compost	5,22 b	4,08 abc	4,36 b	8,04 b	48,31 b	2,76 a
3 years compost	6,44 a	2,93 c	6,85 a	9,78 ab	69,90 a	0,00 a
4 years compost	5,03 b	6,28 abc	6,47 ab	12,80 a	51,16 ab	0,91 a
Control area	5,04 b	5,33 ab	4,82 ab	10,40 ab	50,45 ab	3,64 a
<b>20 to 40 cm</b>						
Ash	5,50 ab	5,07 a	6,74 a	11,80 a	57,56 a	0,29 b
1 year compost	4,48 c	5,30 a	3,01 b	10,10 a	33,84 b	16,18 a
2 years compost	4,89 bc	5,00 a	4,42 ab	9,46 a	46,05 ab	10,85 ab
3 years compost	5,86 a	3,55 a	5,52 ab	9,07 a	60,75 a	0,00 b
4 years compost	5,25 ab	3,43 a	5,39 ab	8,82 a	59,35 a	3,87 ab
Control area	4,92 bc	4,80 a	4,67 ab	9,96 a	47,01 ab	5,67 ab
<b>40 to 60 cm</b>						
Ash	5,27 ab	5,14 a	4,55 ab	9,69 ab	47,57 a	6,09 bc
1 year compost	4,16 c	5,14 a	1,39 b	6,53 ab	20,04 a	40,67 a
2 years compost	4,59 bc	5,62 a	3,30 ab	9,60 ab	34,09 a	25,68 ab
3 years compost	5,86 a	3,65 a	3,47 ab	7,08 b	42,87 a	0,00 c
4 years compost	5,17 ab	3,97 a	2,40 ab	6,37 b	40,78 a	4,76 bc
Control area	4,66 bc	4,80 a	2,54 ab	22,1 a	52,12 a	12,59 bc

Average followed by the same letter in the column do not differ statistically by the Tukey test at 5% probability.

Free aluminum increased relative to depth. This may be due to the effect of previous surface-made liming and, or higher organic matter content in the layer (0-20 cm). In addition to the liming, organic matter originates organic ligands that are released during the mineralization process,

which form complexes with aluminum or soluble complexes with phosphorus from the soil solution, preventing it from being adsorbed (IYAMUREMYE *et al.*, 1996; GONÇALVES, SILVA, OLIVEIRA, and STEINER, 2020). The reduction of Al toxicity after

application of plant residues was also observed by Hue and Licudine (1999).

Regarding pH, there was a significant difference between the treatments. There is a variation in the values mainly with 3 years of compost, being higher. This fact can be explained by the formation of soluble acids at the beginning of composting, which are converted to carbon dioxide by microbial action (Iyengar & Bhave, 2005). Or because the nitrification process occurs in the other treatments, generating as a product  $H^+$  molecules, explaining lower values in relation to the treatment with 3 years of application, especially with four years being observed an increase in H+Al in the soil.

For H+Al, there was a statistical difference, with the treatment with four years of compost being the highest value. As this treatment has a four-year history of compost application is likely a relative amount of nitrogen, it is initially transformed into ammonium ( $NH_4^+$ ) by the action of nitrosomonas, and then in  $NO_2^-$  by the predominant

action of nitrobacteria, which quickly converts to nitrate, which is the final product of the degradation of organic N (SANCHEZ-MONEDERO *et al.*, 2001; KIEHL, 2002; MORAES *et al.*, 2020). It happens that when ammonia ( $NH_4^+$ ) is oxidized to  $NO_3^-$ , there is net production of  $2H^+$ , justifying the high values.

#### 4.2 Total and Available Nutrients

The different treatments interfered significantly ( $P < 0,05$ ) in the total concentrations of P, Ca, Cu, Mn, and Cr, in the 0 to 20 cm depth layer (Table 4). With the increase in the years of application of organic compost, the total concentrations of P were also increased, corroborating the results of Almeida Júnior (2010), where he observed a positive correlation between P content in the soil and amount of filter cake applied on the surface. However, this effect was not observed in subsequent layers (20-40 and 40-60 cm), due to the low natural mobility of this nutrient in the soil.

Table 4. Total concentration of elements in the soil after application of the treatments, at depths of 0-20, 20-40 and 40-60cm.

Treatment	P	K	Ca	Mg	Cu	Mn	Cr
mg L <sup>-1</sup>							
<b>0 to 20 cm</b>							
Ash	71,45 b	12,40 a	94,50 a	24,9 a	0,478 a	8,712 a	1,34 a
1 year compost	50,24 b	11,50 a	75,50 bc	17,9 a	0,158 b	0,860 bc	0,59 b
2 years compost	66,10 b	27,20 a	84,20 abc	25,2 a	0,202 b	0,546 c	0,40 b
3 years compost	85,45 b	26,20 a	91,10 ab	24,7 a	0,160 b	1,122 bc	0,49 b
4 years compost	137,10 a	15,83 a	70,33 c	21,7 a	0,360 a	1,157 bc	0,42 b
Control area	51,40 b	8,40 a	72,50 c	18,2 a	0,426 a	1,556 b	0,93 ab
<b>20 to 40 cm</b>							
Ash	65,50 a	8,40 ab	80,20 a	22,8 a	0,492 a	8,774 a	1,22 a
1 year compost	45,20 a	4,75 b	77,20 a	17,0 c	0,136 a	0,786 c	0,60 bc
2 years compost	41,44 a	22,62 a	80,40 a	22,2 bc	0,202 a	0,910 bc	0,46 c
3 years compost	54,17 a	12,50 ab	75,80 a	20,6 c	0,133 a	0,864 bc	0,53 c
4 years compost	63,34 a	14,50 ab	68,50 a	21,7 bc	0,263 a	0,900 bc	0,28 c
Control area	48,67 a	7,60 ab	72,80 a	16,0 a	0,400 a	1,870 b	1,10 ab
<b>40 to 60 cm</b>							
Ash	47,40 a	10,50 a	83,70 ab	22,8 a	0,470 a	8,870 a	1,13 a
1 year compost	42,22 a	6,88 a	74,00 ab	16,7 a	0,134 b	0,628 b	0,49 b
2 years compost	61,94 a	21,17 a	90,20 a	22,9 a	0,220 b	0,728 b	0,37 b
3 years compost	35,94 a	13,62 a	80,90 ab	17,1 a	0,138 b	0,734 b	0,60 b
4 years compost	42,56 a	16,00 a	71,33 b	18,3 a	0,190 b	0,623 b	0,42 b

Control area	38,45 a	6,13 a	70,30 b	17,3 a	0,400 a	1,352 b	1,07 a
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Average followed by the same letter in the column do not differ statistically by the Tukey test at 5% probability.

There were no significant increases in K and Mg concentrations in the soil under ash application. On the other hand, Ferreira et al. (2012) observed significant differences in K and P concentrations in the soil after the application of different types of sugarcane bagasse ash in varied doses, as well as the interaction of these factors, confronting the results of the present study. Research conducted in tropical soils has studied the behavior of heavy metals in these soils. Among these, Oliveira & Mattiazzo (2001) highlight that heavy metals were retained in the surface layer of a Latosol where it received sewage sludge and cultivated with sugarcane.

The highest concentrations of Ca, Cu, Mn and Cr in the surface layer were observed when pure ash was applied. Probably due to the higher concentration of nutrients that this treatment has, compared to the organic compound (ash+filter cake), according to Table 4. On the other hand, Ferreira et al. (2012) did not observe significant differences in the contents of these chemical elements after the application of sugarcane bagasse ash. It is noteworthy that for some chemical elements (Cu and Cr), the control did not differ statistically from the ash, possibly since there is no sugarcane crop in the area and, therefore, the non-removal of these from the soil, via root absorption. Research conducted by Chaudhuri et al. (2003) it allowed to conclude that the application of ash in the soil proportionally increased the concentrations of Cu in the 0-20cm layer in an acid soil, corroborating the results of the present study.

Among the micronutrients, Cu is the least mobile in the soil thanks to its strong adsorption in organic and inorganic soil colloids. In organic matter, Cu is retained mainly by humic and fulvic acids, forming stable complexes. Therefore, Cu organic complexes play an important role both in mobility and availability of Cu for plants (ABREU et al., 2007). The areas where they received organic compound, Cu concentrations in the surface layer were lower than the ash (Table 4), confirming the effect of organic matter on the formation of complexes with this metal. Some of these complexes are

so stable that most Cu deficiencies have been associated with organic soils (ABREU et al., 2007; SATTOLO, MARIANO, BOSCHIERO, OTTO, 2017; AFFERTÉ et al., 2018).

In the 20 to 40 cm layer, significant differences were found between treatments for the total concentrations of K, Mg, Mn, and Cr (Table 4). For K, the highest average was observed in the area where two years of compost application was received, but it differed statistically only from the treatment which received one year of compost application. For Mg, Mn and Cr, the highest concentrations were observed when pure ash was applied.

Studies conducted by Oliveira et al. (2002), state that Latosols where they received surface application of organic residues, even in tropical conditions, where highly weathered soils dominate, no movement of heavy metals such as Cu and Cr in the soil profile was observed. However, in the present study, it is possible to observe higher concentrations of these metals in the layers of 20-40 and 40-60cm (Table 4), where organic compost was received, mainly, in the areas where it received pure ash, demonstrating movement in the soil profile.

In the 40 to 60 cm layer, the total levels of Ca, Cu, Mn, Cr were significantly influenced (Table 4). The highest concentrations of Cu, Mn and Cr were observed where pure ash was received, while for Ca the highest average was observed in the area where compost was applied for two consecutive years.

Mn concentrations were higher when pure ash was applied in the three layers studied, demonstrating that this effect is mainly due to ash, because in the areas where compost was applied, no significant differences were found. Cr concentrations also followed the same tendency.

In the soil surface layer (0 to 20 cm), except for phosphorus, the concentrations of all nutrients studied were influenced by the application of ash or organic compost (Table 5). The highest concentrations of Mg, Cu and Mn were observed in the plots that received pure ash.

Table 5. Concentration of nutrients available to plants in the soil after application of treatments, at depths of 0-20, 20-40 and 40-60cm.

Treatment	P	K	Ca	Mg	Cu	Mn	Cr
mg L-1							
<b>0 to 20 cm</b>							
Ash	11,25 a	20,12 b	160,80 a	31,50 a	0,526 a	9,730 a	0,070 a
1 year compost	21,58 a	16,88 b	83,75 bc	19,31 ab	0,188 b	0,880 cd	0,022 ab
2 years compost	2,82 a	15,62 b	77,00 c	17,75 b	0,113 b	0,785 d	0,018 ab
3 years compost	78,60 a	32,80 ab	138,10 ab	25,80 ab	0,118 b	3,102 bc	0,006 b
4 years compost	18,08 a	44,50 a	160,70 a	26,00 ab	0,257 b	1,760 cd	0,023 ab
Control area	2,25 a	33,62 ab	95,38 bc	13,62 b	0,284 b	4,168 b	0,008 b
<b>20 to 40 cm</b>							
Ash	10,05 a	16,38 a	138,90 a	24,50 a	0,448 a	9,360 a	0,032 a
1 year compost	2,96 a	22,12 a	60,50 b	11,90 b	0,148 c	1,132 c	0,030 a
2 years compost	29,01 a	9,50 a	101,00 ab	14,60 ab	0,092 c	0,813 c	0,000 a
3 years compost	9,87 a	30,25 a	99,62 ab	16,80 ab	0,108 c	2,394 c	0,010 a
4 years compost	3,68 a	29,00 a	119,80 ab	21,50 ab	0,163 c	1,430 c	0,000 a
Control area	3,48 a	25,17 a	84,83 ab	15,88 ab	0,308 b	5,390 b	0,000 a
<b>40 to 60 cm</b>							
Ash	2,96 a	14,40 abc	99,10 a	14,62 a	0,272 a	9,544 a	0,066 a
1 year compost	5,30 a	9,50 bc	43,62 c	4,88 c	0,082 b	0,370 d	0,018 a
2 years compost	5,66 a	6,00 c	55,62 bc	7,50 bc	0,062 b	0,474 d	0,014 a
3 years compost	8,06 a	27,75 a	76,30 ab	10,38 abc	0,084 b	1,476 c	0,006 a
4 years compost	1,14 a	21,50 ab	60,17 bc	9,50 abc	0,070 b	1,473 c	0,003 a
Control area	4,46 a	20,88 ab	60,00 bc	12,00 ab	0,274 a	3,756 b	0,008 a

Average followed by the same letter in the column did not differ statistically by the Tukey test at 5% probability.

In the layer of 20 to 40 cm depth in the soil, only the concentrations of Ca, Mg, Cu and Mn were influenced by the application of compost or ash. In the 40 to 60 cm depth layer, in addition to these elements mentioned, the K concentration was also influenced, which is corroborated by Ramos, Lana, Korndörfer and Silva (2017).

The application of compost in consecutive years favored only the levels of K and Ca. On the other hand, in the deepest soil layer (40 to 60), higher concentrations of K were observed. Potassium has low adsorption capacity by soil colloids (SHARMA *et al.*, 2016; AQUINO *et al.*, 2018; YILMAZ, WZOREK, AKÇAY, 2018), being quite susceptible to percolation along the soil profile. In this sense, possibly due to this process, higher concentrations of K were observed in the areas that received compost for three or four years.

#### IV. CONCLUSIONS

1. The application of ash in the soil promoted an increase in the total concentrations of heavy metals in the soil such as Cu, Mn, and Cr up to 60 cm deep.
2. Application of organic compost in different years favors the increase in total nutrient concentrations in the soil surface layer and thereby improving the potential for their availability for sugarcane crop.

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# Innovative Business Model: The Production of Tamarind Jam with Pepper in the Northeastern Semiarid

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Received: 11 Nov 2020;

Received in revised form:

09 Jan 2021;

Accepted: 19 Jan 2021;

Available online: 26 Jan 2021

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**Keywords**—*Business Model Canvas, Innovation, Jelly, Semiarid.*

**Abstract**— *The Business Model Framework or "Business Model Canvas", as it is also known, is a tool that allows you to plan, create or reformulate some enterprise, thus contributing, to make it more innovative. Developed by the Swiss Alex Osterwalder (2000), it is an instrument that aims to understand in an easy and logical way the structure of a business, from the description of elements and phases that make up the enterprise, such as: customer segment, value proposition, distribution channels, customer relationship, revenue sources, key resources, key activities, key partnerships and costs. This study demonstrates the successful experience of a couple of entrepreneurs in the municipality of Juazeiro-Bahia, which boosted their family income, benefiting the fruit of tamarind (*Tamarindus indica*), allied to pepper (*Capsicum frutescens* 'Malagueta'), innovating and giving rise to Tamarind Pepper Jelly.*

## I. INTRODUCTION

Agriculture is an essential activity for human life, obtaining through it food and raw material for the production of industrialized goods. In recent years, Brazilian agriculture has advanced safely towards sustainability, producing food or resources with the conservation of the environment, the well-being of society and profitability, highlighting, in this way, sustainable entrepreneurship that combines wealth generation with responsible development.

Allied to this, it should not be forgotten that, for the creation, development and innovation in enterprise, it is necessary to search for tools that help entrepreneurs in understanding the structure of business. In this sense, the Business Model Framework or "*Business Model Canvas*", is a tool that allows you to plan, create or reformulate some enterprise, thus contributing, to make it more innovative such model. This model was developed by the

Swiss Alex Osterwalder (2000), and is an instrument developed to understand the structure of a business in an easy and logical way.

The objective of this model is to describe the elements and phases that make up the enterprise, which are: customer segment, value proposition, distribution channels, customer relationship, revenue sources, main resources, key activities, key partnerships and costs.

Therefore, this study analyzes a successful experience of a couple of entrepreneurs, located in the municipality of Juazeiro-Bahia, in the Sertão Territory of São Francisco, who realized the opportunity to increase family income, benefiting a typical fruit of the region, tamarind (*Tamarindus indica*), allied with the pepper (*Capsicum frutescens* 'Malagueta'), an ingredient very characteristic of Bahia, thus innovating and giving rise to Tamarind Pepper Jam.



## II. THEORETICAL REFERENCE

### 2.1 Agroecology

Agriculture is an activity that aims to cultivate the soil for the production of vegetables transforming the environment and being of extreme relevance for human survival. From the eighteenth century onwards, modern agriculture began in Western Europe with high-scale production and as a corollary there was an increase in the use of chemicals, genetically altered seeds [1].

Thus, although there was initially a hope that, with the increase of food, there would be a satisfaction of human needs, it was observed, from the 20th century, that the agricultural production model has caused harmful socio-environmental impacts, such as erosion, soil and water contamination, reduced biodiversity, impoverishment of rural populations and increased disease. Therefore, it became clear, the need to seek a more sustainable agriculture, thus appearing agroecology, which came as a new scientific approach helping in the search for more sustainable alternatives to conventional hegemonic style of agriculture [2].

Thus, it is possible to understand the need to develop a sustainable agriculture that starts from ecological perspectives optimizing the agrosystem, remediating the environmental and social problems caused by economic development.

In this context, it provides the necessary knowledge and methodologies to develop an agriculture that is both environmentally appropriate, productive, socially equitable and economically viable, promoting better use of domestic resources, mitigating the use of external inputs, bringing, in addition, efficiencies in productive diversification strategies [3].

In this way, agroecology is not only a concept, but an orientation, whose contributions go beyond the technological or agronomic aspects of production, integrating and articulating knowledge of different sciences, as well as popular knowledge [3]. It is a growing sector today, favoring farmers, as it enhances the development of sustainable practices in social, environmental and financial terms, and the growth of the market for the consumption of healthier foods.

It is also worth mentioning the rural entrepreneurship that is the management of property to generate satisfactory and sustainable results, being currently applied to small family farms or by entrepreneurs who seek innovations in their activity, it is important to highlight the importance of agroecology for the development of sustainable agriculture, thus reducing environmental problems and generating economic development, without alienating

social welfare and the conservation of natural resources and the growth of rural enterprises.

### 2.2 Entrepreneurship

Entrepreneurship seeks to visualize business opportunities, with permanent innovation, taking calculated risks, with the aim of obtaining income, recognition and growth in the market. [4] entrepreneurship means doing something new, different, changing the current situation and constantly seeking new business opportunities, focusing on innovation and value creation.

[5] it is a process of creative destruction through which existing products or production methods are destroyed and replaced by new ones. [6] entrepreneurship is the ability to create and constitute something from very little or almost nothing. [7] confirms that entrepreneurship is a process of transforming dreams into reality and wealth.

Therefore, whatever the definition of entrepreneurship, there are at least the following aspects: **A)** has initiative to create a new business; **B)** uses the available resources in a creative way, transforming the social and economic environment where you live; **C)** accepts taking the calculated risks and the possibility of failure.

### 2.3 Tamarind (*Tamarindus indica*) and Chili (*Capsicum frutescens* 'Malagueta')

Brazil is a great producer of fruit, possessing regional fruit plants with a variety of aromas and flavors, being privileged for its diversity of climate and soil, ensuring a very diversified fruit production. Therefore, it is one of the main producers and exporters of several native and exotic fruit species [8].

In the Northeast region of Brazil, the Petrolina/PE and Juazeiro/BA Polo is recognized worldwide for its economic dynamism in irrigated fruit production, and it is important to mention that, according to data from the Brazilian Agricultural Research Company [9], the majority of fruit production in the region is intended for in natura consumption, which requires a high standard of fruit quality.

In addition, as a way to find an alternative to the use of fruit outside the quality standard for in natura consumption, other activities such as the production of jellies can also be observed in the region, highlighting the production of mixed jellies that unite nutritional characteristics of two or more fruits, which, in addition to providing pleasant sensory characteristics, gradually conquer noble space in the consumer market [10].

Based on this, a couple of entrepreneurs from Juazeiro-BA, seeking alternatives to improve family income, began to produce jelly joining a typical fruit of the region, tamarind (*Tamarindus indica*), allied with pepper (*Capsicum frutescens 'Malaalgueta'*), giving rise to Tamarind Pepper Jam.

Tamarind belongs to the leguminous family and, originating in tropical Africa, from where it dispersed to all tropical regions. It is mainly used from pulp for the preparation of sweets, ice creams, liquors, concentrated juices and other foods [11]. In Brazil, the fruit is widely consumed in the North and Northeast regions.

It is worth mentioning the importance of tamarind for family farming, which is a highly organic fruit, making it necessary to produce products that use this fruit as raw material in order to increase their commercial interest [12]. In addition to tamarind, the entrepreneurial couple uses pepper as an ingredient for the production of mixed jam.

Pepper is the common name given to various plants, their fruits and seasonings obtained from it, with a generally spicy flavor. The cultivation of peppers of the genus *Capsicum* in Brazil is of great importance, either for generating incomes, mainly when the producer adds value to the product, or for its social importance, because the plant is cultivated by family farmers, generating employment, since the crop requires a large amount of labor, especially during the harvest [13].

The term chilli or chili pepper is used for varieties of *Capsicum frutescens*. *Capsicum*se peppers stand out as part of the market for fresh vegetables in Brazil, as well as the strong segment of seasonings, seasonings and preserves worldwide [14].

Therefore, the pepper (*Capsicum frutescens 'Malagueta'*) is a very characteristic ingredient of Bahia and together with the tamarind, brings a peculiar flavor to the Tamarind Jelly with Pepper produced in the Sertão Territory of São Francisco, generating income for a family group that undertook in the production of this mixed jelly, of differentiated flavor, that attracts local and regional consumers.

### III. METHODOLOGY

The study was developed in the municipality of Juazeiro-BA, located in the São Francisco Sertão Territory, on the right bank of the São Francisco River, 507.9 km from the state capital, Salvador, having access by the BR-407 highway, this being the fastest route. The population of Juazeiro coexists with natural restrictions typical of the Brazilian semiarid region, scarce and irregular rains and, therefore, they seek in the potentialities

of the region the resources for the maintenance of life in the locality.

Thus, this is an exploratory and descriptive study, with a qualitative approach, based on the phenomenological method, which is used in qualitative research, and concerns itself with the direct description of the experience as it is, where reality is socially constructed and understood in the way it is interpreted, not posing itself as unique, and may exist as many as its interpretations [15].

In this sense, it is an exploratory study, because it seeks to provide greater familiarity with the problem under study, aiming to make it more explicit [15]. It is also descriptive, because it explains particularities of a given group, capturing descriptive aspects [16].

As for nature, this study brings a qualitative approach, where we sought to understand social phenomena with the smallest possible distance from the studied environment, seeking to understand and explain the dynamics of social relations [17].

The study was divided into 5 phases:

1) In the first phase we sought to know the problematic in thesis from the reading of theorists and published works that address on this theme, through search in journals websites such as *Scielo* and *Google Academic*, from the keywords "business model", "jelly" and "semiarid";

2) In the second phase, we sought to know in situ, from the observation, how is developed the enterprise of production of tamarind jelly with pepper, in order to better understand the context;

3) Then, an interview was made aiming to know more about the development of the enterprise, seeking to work from there the Business Model Framework or "*Business Model Canvas*";

4) Finally, a model was chosen that is considered suitable for such an enterprise aiming at enhancing the production and commercialization of the product;

5) Finally, the characteristics of the enterprise were presented to the entrepreneurs, using the Business Model Framework methodology.

### IV. RESULTS AND DISCUSSIONS

#### 4.1 The Emergence of Tamarind Pepper Jelly

Tamarindo Pepper Jam is produced by the family group "Doce Caseiro Emanuel", located in Juazeiro-BA, in the Sertão Territory of São Francisco, where it develops fruit processing, such as tamarind, for the production of

sweets, jellies and candies, aiming at foster the productive chain of fruit growing.

The production began after financial difficulties of the couple, where the husband was an investor in the Stock Exchange and after having a great financial loss and failing in his profession of Technical in Agrimeasurement, his wife saw as a possible source of income the manufacture of home-made sweets, as he had acquired experience with producing sweets in a period of rehabilitation of his life. Thus, everything was started by improvising, in one of the rooms at the back of the couple's house, with a stove and an industrial pan used, artisanal way, the production of sweets in social projects of the church they attend.

In this way, the owner produced the candy, while his companion, by having experiences with the trade, was responsible for sales, starting the venture that soon after would be called "Sweet Homemade Emanuel".

Initially banana and guava sweets were produced, over time, other recipes were learned and put into practice, such as tamarind jam. At first, only candies and tamarind jellies were produced, without the pepper, however, as the owner is a "lover" of pepper and already know the recipe, decided to bet on the flavor that would derive from the junction of these two components, thus forming the tamarind bullet with pepper.

In this perspective, with the arrival of a new Coordinator at the Public Center of Solidarity Economy of the São Francisco Sertão Territory (CESOL-SSF), state program of the Government of Bahia, which aims to contribute to training, dissemination and commercialization of the products of the Popular and Solidarity Economy and Family Agriculture of the São Franciscano Territory, encouraged the manufacture of the Tamarindo Bullet with Pepper without the seed, which led, by chance, to the development of the Tamarindo Jelly with Pepper.

Launched in the 2nd edition of the Solidarity Economy Festival held in Salvador Shopping, in December 2019, promoted by the Secretariat of Labor, Employment, Income and Sport of Bahia (SETRE), was a great success, giving a significant profit to the productive group and until then, having a great demand of demand, being one of the main products for the strengthening of the enterprise. Tamarindo Pepper Jelly weighs 220 grams, is conditioned in glass packaging, sealed and costs R\$ 10,00.



Image 01. Tamarind Jam with Pepper

Source: Personal Archives (2019)

#### 4.2 The Business Model - Tamarind Pepper Jelly

The Business Model Framework or "Business Model Canvas" is a methodology emerged in the mid-2000s, by the Entrepreneur, Speaker, Consultant and Management Theorist, the Swiss Alex Osterwalder, in his doctoral thesis by the *Faculté des Hautes Études Commerciales de l'Université de Lausanne - HEC Lausanne* [18].

It is a very efficient and simple tool, in a frame format, that allows to create or remodel, business models, considering 09 elements that every enterprise has: Value Proposition, Customer Segment, Distribution Channels, Customer Relations, Sources of Revenue, Main Resources, Main Activities, Main Partnerships and Cost Structure, collaborating with the entrepreneur, plan a successful and innovative business [18].



Image 02. Business Model Frame or "Business Model Canvas"

Source: Portal Dinamize (2020)

Through the data collected and analyzed, it was possible to understand the business model developed by the family group "Doce Caseiro Emanuel", with the production of Tamarindo Pepper Jelly, presenting the following characteristics:



Image 03. Emanuel Homemade Candy Business Model

Source: Elaboration by the Authors

Through the information of the Business Model Framework, it is shown as follows:

- Value Proposition: Produced in an artisanal way and much more than just a tamarind jam with pepper, an experience of pleasure, intensity, unparalleled, with health and quality.
- Customer Segment: In addition to ordinary people, commercial establishments such as delicacies, emporiums, stores of regional products, markets and bakeries.
- Channels: By Social Network *Instagram*, by phone contact, at home, in commercial establishments, agricultural fairs and solidarity economy and the application of messages and voice calls to *smartphones*, *Whatsapp*.
- Customer Relations: Personal service, by phone contact, *Instagram* and *Whatsapp*.
- Sources of Revenue: Direct sale, cash (cash/forward), and by credit or debit card.
- Main Resources: Financial, for the acquisition of goods and production materials, physical, such as equipment, supplies, production site, among others and human, the workers of the producers.
- Main Activities: Product marketing, production and marketing.
- Main Partnerships: Caatinga Emporium and Meu Sertão Emporium, spaces for the commercialization of Family Farming products, in particular the Semiárido Region of Bahia, Public Center of Solidarity Economy of the Sertão Territory of São Francisco, with support in the visual identity, study of economic viability and commercialization of products of Family Agriculture, located in the Sertão Territory of São Francisco, in Bahia, Sala do Empreendedor and Sebrae Juazeiro-BA Unit, with services and guidance on various themes related to entrepreneurship.

- Cost Structure: Water, packaging, internet, light, raw material, cleaning material, remuneration, label and transport, are the costs of the venture.

Therefore, from the analysis and discussion obtained and presented in the previous items, it can be noted that the viability of the production of tamarind jelly with pepper is an alternative for the utilization of the fruits, allowing their commercial use, increased market supply and marketing quality. Its processing is interesting, as it requires few equipment and is produced in an artisanal way.

## V. CONCLUSIONS

In view of the above, the objective of the present study was to develop and characterize tamarind pepper jelly, through the data collected and analyzed, and it is possible to understand the business model developed by the family group "Doce Caseiro Emanuel" With the production of Tamarindo Jelly with Pepper and as an unpretentious production, it has positively modified the life of the entrepreneurial couple.

Therefore, the development of new products with high fruit proportions in their formulations and with good functional and nutritional properties contributes to diversify the market possibilities, especially if the products are attractive and practical. Due to the diversity of the fruits existing in the Northeastern Semiárido and the fact that they have properties suitable for processing, in addition to functional properties, it is demonstrated that this is a market that has growth potential in Brazil.

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# Orthostatic Hypotension and associated factors in older adults Brazilian and French with diabetes

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Received: 05 Nov 2020;

Received in revised form:

11 Jan 2021;

Accepted: 18 Jan 2021;

Available online: 26 Jan 2021

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**Keywords**— *diabetes, diabetic neuropathy, older adults, orthostatic hypotension.*

**Abstract**— *Diabetic neuropathy is one of the major chronic complications of diabetes, including different clinical manifestations affecting the peripheral nervous system. The study aims to describe the characteristics of the older people with type 2 diabetes mellitus in Brazil and France who presented orthostatic hypotension and associated factors. This is a cross-sectional descriptive and analytical study, in which 248 Brazilian older adults with diabetes aged 65 or more and 987 older adults French with aged 75 or over, evaluated for the outcome of orthostatic hypotension, having the associated factors related to complications been analyzed. It was evident that 2/3 of the older adults Brazilian with diabetes 162 (69.8%) presented orthostatic hypotension on examination, while less than 1/3 of the French older adults with diabetes [301 (30.5%)] displayed this change on clinical examination, with statistically significant differences between the two populations for the variables: age, duration of diabetes, smoking, body mass index, degree of hypertension, diabetic neuropathy, amputations, obstructive limb arteriopathy, and use of antihypertensive drugs. The study reinforces the importance of tracking this important alteration of the physical examination, which may result in relevant chronic complication to the health of the older people with diabetes.*

## I. INTRODUCTION

Brazil has been undergoing a process of demographic and epidemiological process with an increasing population of older people. In developed countries like France, the aging of the population took many years to come about, while in developing countries like Brazil, this demographic change occurred in one fifth of the period.<sup>1</sup>

This global phenomenon experienced by several countries in different periods contributed to a higher prevalence of chronic non-communicable diseases (NCDs) such as cardiovascular diseases, neoplasia, chronic respiratory diseases, and diabetes *mellitus*. Among them,

diabetes stands out as the causes of high morbidity and mortality in Brazil, besides causing important economic repercussions.<sup>2</sup>

The World Health Organization (WHO) estimates that in 2030 Brazil will have a population of approximately 21.5 million diabetics,<sup>3</sup> and that 33% of that population will be represented by people in the age group between 60 and 79.<sup>4</sup> It is relevant to mention that the number of diabetics in the world population tends to increase, according to the following estimates: 463 million in 2019, 578 million in 2030 and 700 million in 2045.<sup>3</sup>

In France, an estimated 6% prevalence of diabetes is present in its general population, which is composed of a large number of older people at an average age of 65, mostly males (54%) and a significant percentage of immigrants (23%).—Diabetes mellitus (DM) is the most prevalent non-communicable chronic disease among all chronic conditions, responsible for doubling the rate of patients covered by the public health in that country over the past ten years.<sup>5</sup>

DM, as a chronic disease with high morbidity and mortality, results in numerous complications, both acute and chronic. Among the chronic ones, retinopathy, ischemic heart disease, neuropathies, nephropathy, cerebrovascular and peripheral vascular diseases stand out.<sup>6</sup>

In this context, diabetic neuropathy (DN) is the most prevalent chronic disease complication of DM, behaving as a heterogeneous group of clinical and subclinical manifestations that affect the peripheral nervous system (PNS) and its sensory motor and autonomic components.<sup>7</sup> As diabetes evolves, there is an increased prevalence of diabetic neuropathy, which may exceed the figure of 50%.<sup>8</sup>

It is worth mentioning that 20% of the patients with DN will experience neuropathic pain, which is responsible for causing a significant reduction in the quality of life and the functional capacity. In addition, DN is a risk factor for complications such as deformities, ulcers, lower limb amputations and other microvascular changes.<sup>9</sup> With the ample occurrence of diabetic neuropathy, there are three main forms of presentation: diffuse neuropathy, mononeuropathy and polyradiculopathy.<sup>7</sup>

The cardiovascular autonomic neuropathy (CAN) is defined as a set of abnormalities affecting the autonomic fibers that innervates the heart and blood vessels, causing changes in heart rate and vascular dynamics. The clinical manifestations resulting from these changes are resting tachycardia, exercise intolerance, orthostatic hypotension, syncope, intraoperative instability, silent myocardial infarction, ischemia and autonomic cardiomyopathy.<sup>10</sup> When referring to CAN solely, there is an increase of its prevalence, which may reach 60-65%, depending on the time of the evolution of type 2 diabetes mellitus and the aging of the patient.<sup>7,10</sup>

Orthostatic hypotension (OH) is defined by the pressure drop of  $\geq 20$  mmHg of the systolic blood pressure (SBP) or of  $\geq 10$  mmHg of the diastolic blood pressure (DBP) with a 3-minute interval between the initial position in supine position and the orthostatic position. Its pathophysiology can be summarized as a cardiovascular central and peripheral sympathetic denervation process, leading to failure in vasoconstriction of the vascular bed. It is also

known that the presence of orthostatic hypotension in a diabetic patient is associated with increased mortality in 10 years.<sup>11,12</sup>

Orthostatic hypotension patients often experience dizziness, weakness, fatigue, blurred vision and cervical pain.<sup>13</sup> The risk factors most associated with OH are: arterial hypertension, old age, antihypertensive drugs and diabetes mellitus.<sup>11</sup> The prevalence of OH in the world population is quite diverse and varies depending on the study performed, but is usually around 5% in younger patients aged 45-64 and averages 30% in older patients over 65 years old. This large variation or considerable range in prevalence is due to the different populations studied, considering which definition is being used and which technique is being applied to measure the blood pressure.<sup>14</sup>

Thus, the objective of this study was to describe the characteristics of the population of older people suffering from type 2 diabetes mellitus in Brazil and France, who presented orthostatic hypotension and associated factors.

## II. MATERIALS AND METHODS

This was an international, cross-sectional, descriptive and analytical study. In Brazil, the research universe included 248 people aged 65 and over with diabetes type 2 mellitus (DM2), who had been diagnosed with this comorbidity for at least one year. They were selected by the original numbering of their medical records, one in every eight patients assisted by the specialized attention of the Unified Health System (SUS) of the Municipality of Fortaleza, capital of the State of Ceará. A comparison was made with the GERODIAB cohort of the Hospital Center of Rouen (CHU / Rouen) in the city of Rouen - France - where 987 diabetic older adults aged 70 and more were followed.<sup>15</sup> The cutoff point used for the age in Brazil was 65 to equalize the samples between Brazil and France, since, in that country, the age of 70 was considered, which corresponds to five years more than the age considered for the French older adults.

The prospective, longitudinal, multicenter study called GERODIAB, was carried out in five geographic regions of France along five years, in which eligible individuals were recruited for follow-up and analysis of glycemic control and morbidity and mortality for DM2. The French specialized centers randomized for the follow-up of diabetic patients in the study were also part of a specialized network for the assistance of the older people in order to maintain the homogeneity of the patients' profile.<sup>16</sup>

The data were collected through a semi-structured questionnaire containing sociodemographic and clinical aspects related to diabetes mellitus (age, sex, time in years of illness, body mass index, waist/hip ratio, harmful habits); general health data (systemic complications, use of medications, arterial hypertension, orthostatic hypotension, among others). Concerning the clinical evaluation, the variables were identified from medical records taken by doctors at the specialized center, complemented with laboratory and imaging exams that participants of the study brought at the time of the clinical evaluation performed by the team responsible for the study in Brazil and France, identifying antecedents, associated diseases and developing complications of diabetes and treatment provided.

For the outcome of orthostatic hypotension (OH), during the clinical evaluation of the diabetic older adults, the pressure levels of the individual in the lying and standing positions were measured, in 1, 3 and 5 minutes after orthostasis with a manual sphygmomanometer properly calibrated. Orthostatic hypotension was defined as a reduction in systolic blood pressure (SBP) of at least 20 mmHg and/or a decrease in diastolic blood pressure (DBP) of at least 10 mmHg in any of the measurements in the standing position.<sup>17</sup> The older people who were not able to undergo evaluation were excluded from the analysis of the study, totaling 16 of the total sample of Brazil.

The research project was approved by the Ethics Committee of the University of Fortaleza (Approval No. 1.666.717).

### III. RESULTS

Of the total of the older adults with type 2 diabetes mellitus in the Brazilian sample ( $n = 232$ ), 162 (69.8%) presented orthostatic hypotension on clinical evaluation, with no significant difference in age, sex, body mass index, presence of systemic artery hypertension, smoking, diabetic neuropathy, foot injury, amputation, obliterating arteriopathy of the lower limbs - OALL, coronary artery disease, heart failure and cerebrovascular disease (Table 1).

In the French sample ( $n = 987$ ), 301 (30.5%) of the diabetic older adults included in the study had OH. There was a statistically significant difference between the Brazilian and French diabetic older adults in the following variables: average age in years ( $p < 0.001$ ), time of disease in years ( $p = 0.002$ ), body mass index ( $p < 0.033$ ) (Table 2).

Concerning the comorbidity of systemic arterial hypertension, a statistical significance was observed in the

percentages of moderate to severe SAH among populations, with the highest frequency in the sample from France ( $p = 0.001$ ). In relation to the average of pressure levels in the lying and standing positions in minutes 1, 3 and 5 in orthostasis, there is a statistically significant difference between lying DBP ( $p < 0.001$ ), standing SBP in the first minute ( $p = 0.008$ ) and DBP standing in the first, second and third minutes ( $p < 0.001$ ) with higher averages in the Brazilian population in all of the variables cited (Table 3).

Among the chronic complications of type 2 diabetes mellitus, a greater frequency of peripheral neuropathy and amputation in Brazilians than in French was observed. ( $p < 0.001$  e  $p = 0.040$ , respectively). Concerning obliterating arteriopathy of the lower limbs (OALL), the prevalence is higher for the French. ( $p < 0.001$ ) (Table 4).

Table 5 shows a higher prevalence of older adults French with OH using inhibiting pharmacological class drugs of the angiotensin converter enzyme (ACE) ( $p < 0.001$ ) beta-blockers ( $p = 0.029$ ), diuretics ( $p < 0.001$ ) and calcium channel antagonists (CCA) ( $p < 0.001$ ) than the Brazilian older adults, with the exception of angiotensin receptor blockers (ARBs) (58.6% vs 40.9%) ( $p < 0.001$ ) and the association of diuretics, CCA and other medications (15.4% vs 4.7%) ( $p < 0.001$ ).

### IV. DISCUSSION

From the total of 232 Brazilian diabetic older adults in study, 162 (69.8%) presented orthostatic hypotension (HO), while of the total of the French samples, ( $n = 987$ ), 301 (30.5%) presented OH. Although the great difference in the prevalence of OH between the two populations is highlighted, this finding differs from the prevalence of 15.3% found in the literature of diabetic neuropathy, including orthostatic hypotension in the general population of people affected by DM2.<sup>18</sup> However, the prevalence of OH ranges from 31 to 73% according to the diagnostic method; population studied and associated risk factors.<sup>19</sup>

In the Brazilian population, there was no statistically significant difference for gender, body mass index, smoking, coronary heart disease complications, heart failure and cerebrovascular disease and the presence of orthostatic hypotension, as in the American study of 302 older adults.<sup>20</sup>

However, orthostatic hypotension has been associated with increased cardiovascular morbidity and mortality, especially for stroke and coronary disease.<sup>21,22,23</sup>

The fact that there was a statistically significant difference between the Brazilian and French diabetic older adults who had OH on clinical examination for the



following variables: mean age ( $p < 0,001$ ), average disease time in years ( $p = 0.002$ ), body mass index ( $p < 0,001$ ) and smoking ( $p = 0.033$ ), is important.

It must be taken into account that the average age in the French sample may be greater by the inclusion criterion adopted as a cutoff point between the two populations, being 65 for Brazil and 70 France.

As for the time of diabetes mellitus in years, there was a greater mean time in the French sample. This difference can be related to the expected evolution of the disease with complications that would be more prevalent in a period of disease equal to or greater than 10 years, mainly in the age group of 60-69, considering that age and time of illness can be independent predictors for the clinical evolution of DM and orthostatic hypotension as its complication.<sup>18,24</sup>

The activation of inflammatory cytokines plays an important role in the balance of the sympathetic system in diabetic patients, with inflammatory markers such as elevated CRP, IL-6 and TNF, exerting an inflammatory response in the adipose tissue.

However, the relationship between inflammation and diabetic neuropathy and orthostatic hypotension is uncertain and if it is bidirectional.<sup>10,19</sup> This association, although not yet clear, may justify the association between obesity, comorbidity associated with chronic inflammation, and orthostatic hypotension in people carrying DM2.<sup>25</sup> There is a significant association between cardiac autonomic neuropathy in the diabetic patient and increased BMI. In addition, the prevalence of parasympathetic dysfunction is 25% in patients with obesity and autonomic cardiovascular neuropathy.<sup>26</sup>

The findings detected a relative association to smoking and diabetic older adults ( $p = 0.033$ ), as corroborated by authors who emphasize the evidence that there is a significant association between smoking and increased risk of developing DM2<sup>27</sup> and, even after 5 years of quitting, this risk remains elevated, decreasing only after 10 years of interruption.<sup>28</sup> When analyzing the association between smoking and the presence of microvascular complications such as diabetic neuropathy, two important studies have shown that this relation was significant in type 1 DM, but not in DM2.<sup>29,30</sup> However, when with more sensitive and specific assessment of nerve conduction, smoking proved to be an independent risk factor for the manifestation of neuropathy in patients with DM2, especially in those with a greater smoking intensity, who presented worse nerve conduction.<sup>31</sup>

The research data showed that the mean pressure in the supine position for Brazilians were higher than for the French, with mean SBP ( $p = 0.098$ ) and DBP ( $p < 0,001$ ) respectively, which may be related to a higher prevalence

of OH in that population. Nevertheless, there was a higher percentage of moderate to severe hypertension in the French with orthostatic hypotension (91%; 274). Given this fact, it is worth mentioning that Systemic Arterial Hypertension (SAH) is a risk for OH, especially when referring to uncontrolled SAH ( $BP \geq 140 \times 90$  mmHg) and systolic OH in the first minute, thus increasing the risk of falls.<sup>32</sup> It is known that the incidence, when the two pathologies are associated, increases with age, probably due to altered autonomic and baroreflex functions, with baroreceptor sensitivity being reduced as the blood pressure level rises. There is evidence that the greater the blood pressure in the supine position, the greater the prevalence of OH in individuals over the age of 40.<sup>33,34</sup> Although SAH occurs in more than 50% of adults with DM, there is little information on the incidence or prognosis of OH in this scenario.<sup>11</sup> The participants in the ACCORD study (2010) had a higher risk of OH because of DM, SAH and antihypertensive treatment. This was possibly due to the fact that patients undergo intensive treatment with antihypertensive drugs to obtain SBP  $< 120$  mmHg, which contributes to an increased risk of OH due to the greater number and greater dosage of these medications.<sup>11</sup>

Other studies show that OH was more prevalent in patients with not-controlled SAH and in the older adults, possibly due to side effects and the amount prescribed medication, which are based on the diagnosis of SAH performed by measuring the pressure level in the sitting position. Therefore, the systematic measurement of standing BP in all older adults with uncontrolled SAH is recommended, since more than 60% of the individuals studied with HO showed controlled levels of blood pressure when it was measured in orthostasis. In conclusion, if the BP measurement only in supine position is taken into account, a higher percentage of patients would need more aggressive treatment, which would probably worsen OH and its clinical consequences, such as syncope, falls, cardiovascular morbidity and mortality, functional impairment and hospitalization.<sup>20</sup>

The study revealed a higher percentage of diabetic neuropathy ( $p < 0,001$ ) and amputation ( $p = 0.040$ ) in Brazilian diabetic older adults with OH than in French ones. This finding may be related to a higher prevalence of these complications in the Brazilian population compared to the French one. Additionally, the average time of the disease among French diabetics is higher than that of Brazilians and may present an indirect correlation with the orthostatic hypotension associated with this variable.<sup>25</sup> Conversely, the obliterating arteriopathy of lower limbs was more prevalent in French diabetic older adults with HO ( $p < 0,001$ ), what can also be associated with the

highest percentage of this comorbidity in French older people.<sup>35</sup>

This study found a higher percentage of the use of ACE inhibitors, beta-blockers, diuretics or calcium channel antagonists in the French diabetic older adults with orthostatic hypotension than in Brazilians, also corresponding to the classes of medication that have higher prevalence in France.<sup>35</sup> Therefore, we have that diabetic French older adults make more use of these medications and their use is associated with OH. For the use of Angiotensin Receptor Blockers (ARB), the research revealed an inverse association.

Although the association of antihypertensive drugs with orthostatic hypotension is controversial, with studies showing a reduced, similar or absent risk with this association,<sup>36,37,38,39,40</sup> others show a positive association between this class of medication and the prevalence of OH. Among them, we highlight the beta-blockers, alpha-adrenergic receptor blockers and thiazides diuretics as the most frequently associated with OH,<sup>25</sup> while the ARBs do not show this relationship.<sup>21,41,42</sup>

The mechanisms responsible for causing OH among antihypertensive drugs are decreased vasoconstriction, limited adjustment of the cardiac output and / or increased venous pool.<sup>42</sup> It is important to mention that the dosages of the medications used were not taken into account in the analysis of the data.

Health professionals raise several concerns about the consequences of more intense treatment for BP reduction, despite all indications of therapeutic targets for hypertension in the literature.<sup>43</sup> These concerns led to warnings in recent guidelines on the initiation of anti-hypertension therapy in adults with a previous history of falls,<sup>44,45,46</sup> once the physiological changes inherent to ageing, such as decreased baroreflex activity and loss of artery complacency become relevant factors when treating older hypertensive patients, as these changes lead to a greater risk of OH, consequently increasing the risk of falls and other complications. Furthermore, comprehensive studies mention the importance of knowing the real need to indicate a pharmacotherapy and to maintain SBP between 140 and 150 mmHg in order to avoid the emergence of the adverse events previously mentioned.<sup>47,48</sup> Despite this, analyzes carried out later demonstrated that reducing BP more rigorously is not associated with OH.<sup>11,49</sup>

The study is limited as we could not check for associations between the study variables and geriatric syndromes that can influence adherence to drug therapy and the presence for orthostatic hypotension among older adults with diabetes.

Due to the circumstances of the findings, the importance of systematization in the screening for orthostatic hypotension in diabetic individuals is emphasized, since the diabetic autonomic neuropathy is irreversible despite the numerous therapies established in the literature,<sup>22</sup> affecting the treatment and prognosis of the diabetic patient.<sup>50</sup> It is no longer admissible that, during the evaluation of a diabetic older adults, blood pressure levels is not measured minimally in two positions, when possible.

V. TABLES

Table 1. Characteristics of diabetic older adults in Brazil with and without orthostatic hypotension (OH).

	OH Yes (n = 162)	OH No (n = 70)	P value
Age in years	73.2 ± 6.3	72.3 ± 5.8	0.375 <sup>1</sup>
Gender (female)	94 (58.0)	38 (54.3)	0.598 <sup>2</sup>
Time of DM (in years)	14.5 ± 10.2	13.6 ± 8.6	0.903 <sup>1</sup>
BMI	28.4 ± 4.9	29.4 ± 5.2	0.393 <sup>1</sup>
Waist / hip	0.99 ± 0.07	0.99 ± 0.07	0.620 <sup>1</sup>
Smoker	14 (8.6)	6 (8.6)	0.986 <sup>2</sup>
Arterial Hypertension	135 (83.3)	62 (88.6)	0.306 <sup>2</sup>
Peripheral neuropathy	61 (41.2)	26 (39.4)	0.802 <sup>1</sup>
Foot wound	15 (9.3)	(7.1)	0.589 <sup>1</sup>
Amputation	10 (6.3)	3 (4.3)	0.759 <sup>2</sup>
Obliterating arteriopathy of lower limbs (OALL)	13 (8.4)	4 (6.3)	0.783 <sup>2</sup>
Coronary insufficiency	51 (31.9)	17 (24.3)	0.246 <sup>1</sup>
Heart Failure	18 (11.3)	13 (18.6)	0.140 <sup>1</sup>
Stroke	15 (9.3)	11 (15.7)	0.153 <sup>1</sup>

<sup>1</sup>Mann-Whitney test; <sup>2</sup>Chi-square test

Table 2. Comparison of demographic and anthropometric characteristics of Brazilian and French patients who presented Orthostatic Hypotension in the research.

	Brazil (n=162)	France (n=301)	P value
Age in years	73.2 ± 6.3	77±5	<0.001 <sup>1</sup>
Sex (female)	58.0	54.0	0.171 <sup>2</sup>
Duration of disease in years	14.5 ± 10.2	17±11	0.002 <sup>1</sup>
BMI	28.4 ± 4.9	29.8±5.3	<0.001 <sup>1</sup>
Waist / hip	0.99 ± 0.07	0.98 ± 0.09	0.165 <sup>1</sup>
Smoker	14 (8.6)	5.0	0.033 <sup>2</sup>

<sup>1</sup>T test for a sample; <sup>2</sup> Binomial test

Table 3. Pressure levels according to the assessment of orthostatic hypotension in Brazil and France.

	Brazil (n = 162)	France (n = 301)	P value
Arterial hypertension (moderate or severe)	135 (83.3)	274 (91.0)	0.001 <sup>2</sup>
SBP lying down (mmHg)	149.2 ± 24.1	146 ± 21	0.098 <sup>1</sup>
Standing SBP (mmHg)			
1 min	139.0 ± 23.6	134 ± 23	0.008 <sup>1</sup>
3 min <sup>1</sup>	140.2 ± 23.7	137 ±	0.098 <sup>1</sup>
5 min	140.3 ± 23.7	137 ± 21	0.085 <sup>1</sup>
Lying DBP (mmHg)	84,3 ± 11,2	78 ± 11	<0,001 <sup>1</sup>
Standing DBP (mmHg)			
1 min	76,0 ± 11,6	71 ± 13	<0,001 <sup>1</sup>
3 min	76,3 ± 12,7	72 ± 12	<0,001 <sup>1</sup>
5 min	76,6 ± 11,9	72 ± 20	<0,001 <sup>1</sup>

<sup>1</sup>T test for a sample; <sup>2</sup> Binomial test

Table 4. Comparison between the older adults with OH, according to chronic complications related to diabetes mellitus.

	Brazil (n= 162)	France (n=301)	P value
Peripheral neuropathy	61(41,2)	26,2	<0,001 <sup>2</sup>
Foot wound	15 (9,3) <sup>2</sup>	7,0	0.158 <sup>2</sup>
Amputation	10 (6,3)	3,3	0,040 <sup>2</sup>
Obliterating arteriopathy of the lower limbs (OALL)	13 (8,4)	30,5	<0,001 <sup>2</sup>
Coronary insufficiency	51 (31,9)	29,9	0.320 <sup>2</sup>
Heart Failure	18 (11,3)	10,1	0.341 <sup>2</sup>
Stroke	15 (9,3)	13,7	0.058 <sup>2</sup>

Binomial test

Table 5. Comparison between diabetic older adults with OH regarding the classes of drugs used.

Class of medicines	Brazil (n = 162)	France (n = 301)	P value
ACE	23 (14,2)	37,2	<0,001 <sup>2</sup>
ARB	95 (58,6)	40,9	<0,001 <sup>2</sup>
Beta-blockers	54 (33,3)	40,9	0,029 <sup>2</sup>
Diuretics	60 (37,0)	53,2	<0,001 <sup>2</sup>
Calcium channel antagonists (CCA)	41 (25,3)	38,2	<0,001 <sup>2</sup>
Diuretics + CCA	26 (16,0)	24,3	0,007 <sup>2</sup>
Diuretics + CCA + other	25 (15,4)	4,7	<0,001 <sup>2</sup>
Amount	1,7 ± 1,2	1,8 ± 1,0	0,224 <sup>1</sup>

<sup>1</sup>T test for a sample; <sup>2</sup> Binomial test

## VI. CONCLUSION

A higher prevalence of orthostatic hypotension (OH) was detected in clinical evaluation among Brazilian older adults than in French ones. For OH, there was a significant difference between demographic and anthropometric characteristics such as average age in years; time of DM in years; body mass index and smoking. The pressure means in the supine position were higher for Brazilians, while there was a higher percentage of moderate to severe hypertension in the French.

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# KC-390 Certification Process EIS – Entry Into Service

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Received: 01 Nov 2020;

Received in revised form:

06 Jan 2021;

Accepted: 16 Jan 2021;

Available online: 26 Jan 2021

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**Keywords** - *Airworthiness, certification,  
military aviation, KC-390, Space.*

**Abstract-** *This work contextualizes the certification and its importance in the international scenario for military aeronautical products. It presents a brief summary of the Military Airworthiness Certification process in Brazil for aircraft that do not have a Type Certificate, which is applied to projects under development. For this, the work: reviews and analyzes the Brazilian context; identifies the Special Initial Flight Permit process of the Brazilian military aeronautical industry; and exemplifies its application in the (Entry Into Service) KC-390 airworthiness certification process. At the end of the work, it was possible to understand the processes used and their patterns. In addition, the practices adopted can serve as benchmarking for applications in other contexts.*

## I. INTRODUCTION

The certification activity, that is, an independent assessment of the conformity of aeronautical products by third party, obliges aircraft and their components manufacturers to incorporate quality mechanisms in all phases of their projects with the main objective of preventing the recurrence of accidents caused by design failures. In addition, certification contributes to the military aeronautical industry obtaining high levels of confidence, using elaborated tools to mitigate security problems however, aiming the military mission accomplishment for which the design was developed [6].

The KC-390 is the largest military aircraft developed, manufactured and in the process of military certification in the Southern Hemisphere. It has the capacity to carry out missions of Logistic Air Transportation, Refueling in Flight (REVO), Aeromedical Evacuation, Search and Rescue, Combat Fire in Flight, among others. The KC-390 was developed to meet the operational requirements of the Brazilian Air Force, providing strategic mobility to the Brazilian Defense Forces.

The Brazilian Aeronautical Command Certification Authority is defined as the Department of Aerospace Science and Technology (DCTA) for the space, aeronautical and defense sectors. The body that performs

product / project certification activities and quality management systems related to the aerospace sector is IFI, Institute for Fostering and Industrial Coordination and had the biggest challenge, in terms of certification, the KC-390.

This work presents the main characteristics of the airworthiness certification process for military aircraft that have their type certification process in progress. Exemplifying it in the KC-390 project.

## II. BRAZILIAN MILITARY TYPE CERTIFICATION PROCESS

A canonical certification process consists of 5 phases: **conceptual design, requirements definition, compliance demonstration planning, implementation, and post-certification.**

In the **conceptual design** phase, the developer establishes the conceptual design of the product that can be certified in the future. Together, the Certification Authority and the developer carry out interactions that allow the discussion of new technologies, materials, processes and other aspects relevant to the project. It is at this stage that the definition of the set of requirements that will constitute the Certification Basis (BC) begins.

In the **requirements definition** phase is when the process formally begins with the Certification Authority. The Certification Basis (BC) is refined and agreed between the developer (who, from this stage on, can also be called the applicant) and the certifier. The approval of this BC is an activity under the responsibility of the Certification Authority. Therefore, it cannot be delegated. The Certification Plan (PC), an agreed strategy for verifying requirements, and including management plans (how the process will be conducted), which begins to be defined at this point.

In the **planning** phase of the compliance demonstration, the Certification Authority assesses its involvement in the certification activities, based on risk factors and consolidating the plans that started to be discussed in the previous phase.

In the fourth phase, of **implementation**, the activities agreed in the Specific Certification Plan are carried out, which consist of executing tests, whether in laboratories or in flight, compliance inspections, analyzes, among others.

Finally, the last phase, **post-certification**, consists of finalizing the documentation to record the activities carried out and future changes. This is also, where the Continued Airworthiness activities take place, which maintain the safe condition of the product, e.g. scheduled maintenance and inspections. In addition, before the product's Entry Into Service (EIS), its Operational Evaluation (AVOP) is carried out, a process by which the operational efficiency and operational suitability of a System or Material are evaluated [7].

It should be noted that the type certificate refers to the approved type design and the Airworthiness certificate refers to the product.

Once the aircraft has an approved type certificate, a conformity inspection is carried out in order to obtain the Initial Airworthiness Certification (CAI), which is issued by the IFI.

A variation of the model above is the Military Airworthiness Certification process in Brazil for aircraft that do not have a Type Certificate, which is applied to projects under development, entitled as Initial Special Flight Permit (PEVi); Applied in the case of the KC-390.

### III. KC-390 AIRWORTHINESS CERTIFICATION PROCESS – EIS

In September 2012, during the discussions on the conduct of the Military Type Certification process for the KC-390 aircraft, Embraer SA proposed to IFI to conduct this certification process through an accreditation of the company, called in Brazil as Accredited Design

Organization (OPC), following, as far as possible and appropriate, the model used by the European Aviation Safety Agency (EASA), which is described in Regulation Part 21 - Subpart J - DOA (Design Organization Approval).

This proposal aimed to implement in the company, at that time, limited to the KC-390 Project, a Design Guarantee System (SGP) capable of guaranteeing to IFI the effectiveness of activities to verify compliance with the requirements from the BC of the referred aircraft, when carried out by its SGP, In a way so IFI could delegate, in part or entirely (at its sole discretion), these activities to the company.

After seven years of development and application of the aforementioned SGP, IFI started to apply such method in the Certification of other Embraer Design, such as IU-50 (IX) and E-99M, breaking the paradigm of the model traditionally used in the certification of Brazilian aeronautical products. Thus, IFI and EMBRAER innovated by adapting the European model to the characteristics of Brazilian military aviation.

Through extensive evaluation, which included Process Audits at the Embraer units of Eugênio de Melo and Gavião Peixoto, and Monitoring the compliance demonstration with the Certification Basis Requirements of the applied Type Designs, the maturity of the company's SGP was considered as appropriate to Accreditation.

Thus, on December 16, 2019, after meeting the Legal Entities Accreditation Committee. Which is a recognition of the great effort made by both organizations was formally expressed, with the issuance of Certificate 001C2019 for Embraer SA, the first Accredited Design Organization (OPC) in Brazil.

The KC-390 Certification process goes through the 5 phases identified in this work.

The strategy was to have two certification processes, one at IFI [8], which takes care of the military version of the plane and the other in the Brazilian National Civil Aviation Agency ANAC, responsible for the certification of the civil part of the aircraft.

As a result, the KC-390 Certification Basis had a basic platform version [1], also known as Green, whose type certificate was issued in 2018 that includes requirements described in the following Brazilian Civil Aviation Regulations:

- RBAC 025 - Airworthiness requirements: transport category airplanes [2];
- RBAC 026 - Continued airworthiness and safety improvements for transport category airplanes [3];

- RBAC 034 - Requirements for fuel drainage and exhaust emissions from aircraft with turbine engines [4]; and
- RBAC 036 - Noise requirements for aircraft [5].

Moreover, being part of the Certification Basis, we have the so-called “Mission Accomplishment requirements”, which, in other words, are the military requirements that shall be certified by the IFI.

For the Compliance Demonstration Planning phase, the implementation of a methodology that enabled EMBRAER as an Accredited Project Organization (OPC) in 2019 was carried out. This, although already adopted worldwide by aviation regulatory agencies such as EASA, was innovative for Brazil.

In 2014, it was estimated that the KC-390 Certification Plan had more than 600 pages; and 624 requirements to be verified by IFI using as a guide MIL-HDBK-516, Airworthiness Certification Criteria the US Air Force (USAF). At the time, the Certification Plan had foreseen more than 47,000 man/hours of workforce to be applied on the certification process, mainly in the Implementation phase.

To complete this process, a Compliance Inspection was carried out for the issuance of the Special Initial Flight Permit and the technical basis equivalent to the type certificate was the issuance of a technical opinion by the Aerospace Products Certification Division at IFI, which describes the applicable requirements to the KC-390 EIS product.

The Post-Certification Phase started with the delivery of the first aircraft, which took place on September 4<sup>th</sup>, 2019. It deals, above all, with the field monitoring process for possible Service Difficulties arising from a failure linked to the aircraft design.

#### IV. PRACTICES ADOPTED TO SERVE AS BENCHMARKING FOR APPLICATIONS IN OTHER CONTEXTS

The military aeronautical industry has activities recognized for their technical commitment and credibility linked to safety and mission fulfillment, such as the KC-390 EIS Certification presented in this work. These activities have a high potential for application in the main technological products industries.

The **space**, medical, automobile and other industries, which deal with high-tech projects and have a specific development of qualification of new components and materials, live with the constant concern with the success of the project and the fulfillment of the mission. For this, it is important to adopt processes that guarantee the

fulfillment of the requirements, the conformity with the specifications and monitor the product life cycle. Although this is already being done on an increasing scale, it is suggested that those industries be inspired by the processes of the aeronautical industry, including those summarized in this work, adopting them as benchmarking and adapting to their needs and specificities.

#### V. CONCLUSION

This work first presented the military aeronautical certification process in the Brazilian context. Subsequently, the processes used by IFI (Brazilian military airworthiness authority) for the canonical certification were summarized, as well as the airworthiness certification

For aircraft that did not finalized their certification processes. It exemplified the stages of the certification process applied in the KC-390 - EIS (Enter Into Service). Finally, it was possible to understand the processes, practices, civil and military standards used by the industry in question. When summarizing the certification process, it is possible to evidence practices adopted to serve as benchmarking for applications in other contexts.

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# Quality & Innovation: Quality Tools That Enhances New Products And Services Development

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Received: 29 Oct 2020;

Received in revised form: 12 Jan 2021;

Accepted: 19 Jan 2021;

Available online: 26 Jan 2021

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**Keywords—** Quality Tools, Innovation  
Process, NPD, Banking Industry,  
Competitive Advantage.

**Abstract—** The purpose of this research is to investigate the possible correlation between quality tools and innovation generation in companies nowadays, with particular interest in the financial sector, governed by strong regulation. Quality Management is one of the main axes of modern management, a movement that had its peak in the '80s and '90s. Due to the high competitiveness of markets and the increasing use of technologies in the development of new businesses and products, innovation and quality have become concerns of the organizations that aim to obtain a sustainable competitive edge. In this way, a bibliographic review allied to the case study was conducted in the retail banking industry, followed by comparative analysis in order to deepen the interpretation of the collected variables. As a conclusion, there is a convergence towards a positive correlation between quality tools and innovation processes underpinning the discussion the measurement of competitive advantage from the perspective of quality and innovation in the banking industry.

## I. INTRODUCTION

In the current economic scenario, marked by globalization and accelerated technological and cultural transformations,

organizations have made use of quality tools and innovation to improve processes, satisfy customers and ensure their competitiveness in the market.

Innovation has long been on the agenda of companies. A decade ago, the consultancy McKinsey [1] identified - while interviewing more than 1400 executives, that innovation is among the three highest priorities to leverage growth to 70% of respondents. At the same time, total quality management (TQM) has been one of the main pillars [2] in the management practice of organizations since the 1980s [3]

Whether in the universe of quality or innovation, their respective tools, methodologies, approaches and techniques have a huge scope and are applicable to virtually all industrial sectors. In the specific case of this research, the focus was to understand this apparent duality between innovation and quality in the context of Brazilian Retail Banks with their uniqueness [4].

Retail banks were chosen as an object of study for being an extremely important sector in the national and international scenario. As stated by S&P Global Market Intelligence (2017), in a ranking of the 50 largest Latin American Banks (according to the value of their assets), five of them are Brazilian.

Thus, the main objective of the study was to evaluate whether or not there is a correlation between the use of quality tools and the process of generating innovations in

retail banks. A decade ago, a research has already addressed this relationship within the manufacturing industry [3] finding evidence of a positive correlation among them. Notwithstanding the opportunity to investigate such relationship, the present research sought to identify any traditional or new quality tools/techniques that could be employed in the innovation process in banks.

The literature review of this research is based on three pillars: quality and competitiveness, innovation and intersections amongst quality tools and the banking industry.

## II. COMPETITIVENESS AND QUALITY

Competitiveness in terms of quality can be understood [5] as the main reason for the success or failure of business organizations. Competition is responsible for the adequacy of a company's activities to customers' needs in the business ecosystem in which it operates.

Additionally, increased competition is a phenomenon not only restricted to developed markets; it is present all over the world. Thus, to facing it, organizations must have an increasingly sophisticated and thorough analysis, as well as greater agility between the planning task and the courses of action necessary for its materialization [6].

A foundation present in this approach is the ephemerality of advantage competitive, which cannot be sustained forever; and will become outdated over time [7].

Quality management is seen today, both in the academic and in the business world's, as a strategic factor for improving competitiveness and productivity. The traditional quality tools are widely used in the corporate world and quality academic studies [8]. They can be used to point out and provide industry improvements, minimizing waste and optimizing productivity. These traditional quality tools were selected as the object of this study and are briefly explained below:

- **Stratification:** Division and organization of a group into several subgroups based on distinguishing or stratification characteristics.
- **Check sheet:** Printed or digital forms used to record and assemble data in a simple way that facilitates its further use and analysis.
- **Pareto diagram:** Vertical bar graph that organizes the information in a way that makes evident and visual, in order of importance of problems and their causes.
- **Cause and Effect Diagram (Ishikawa):** Graphic representation that organizes logical, and in order of

importance, the potential causes contributing to an effect or particular problem.

- **Histogram:** Indicate the frequency and distribution with which certain values occur.
- **Scatter diagram:** Check whether there is indeed a correlation between two parameters or variables of a problem, and if so, what type it is.
- **Control chart:** Visualization of the statistical control state of a process and the monitoring of location and dispersion of process control items.
- **DMAIC:** Establish best practices to ensure that permanent solutions are deployed, and that they can be replicated in other businesses or similar operations.
- **FMEA:** Prevent unacceptable failures and help resource management more efficiently increasing reliability, or decreasing the likelihood of product/process failure.
- **Flowchart:** Graphical representation of a procedure, problem or system, which facilitates the visualization to identify problems and propose improvements.

## III. INNOVATION AND INTERSECTIONS WITH QUALITY TOOLS

Innovation can be defined as the introduction of new products, production methods, markets, sources of supply, forms of organization or processes.

The Oslo Manual defines innovation as the implementation of a new or significantly improved product, process, marketing and organizational method in business practices, in the organization of the workplace or external relations [9].

A review of the literature that discusses the relationship between total quality management and innovation suggests that there are conflicting arguments between such methodologies.

There is a positive correlation between Innovation Management and Quality Tools [10]. In order to study this relationship, it is necessary to identify their intersection. Based upon the literature review, we understand that both concepts, have a common purpose concerning competitiveness: to continuously improve products, processes and applications in the company to please their consumers.

This relationship proves to be crucial to align short- and long-term quality strategy plans, integrating with the company's current and future actions in an evolving process in order to achieve a level of business excellence.

Seeking for this relationship, McAdam, Armstrong and Kelly [11] conducted a survey of 15 small businesses between the Republic of Ireland and Northern Ireland. In order to generate quantitative results, evaluation questionnaires based on the Likert scale were applied (grades 1-6, 1 being the worst and 6 being excellent). As a result, they were able to construct a graph inferring that organizations which had good evaluations in innovation also had great evaluation in quality management and vice versa. Regarding the qualitative results, directors, managers and employees of each of the companies were interviewed by McAdam, Armstrong and Kelly [11] and as an upshot, they obtained a correlation between companies with low level of innovation and bad attitudes of the managers. In conclusion McAdam, Armstrong and Kelly [11] attested that organizations that have achieved high scores in innovation and overall quality tend to have built an innovative culture in an established quality program of continuous improvement and those that have achieved low innovation results, are the ones that still need improvement in these practices.

It is doubtful that an innovative company can be competitive if it does not produce with quality. Literature [2] also point to a significant and positive relationship between quality management performance and innovation performance, especially in the Process Innovation subdivision.

On top of all, there are conflicting arguments in many studies. Various research suggests that quality tools can provide an excellent environment to encourage innovation due to their consumer orientation and continuous improvement, on the other hand, some authors indicate that this relationship generates only incremental innovation, not having such a positive return. However, after analysis of the innovation and quality activities in 451 Spanish companies [12], there is evidence that TQM can in fact provide an excellent business environment to promote innovation through collaboration in business performance.

Another study [3] that also used statistical tools (regression) in a database of 2,278 Brazilian companies to identify the influence of TQM on innovation in business growth, concluded that the use of TQM is more related to process innovation than to new product development (NPD).

TQM can be fragmented into two main components: hard and soft [13]. As hard elements, practices such as the process control and products to meet specifications can be an example; and as soft, were mentioned training, learning, teamwork and cooperation, promoting the human angle of the quality management system.

López-Mielgo, Montes-Peón and Vázquez-Ordás [13] have chosen as their research object Spanish companies that use hard elements of quality control and have verified the effect on the result of innovation in the generation of new products and processes. To this end, a review of the theoretical literature demonstrated a positive relationship between quality management and innovation, since the high capacity for innovation can reduce costs to implement a high-quality standard. Thus, its conclusion emphasized the importance of these departments working together and overcoming differences in their traditional activities, in order to implement quality management tools to standardize the creation of new products and services.

Fernandes [14], in an analysis of the relationship and impact on the organizational performance of TQM and the innovation tools, found that this is a two-way relationship in which the use of TQM can positively or negatively influence innovation, while outputs can be used to improve quality management. Thus, the use of TQM in companies may work to support or to prevent/limit innovation, however most cases have shown a positive impact.

Schniederjans and Schniederjans [15] subdivided the quality management tools into two types: social and technical. Social practices include training, functional cooperation and the relationship with the supply chain. Technical practices were defined as administrative innovation and use tools such as Just-in-Time and Design for Manufacturing. So, practices help each other. Social quality management increases the likelihood of organizational innovation through agile sharing and dissemination of ideas within the organization. However, despite understanding that organizational size and managerial ethics are variables that can positively affect the relationship between technical quality and innovation practices, the authors stated that it was not possible to find sufficient data to prove this correlation [15].

#### IV. BANK INDUSTRY

Quality management contributes to the process of competitiveness by offering the market flawless products and fast deliveries, associated with operational programs that can fully contribute to serving their consumers.

The banking sector as any economic unit aims to achieve productivity gains that enable it to achieve levels of efficiency equal to or greater than competitors. Nowadays, Brazilian banks face competition from technology companies in financial services, also called Fintech's, that are creating innovation with technology-based processes from differentiated business models

In accordance with a recent research conducted by the Brazilian Federation of Banks (FEBRABAN), the main representative body, the innovation promoted by the Brazilian banking sector is highlighted worldwide, as a result of solid investments and constant care to attain improvements of the system. With the pursuit of maintaining competitiveness, deep transformations in the banking sector have taken place over the past five decades [16].

**V. METHODOLOGICAL PROCEDURES**

The literature review serves as the basis for the empirical part of the research. The preparation for field research is presented, with the selection of the case and the elaboration of the data collection protocol. Followed by data collection and analysis of responses. Finally, comparative analysis of the cases is carried out in the light of the literature review. Figure 1 illustrates the main stages of the work. We created research protocols to be used both on a large scale in the banking sector and to grounding research in the case highlighted by the survey.

The interviews were conducted from direct observation techniques with several employees in assorted positions,

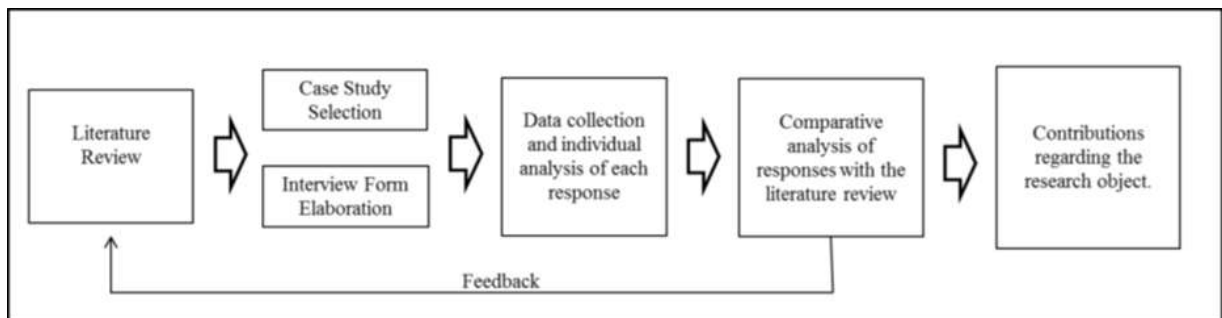
working in product development, innovation or quality control areas of two major retail banks in Brazil, which the sum of participation in the national market represents more than 20% of the total market assets, what illustrates the representativeness and importance of the sample studied for the academic and business world.

**VI. RESULTS**

All respondents agreed somehow on the importance of using quality tools in order to achieve a competitive differential in the retail banking sector.

From then on, the following questions sought to investigate with the interviewees the tools used in development environments in retail banks and among them, which stand out. It is possible to observe the use of the tools as Pareto diagram (52%), histograms (47%), dispersal diagrams (42%), cause and effect diagrams or Ishikawa (37%) and control charts (37%). Table 1 expresses the form and purpose of the quality tools used.

Thus, it was noted that quality tools are generally not used alone, but together or associated with other tools/methodologies, in order to take advantage of the best characteristics of each one.



*Fig. 1: Grounded Research Method for this Research*

Comparing the results with the bibliographic review, some tools have greater potential than they are currently employed. Table 2 compares the potential versus actual

utilization of each of the quality tools cited in field research.

Table 1: Quality Tools for Competitiveness

Quality Tool	Approach for Competitiveness
Scatter Diagram	(1) Correlation analysis between the amount of training hours for the bank manager and the fulfillment of the sales goal; (2) Analysis for the generation and introduction of new credit models; (3) Analysis of correlation between error and the cause of the problem; (4) Optimal goal definition for bank managers.
Pareto Diagram	(1) Identify bank branches with the highest number of customer complaints; (2) Analyze the main operational errors and problems that impact the largest number of customers; (3) Analyze various sources to identify the most relevant products; (4) Check which products bring the highest return to allocate marketing money.
Histogram	(1) Verification of the cost distribution curve x volume for the identification of budget offenders; (2) Future consumption forecast; (3) Checking the level of service or error analysis; (4) Analyze the customer's income in order to adjust the supply of products according to the salary range.
Control Charts	(1) Control of expenses for identification of outliers; (2) Analysis of credit product claims; (3) Check the customer profile and its purchase history; (4) Control sales of products and identify deviations in projection and failures in the supply channels; (5) Operation control.
Cause and Effect diagrams	(1) Analyze the root cause of the operational problems pointed out by the analysis made via the Pareto diagram; (2) Analyze the root causes of factors that have effect or a change in the cost of an activity (drivers); (3) Analysis and discussion of the root cause generating new ideas.
DMAIC	(1) List improvement plans to increase the level of customer satisfaction.
Stratification	(1) Check the customer profile and their purchase history.
Flowchart	(1) Process mapping aiming for continuous improvement (As is/To be).
FMEA	(1) Implementation of projects and technical revisions.
Check Sheet	(1) Sales goal analysis

Table 2: Use of Quality Tools for Innovation Purpose

Quality Tool	Potential to create innovation (literature review)	Real use to create innovation (interviews)
Stratification		
Check sheet		
Pareto diagram		
Cause and Effect Diagram		
Histogram		
Scatter diagram		
DMAIC		
FMEA		
Flowchart		

Low Potential → High Potential

After analyzing the quality tools, it was necessary to understand the role of innovation to achieve a competitive edge, in this case, 94.7% of respondents agree that the management of innovation is indispensable for such achievement in the Retail Banking sector.

With this, deepening the reason of the previous answer was possible to realize that the respondents believe that it is essential to innovate/break paradigms in a highly regulated sector, aiming at customer loyalty and engagement, delivering products and services with high added value, as well as increase the efficiency of internal and external processes.

As a next step, the interview aimed to analyze the possible correlation between the use of quality tools and innovation management, where 89.5% of respondents agree, partially or totally, that tools can be used as input to generate innovation in products and processes. In addition, 68.4% of respondents have been able to observe this use in practice.

Quality tools can also guide needs for change and improvements during the creation of a new digital channel. For example, one of the largest banks in Brazil identified the need to create an application (app), with the same features, but in a lighter version, aiming to contain a high level of uninstallation of the original application.

In that wise, it is possible to realize that the responses of the form corroborate the studies analyzed during the literature review. In Table 3 it is possible to verify that most studies point to a positive correlation between the use of quality tools and the process of generating innovation. Although the "traditional" quality tools exposed in the literature review are useful to ensure continuous improvement of processes, some applications require new approaches [17]. Knowing the real needs of the customer, what defines an attractive customer service, what vision of the future motivates employees to have self-initiative and the documentation systems and methods used to increase

the success of the project activities are some examples of needs that cannot be met by traditional quality tools.

So, there is a demand to create new methods to achieve new standards and requirements, such as: (a) gathering creative ideas; (b) a plan to enrich ideas and solutions; (c) cooperation between people and (d) innovation in products, services and processes.

Table 3: Quality Tools and Innovation Intersection

Author(s)	Positive Correlation	Negative Correlation	No Correlation
Kanji (1996)	Yes	No	No
McAdam et al. (1998)	Yes	No	No
Prajogo e Sohal (2002)	Yes	No	No
Levesque and Walker (2007)	Yes	No	No
Martinez Costa and Martinez Lorente (2008)	Yes	No	No
Facó et. al (2009)	Yes	No	No
López-Mielgo et al. (2009)	Yes	No	No
Fernandes (2012)	Yes	Yes	No
Schneiderjans and Schneiderjans(2015)	No	No	Yes

Following these four proposed guidelines, the research group investigated the methods used in the areas of operational research, value engineering and methods of creating and selecting ideas. The authors identified seven "new" methods that may be useful to achieve innovation success in aspects involving projects, assurance and reliability, maintenance capacity and process improvement [18] presented in Table 4.

Table 4: New Quality Tools and their Approaches for Innovation

Quality Tool	Approach for Competitiveness
<b>Scatter Diagram</b>	(1) Correlation analysis between the amount of training hours for the bank manager and the fulfillment of the sales goal; (2) Analysis for the generation and introduction of new credit models; (3) Analysis of correlation between error and the cause of the problem; (4) Optimal goal definition for bank managers.
<b>Pareto Diagram</b>	(1) Identify bank branches with the highest number of customer complaints; (2) Analyze the main operational errors and problems that impact the largest number of customers; (3) Analyze various sources to identify the most relevant products; (4) Check which products bring the highest return to allocate marketing money.
<b>Histogram</b>	(1) Verification of the cost distribution curve x volume for the identification of budget offenders; (2) Future consumption forecast; (3) Checking the level of service or error analysis; (4) Analyze the customer's income in order to adjust the supply of products according to the salary range.
<b>Control Charts</b>	(1) Control of expenses for identification of outliers; (2) Analysis of credit product claims; (3) Check the customer profile and its purchase history; (4) Control sales of products and identify deviations in projection and failures in the supply channels; (5) Operation control.
<b>Cause and Effect diagrams</b>	(1) Analyze the root cause of the operational problems pointed out by the analysis made via the Pareto diagram; (2) Analyze the root causes of factors that have effect or a change in the cost of an activity (drivers); (3) Analysis and discussion of the root cause generating new ideas.
<b>DMAIC</b>	(1) List improvement plans to increase the level of customer satisfaction.
<b>Stratification</b>	(1) Check the customer profile and their purchase history.
<b>Flowchart</b>	(1) Process mapping aiming for continuous improvement (As is/To be).
<b>FMEA</b>	(1) Implementation of projects and technical revisions.
<b>Check Sheet</b>	(1) Sales goal analysis

Furthermore, it is possible to compare the use of old and new tools in the innovation process [19], pointing out that the seven new tools are more related to a concept and ideation, or even to a structured way of solving problems. The latter skills are often found in the early stages of the innovation cycle.

## VII. CONCLUSION

The present work has been proposed in order to analyze whether there is a correlation between the use of quality tools and the process of generating innovation in retail banks. The study was subdivided into three main optics: (1) potential correlation, (2) collaboration of quality tools to overcome innovation barriers, and (3) contribution of these tools to the role of innovation in highly regulated competitive environments. For this, the chosen methodology was a case study with two main pillars: bibliographic review and interview with employees of the Brazilian retail banking sector.

Although not unanimous, the vast majority of authors agrees that there is a positive correlation between the use of quality tools or quality management with the management of innovation. The hypothesis was also supported by the interview; where the use of quality and innovation tools were seen as a competitive differentiator by the interviewees and both have a positive correlation.

As a second analysis result, it is perceived that tools can be applied to break down barriers to innovation. Thereupon, traditional quality tools cooperate to understand the process (flowchart), view current product results (histogram), analyze market behaviors (scatter diagrams), organize and relate data (stratification) identify the main problems or gaps (Pareto diagram) and point out their causes (cause and effect diagram). Moreover, since they are very focused on problem solving, the new quality tools have shown to be helpful in the initial processes of an innovation cycle.

As a last result, the analysis showed that quality tools are able to collaborate throughout the innovation processes ensuring positive impacts related to changes. We highlight the use of tools such as Pareto diagram, Histogram and Dispersion diagram, as well as new quality tools that reaffirm how the changes generated by regulation or not, are affecting the competitive environment of the retail bank.

#### ACKNOWLEDGEMENTS

The authors sincerely thank CNPq for supporting this research and to the Innovation and Sustainable Competitiveness Forum (FICS / UFABC) for their intellectual reinforcement.

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## Factors associated with pressure injury and preventive measures in an intensive care unit

## Fatores associados à lesão por pressão e medidas preventivas em unidade de terapia intensiva

## Factores asociados con lesiones por presión y medidas preventivas en una unidad de cuidados intensivos

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Received: 01 Nov 2020;

Received in revised form: 15 Jan 2021;

Accepted: 22 Jan 2021;

Available online: 27 Jan 2021

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**Keywords—** Pressure Injury,  
Associated Factors, Preventive  
Measures

**Abstract—** Pressure injury is a localized damage to the underlying skin and / or soft tissue, usually on a bony prominence or related to the use of a medical device or other artifact. The lesion can appear on intact skin or as an open ulcer and can be painful. The injury occurs as a result of intense and / or prolonged pressure in combination with shear. Tolerance of soft tissue to pressure and shear can also be affected by microclimate, nutrition, perfusion, comorbidities and their condition. The objective of identifying the associated factors and preventive measures for pressure injuries in an intensive care unit, in order to support the professional in decision making to improve the care provided to these patients. The methodology is a narrative review study with an exploratory, observational, retrospective study approached in 07 articles in the databases (PUBMED, LILACS, BVS, SciELO, REBEN) between 2008 to 2016. During the review, it was found that most pressure injuries could be avoided by taking simple actions such as changing the position, using pressure relief devices in areas of bone prominence, careful observation of the skin and greater knowledge by health professionals, making it necessary to qualify health professionals with regard to the main characteristics of patients who develop pressure injuries and risk assessment scales such as the Braden scale, with the possibility of making prognoses and, thus, prevent them. It is concluded that the majority

of pressure injuries could be avoided, through the identification of risk and the implementation of a care plan, preventing this condition that brings so much discomfort to the client and his family. From some simple actions such as changing the position every two hours.

**Resumo** - Lesão por pressão é um dano localizado na pele e/ou tecidos moles subjacentes, geralmente sobre uma proeminência óssea ou relacionada ao uso de dispositivo médico ou a outro artefato. A lesão pode se apresentar em pele íntegra ou como úlcera aberta e pode ser dolorosa. A lesão ocorre como resultado da pressão intensa e/ou prolongada em combinação com o cisalhamento. A tolerância do tecido mole à pressão e ao cisalhamento pode também ser afetada pelo microclima, nutrição, perfusão, comorbidades e pela sua condição. O objetivo de identificar os fatores associados e medidas preventivas para lesão por pressão em unidade de terapia intensiva, a fim de subsidiar o profissional na tomada de decisão para a melhoria da assistência prestada a esses pacientes. A metodologia trata-se de um estudo de revisão narrativa com abordagem de estudos exploratórios, observacionais, retrospectivos pesquisados em 07 artigos nas bases (PUBMED, LILACS, BVS, SciELO, REBEN) entre 2008 a 2016. Durante revisão, verificou-se que a maioria das lesões por pressão poderiam ser evitadas a partir de algumas ações simples como realizar mudança de decúbito, o uso de dispositivos para alívio da pressão em áreas de proeminência óssea, observação criteriosa da pele e maior conhecimento por parte dos profissionais de saúde, tornando-se necessário qualificar os profissionais de saúde no que diz respeito às características principais dos pacientes que desenvolvem lesão por pressão e das escalas de avaliação de risco como a escala de Braden, com a possibilidade de realizar prognósticos e, assim, preveni-las. Conclui-se que a maioria das lesões por pressão poderiam ser evitadas, através da identificação de risco e implantação de um plano de cuidados, previne essa afecção que traz tantos desconfortos para o cliente e seus familiares. A partir de algumas ações simples como realizar mudança de decúbito a cada duas horas.

**Keywords**— Lesão por Pressão; Fatores Associados; Medidas Preventivas.

**Resume** - La lesión por presión es un daño localizado en la piel subyacente y / o tejido blando, generalmente en una prominencia ósea o relacionado con el uso de un dispositivo médico u otro artefacto. La lesión puede aparecer en piel intacta o como una úlcera abierta y puede ser dolorosa. La lesión ocurre como resultado de una presión intensa y / o prolongada en combinación con cizallamiento. La tolerancia de los tejidos blandos a la presión y el cizallamiento también puede verse afectada por el microclima, la nutrición, la perfusión, las comorbilidades y su condición. El objetivo de identificar los factores asociados y las medidas preventivas de las lesiones por presión en una unidad de cuidados intensivos, con el fin de apoyar al profesional en la toma de decisiones para mejorar la atención brindada a estos pacientes. La metodología es un estudio de revisión narrativa con un estudio exploratorio, observacional, retrospectivo abordado en 07 artículos en las bases de datos (PUBMED, LILACS, BVS, SciELO, REBEN) entre 2008 y 2016. Durante la revisión, se encontró que la mayoría de las lesiones por presión podrían evitarse tomando acciones simples como cambiar la posición, usar dispositivos de alivio de presión en áreas de prominencia ósea, observación juiciosa de la piel y un mayor conocimiento por parte de profesionales de la salud, por lo que es necesario capacitar a los profesionales de la salud en cuanto a las principales características de los pacientes que desarrollan lesiones por presión y escalas de valoración del riesgo como la escala de Braden, con posibilidad de hacer pronósticos y, así prevenirlos. Se concluye que la mayoría de las lesiones por presión podrían evitarse, mediante la identificación de riesgo y la implementación de un plan de cuidados, previniendo esta condición que tanto malestar trae al cliente y su familia. Desde algunas acciones sencillas como cambiar de posición cada dos horas.

**Palabra Clave** - Lesão por Pressão; Fatores Associados; Medidas Preventivas.

## I. INTRODUCTION

According to the National Pressure Ulcer Advisory Group (NPUAP), pressure injuries are local damage to the underlying skin and / or soft tissues, usually in bone protrusions or related to the use of medical equipment or

other artifacts. The lesions can appear on the skin intact or as open ulcers and can be painful. High pressure and / or prolonged pressure combined with shear force can cause injury. Soft tissue tolerance to pressure and shear can also

be affected by microclimate, nutrition, perfusion, comorbidities and conditions (CALIRI et al., 2016).

In addition to prolonging hospital stay and increasing mortality, crushing also increases the cost of treatment, which results in an increase in the workload of nursing professionals and physical and emotional pain for patients and their families (PACHA et al., 2018). In view of this series of problems, in addition to providing care, the nursing team must also be aware of preventive measures and related factors, essential for the control / minimization of pressure injuries (OLIVEIRA et al., 2014).

With the participation of the top management of the organization and its employees, more and more initiatives are being promoted globally to improve health, safety and quality. Therefore, the quality objectives of the various services provided to society mean the optimization of results. These standards were established to promote specific improvements in areas of care that are considered problematic and have specific measurement elements that are evaluated regardless of the following criteria: correct patient identification; improve the efficiency of communication between health professionals; increase use Drug safety risks; eliminate the wrong aspects, wrong patients, wrong procedures; reduce the risk of infection; reduce the risk of injury / fall victims (VARGAS & LUZ, 2010; ROQUE & MELO, 2014).

As a reason, pressure injury is an unpleasant and painful complication that can affect bedridden patients in the intensive care unit. To determine the risk factors and preventive measures, the knowledge of the professionals of the nursing team who provide assistance is extremely important. to the patient. . This is a study on stress injuries in an intensive care unit, with the objective of identifying relevant factors and preventive measures for solving problems, assisting professionals in making decisions to improve the care provided to these patients, important for the control / minimum It is very important to change the patient's condition. Stress injury in the intensive care unit.

Therefore, as pressure injuries represent a threat related to bedridden patients, prolong hospital stay, make recovery difficult and increase the risk of other complications (such as infection), we proposed this topic.

The aim of the study is to determine the relevant factors and preventive measures for stress injuries in the intensive care unit, in order to support professionals in decision-making to improve the care provided to these patients, revealing the relevant factors and preventive measures stress injuries.

## II. MATERIALS AND METHODS

The present work is a narrative review of the literature carried out through a bibliographic review focused on describing the factors associated with pressure injuries and preventive measures in an intensive care unit.

The bibliographic research had the following question: What are the factors associated with pressure injuries and preventive measures in the intensive care unit? Articles that sought to explain the factors associated with pressure injuries and preventive measures in an intensive care unit were selected from scientific articles, in Portuguese, English and Spanish.

The organization of this review took place between the months of June and December 2020, thus providing guidance for researchers in relation to the subject addressed, so that they can formulate hypotheses in an attempt to solve frequent problems related to the assistance provided in previous studies.

For data collection, the bases (PUBMED, LILACS, BVS, SciELO, REBEN) were used, searching for keywords such as: Pressure Injury; Associated Factors; Preventive measures. 15 scientific articles containing publications between the years 2008 and 2020, which dealt with the chosen theme, were analyzed.

## III. RESULTS AND DISCUSSION

The skin is a component of the epidermal system, responsible for 16% of body weight, and is the largest organ in the human body, whose main functions are: organic defense, thermal regulation, coverage, prevention of various environmental factors and sensory functions. The skin is divided into three layers: epidermis, dermis and subcutaneous tissue (RODRIGUES, SOUZA & SILVA, 2008).

Compared with the dermis and subcutaneous tissue, the epidermis is the thinnest and most external. The dermis is composed of fibers, blood vessels and nerve endings, which provide support, resistance, blood and oxygen to the skin. The subcutaneous tissue is called subcutaneous tissue and is the deepest layer, basically formed by fat cells, which function as a calorie deposit and maintain body temperature (RODRIGUES, SOUZA & SILVA, 2008).

The National Pressure Ulcer Advisory Group (NPUAP) announced a term change on April 13, 2016. The term "pressure injury" has replaced "pressure ulcer". The term change more accurately describes intact skin ulcers and pressure cutaneous ulcers. In addition to changing the terminology, Arabic numerals are now used instead of Roman numerals in the step names. The term "suspect" has been removed from the diagnostic label for

deep injury. Other definitions of pressure injury agreed at the meeting include pressure injury related to medical equipment and pressure injury to the mucous membrane (CALIRI et al., 2016).

According to the National Pressure Ulcer Advisory Group (NPUAP), pressure injuries are local damage to the underlying skin and / or soft tissues, usually in bone protrusions or related to the use of medical equipment or other artifacts. The lesions can appear on the skin intact or as open ulcers and can be painful. High pressure and / or prolonged pressure combined with shear force can cause injury. Soft tissue tolerance to pressure and shear can also be affected by microclimate, nutrition, perfusion, comorbidities and conditions (CALIRI et al., 2016).

The causes of stress injuries are varied, involving external and internal issues. External factors are related to the injury mechanism, as they hinder the effective circulation of nutrition and oxygenation of the skin. They are: pressure, shear, friction. Internal factors are related to the client's health and affect the structure and integrity of their skin. However, the main factor that causes pressure damage is the pressure exerted on the capillary between the bone structure and the surface, which leads to tissue necrosis (GOMES et al., 2010).

Severely ill patients tend to cause pressure damage due to sedation, altered levels of consciousness, ventilatory support, use of vasoactive drugs, limitation of long-term exercise and hemodynamic instability, depending on the nurse to protect the patient from any related risks. (PESTANA and VIEIRA, 2012).

According to the classification of the National Pressure Ulcer Advisory Group (NPUAP), the pressure injury is divided into the following stages: pressure injury stage 1: skin erythema does not turn white; stage 2 pressure injury: skin loss due to exposure of the dermis; Stage 3 pressure injury: full-thickness skin peeling; pressure injury stage 4: loss of full thickness skin and loss of tissue. There are also injuries caused by unclassified pressure: loss of skin in all thickness and loss of invisible tissue, and injuries caused by pressure of deep tissue: discoloration, deep red, brown or purple, persistent and will not turn white (CALIRI et al. 2016).

The National Pressure Ulcer Advisory Group (NPUAP) also has two additional definitions, such as: medical device-related pressure injury, which describes the cause of the injury. Pressure injuries associated with medical equipment are caused by the use of equipment created and used for diagnostic and therapeutic purposes. The resulting pressure injury usually has the pattern or shape of the device. The pressure injury and mucosal pressure classification system should be used to

classify this type of injury, which is discovered when the damaged area has a history of using medical equipment. Due to the anatomical structure of the tissue, these lesions cannot be classified (CALIRI et al., 2016).

In addition to prolonging hospital stay and increasing mortality, stress injuries also increase treatment costs and, therefore, increase the workload of nursing professionals and the physical and mental pain of the patient and his family, involving pain and severe skin changes. In adult hospitalized patients, the prevalence of pressure ulcers can vary from 3% to 14% (PESTANA & VIEIRA, 2012).

The intensive care unit is a complex ward designed to serve critically ill patients who need specific physical space, professional human resources and advanced technical means. Critically ill patients are those who have severe clinical illnesses or who need strict control. Due to sedation, changes in the level of consciousness, ventilatory support, vasoactive drugs, restricted movement and hemodynamic instability, this patient is subject to pressure injury (ARAÚJO, MOREIRA, CAETANO, 2011).

The reasons for the development of pressure injuries are many, which can involve the environment (pressure, shear and friction) and external factors within the body (age, morbidity, urinary and fecal incontinence, nutritional status, hydration, weight, vascular disease ), infection, activity status and level of consciousness). It is developed based on the individual illness of each client, and these factors are considered integrally in the care provided to them, leading to the worsening of stress, which is considered a serious problem, especially in the elderly and people with chronic diseases. In patients with degenerative diseases (ARAÚJO and SANTOS, 2016).

As for external factors, they are related to the injury mechanism, as they prevent the full circulation of nutrition and oxygenation of the skin. Body pressure is the most important factor that causes pressure injury. When the soft tissue is compressed between the bone protrusion and the hard surface, a pressure occurs that prevents blood flow, leading to tissue hypoxia and death. Shear occurs when the client is lying in bed while the skin layer moves. Friction occurs when two surfaces rub against each other (RODRIGUES, SOUZA and SILVA, 2008).

Internal factors concern the health of the client, which means the structure and integrity of the skin. People affected by acute illnesses are more susceptible to stress injuries and have the following predisposing factors: pain, hypotension, heart failure, vasomotor failure, shock-induced peripheral vasoconstriction, etc. Customers with serious and unstable employees (with possible system failures) are also the most vulnerable to this situation. The decrease in tissue perfusion also increases the risk of

diseases, which can affect patients with diabetes, obesity and edema (RODRIGUES, SOUZA and SILVA, 2008).

The reduction in hemoglobin levels, due to the inefficiency of blood to carry out transport and maintain adequate tissue oxygenation, presents a risk of injury to clients (RODRIGUES, SOUZA and SILVA, 2008). Nutritional deficiencies, such as dehydration, anemia and weight loss, can reduce skin elasticity, reduce oxygen content in tissues and prevent healing. Nutrients (such as vitamin C) are essential for the maintenance and repair of tissues (RODRIGUES, SOUZA and SILVA, 2008).

When the sensory perception is impaired or disappears, the client changes the sensitivity to pain and discomfort, not being able to identify the parts of the body that need to relieve stress (DA SILVA, RIBEIRO-FILHO & PINTO, 2011). Due to the inconvenience, the client has reduced the frequency of changing positions and, therefore, is unable to relieve pressure alone (RODRIGUES, SOUZA and SILVA, 2008).

This humidity usually occurs when the client suffers from urine, fecal incontinence or excessive sweat (SILVA et al., 2020). Excessive contact with water can cause skin maceration, which reacts with corrosive substances in the excrement and becomes inflamed, becoming more susceptible to pressure rupture and, in case of rupture, the lesion ends up being affected. Microorganisms invade and cause infection and moisture also increases the friction effect, which favors the appearance of lesions (RODRIGUES, SOUZA and SILVA, 2008).

Skin thickness and tissue perfusion in the elderly are reduced. The skin becomes dry and the sebaceous and sweat glands are less active. Muscle atrophy and bone structure become more prominent (LEITE et al., 2012). The decrease in sensory perception and the difficulty of reallocation lead to prolonged pressure on the same body area. These changes make the elderly more vulnerable to stress injuries (BRITO, 2017).

Studies show that the incidence of these changes in the elderly in this age group is between 10% and 20% and the annual mortality is 70%. Approximately 20% of these elderly people suffer tissue damage in grades III and IV (SAKASHITA and NASCIMENTO, 2011). Other factors may also be related to the development of pressure injury, that is, changes in BMI, as low weight and prominent bones increase the risk of pressure injury, but overweight people are also susceptible to these injuries due to the poor vascularization of the adipose tissue. It is inelastic and easy to break (QUIRINO et al., 2014).

The development of stress injuries can be affected by smoking, length of hospital stay, as with hospitalization, advanced age, urinary or fecal incontinence, weakness,

paralysis and loss of consciousness, the prevalence of pressure ulcers will increase. Patients suffering from neurological or cardiovascular diseases, dehydration or malnutrition, anemia, hypotension, increased skin and changes in skin elasticity are vulnerable to stress injuries (GOMES et al., 2010).

Sepsis patients are very likely to develop pressure injury, as they have the following clinical manifestations: fever or hypothermia, tachycardia, shortness of breath and respiratory alkalosis, high oxygen consumption, systemic hypoperfusion and metabolic acid Poisoning and high dynamic circulatory status are factors that cause stress damage (GOMES et al., 2010; (ROHR, NICODEM & CASTRO, 2018).

Prevention is defined as a future-oriented strategy, the result of which will be to improve quality, guide analysis and take actions to correct the nursing production process. Preventive measures are designed to prevent individuals from being affected by disease. Prevention has the means to reduce morbidity and mortality (RODRIGUES, SOUZA and SILVA, 2008).

Research shows that preventing stress injuries is not a priority for nursing professionals. However, as the condition brings inconvenience to clients, family members and medical institutions, nurses must be aware of the importance of the intervention (SOARES & HEIDEMANN, 2018). For this type of care, the professional must understand the mechanism of development of the pressure injury and the real situation of the institution where he works (RODRIGUES, SOUZA and SILVA, 2008).

The development of prevention of stress injuries is essentially a task for higher education professionals, who are the best candidates to solve this problem. When formulating a nursing plan, in order to reduce development risks, the nurse must not only understand the client's general body, but also include the body, mind and spirit, as well as the client who is affected by the environment, needing comprehensive help. However, to avoid bodily injury, it is necessary to touch the client's body to maintain the emotional state of the body. Determine the ease of trusting relationships with customers (RODRIGUES, SOUZA and SILVA, 2008).

The knowledge of nursing professionals who are responsible for taking care of clients is essential, because if the nursing team involved is unable to adequately perform their skills and knowledge and is not committed to understanding and preventing stress injuries, then care is provided. nursing to prevent stress injuries Quality may be compromised. Understand what pressure injuries are, risk

factors and preventive measures (PESTANA & VIEIRA, 2012).

The prevention of stress injuries is performed through nursing methods. Nursing methods are used by nurses with some elements. These elements apply technical and scientific knowledge in practice to the client in order to benefit them, determine the characteristics of their professional practice and determine their role (FAVRETO et al., 2017). On the contrary, this process is not passive, on the contrary, the nurse who participates in the personalized nursing process must continuously reflect on his behavior in a dynamic and participatory way (FAVRETO et al., 2017).

In assistance aimed at preventing stress injuries, she went through the following stages: nursing history, nursing diagnosis, nursing plan and nursing development (ALMEIDA et al., 2019).

Through the nursing history, information about the client's health status, skin integrity and the degree of risk of crushing can be obtained. All important information must be collected at the time of admission (SANTOS, 2017). The nurse should investigate the following information: age, underlying disease, nutritional status, anemia, use of medications, past history of loss of skin integrity, presence of edema and / or infection, methamphetamine in protruding bones, increased skin, sensitivity and motor skills, Urinary incontinence and fecal incontinence (ARCO et al., 2018).

Through historical records, the nursing diagnosis can be determined. In this stage of the systematization of care, a care plan can be developed and is the basis for the prevention of stress injuries (SANTOS, VEIGA and ANDRADE, 2011).

The prevention of stress injuries is an issue that needs to be evaluated, because most injuries can be avoided by identifying patients at risk and implementing a care plan. The complexity of patients admitted to the intensive care unit requires daily reassessment (ARAÚJO & SANTOS, 2016).

Currently, there are about 40 pressure injury risk assessment scales, we can take as an example the Braden scale, created by nurse Bárbara Braden to estimate the risk of developing pressure injury. The Braden scale assesses sensory perception, humidity, activity, mobility, nutrition and friction / shear (JANSEN, SILVA & MOURA, 2020).

The development of pressure injuries in hospitalized patients has become one of the indicators of the poor quality of care provided by the nursing team, therefore, the prevention of pressure injuries is very important, and

certain measures can be effective in preventing pressure injuries (ARA (JO & SANTOS, 2016).

Some simple actions, like changing a posture every two hours, lifting the patient instead of dragging him, watching for signs of congestion, congestion and raw collisions, using a decompression device on the protruding area of the bone, watching the skin carefully, and maintaining the skin Integrity, keeping clean, free from moisture, hydration with natural oils, and more knowledge from the medical professional, it is necessary to qualify the medical professional on the main characteristics of the skin. Patients with pressure injuries and risk assessment scales (such as the Braden scale) can have a prognosis and prevent it (ROCKENBACH et al., 2012).

#### IV. CONCLUSION

Ao pesquisar artigos científicos relacionados, constata-se que é muito importante para o enfermeiro compreender sua classificação, escala, fatores de risco e tomar medidas preventivas.

Para prestar um atendimento de qualidade, é necessário conhecimento técnico-científico. O conhecimento dos profissionais de enfermagem que são responsáveis pelo cuidado ao cliente é essencial, pois se a equipe de enfermagem envolvida não consegue realizar adequadamente suas habilidades e conhecimentos e não está comprometida com a compreensão e prevenção das lesões por estresse, então o cuidado de enfermagem é prestado para prevenir lesões por estresse. A qualidade pode estar comprometida. Entenda o que é lesão por estresse, fatores de risco e medidas preventivas.

Durante o processo de revisão, descobriu-se que a maioria das lesões por estresse pode ser evitada identificando riscos e implementando um plano de cuidados, e essa situação pode causar grande desconforto ao cliente e sua família.

Por meio de algumas ações simples, como mudança de postura a cada duas horas, uso de dispositivo de alívio de pressão na área óssea protuberante, observação cuidadosa da pele e mais conhecimento do profissional médico, é necessário qualificar o paciente. A equipe médica deve lidar com as principais características e escalas de avaliação de risco de pacientes que desenvolvem lesões por pressão (como a escala de Braden), e pode fazer prognósticos e preveni-los de acordo.

A lesão por pressão tornou-se um indicador da qualidade da assistência prestada, por isso o enfermeiro deve estar atento à importância da qualidade da sua assistência, e abordar os fatores de risco e as medidas preventivas para essa situação. O enfermeiro deve

compreender também o cliente como um todo, não só o corpo, mas também a mente e o espírito, assim como as pessoas afetadas pelo meio ambiente, que precisam de ajuda geral.

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# Design of Pyrolyzer Multistage Condensation System to Improve the Quality Natural Preservatives of Fisheries Products

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Received: 27 Oct 2020;

Received in revised form: 12 Jan 2021;

Accepted: 21 Jan 2021;

Available online: 27 Jan 2021

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**Keywords—** Condensation, Design, Fisheries, Natural Preservatives, Pyrolysis.

**Abstract—** Fish is a rapidly decomposing source of animal protein, so good handling is important to ensure that the quality of the fish is preserved. How the freshness of fish meat can be preserved can be accomplished through the preservation process. By adding natural ingredients that can prevent the growth of bacteria using liquid smoke, one way of preserving fish meat can be achieved. However, in a traditional way, the application of producing liquid smoke is also carried out such that the resulting liquid smoke still contains ash, tar and carcinogenic compounds. In this research, a pyrolyzer made from stainless steel 304 was designed, with a pyrolysis reactor with a capacity of 10 kg coconut shell and a multi-stage condensation system whose working principle utilizes the properties of smoke molecules that tend to flow or move from the bottom up, so that the higher the quality of the smoke molecules the better because they do not contain Ashes from combustion which cause the creation of carcinogenic Polycyclic Aromatic Hydrocarbon (PAH) compounds. The research method includes planning the pyrolyzer design, selecting engineering materials, procedures for making liquid smoke made from coconut shells, pyrolyzer performance test, testing the chemical content of liquid smoke.

## I. INTRODUCTION

Fish is a source of animal protein which is rapidly decomposing, therefore it is necessary to have good handling so that the quality of the fish is maintained. How to maintain the freshness of fish meat can be reached through the preservation process. One way of preserving fish meat can be done by adding natural ingredients that can inhibit the development of bacteria by using liquid smoke.

Liquid smoke is a liquid condensate resulting from the decomposition of compounds in raw materials using heat which is then condensed, which is called pyrolysis (Destiyantono et al. 2017). Liquid smoke contains the main constituent compounds of acids, phenols, and carbonyls, so that it can be applied as a

natural preservative in food and provides sensory forms of aroma, color, and distinctive taste in food products, as an anti-bacterial which can inhibit the activity of *S. aureus*, *P. aeruginosa*, *E. coli* and *C. albican* (Fathussalam et al. 2019).

The use of liquid smoke must comply with SNI 2725.(1)1.2009, concerning requirements for quality and safety of smoked products as well as preservative content allowed for food and beverage products that are traded. According to (Rasi and Seda 2014) the main requirements for liquid smoke products can be used as a preservative for food products, among others;

- a) Should not contain Polycyclic Aromatic Hydrocarbon (PAH) more than 0.05 µg / kg of liquid smoke, PAH compounds can be carcinogenic, among the PAH

compounds that are often used as an indicator of PAH safety level is benzo (a) pyrene because it has the highest carcinogenic properties.

- b) If the pH value is low, it means that the smoke produced is of high quality, especially in terms of its use as a food preservative. The low pH value as a whole has an effect on the longevity and shelf life of the smoke product or its organoleptic properties. The standardized pH value set is 1.50-3.70.
- c) Apart from being free from hazardous compounds, liquid smoke used as a food preservative must have a flavor that is acceptable to consumers.

However, because the pyrolysis used to produce liquid smoke is still in the form of a cylinder made of iron plate which comes from used lubricating oil drums which generally rust easily causes the resulting liquid smoke to contain iron (Fe), ash, tar and other carcinogenic compounds that do not meet the requirements. Liquid smoke quality standard according to SNI 01-2891-1992.

In this research, a pyrolyzer was designed with 304 stainless steel material, which is equipped with a pyrolysis reactor with a capacity of 10 kg coconut shell and a condensation system whose working principle utilizes the properties of smoke molecules that tend to flow or move from the bottom up, so that the higher the quality of the smoke molecules the better because does not contain ash from combustion and prevents the creation of Polycyclic Aromatic Hydrocarbon (PAH) compounds. Thus, the pyrolyzer design with a multilevel condensation system can produce liquid smoke with food grade quality which is safe for use as a natural preservative and as a food aroma enhancer.

## II. RESEARCH METHODS

This research is divided into several stages, including the design of the pyrolyzator design, testing the performance of the pyrolyzer on the volume and testing the chemical content of liquid smoke. The pyrolysis design planning in this study was carried out using a comparative method, namely by comparing the theory (literature study) with the results of field observations (field observation). Meanwhile, in the pyrolyzer design activity in this study using the Trail and Learn method, which is to design and test the pyrolysis performance, then evaluate and improve the product until it is in accordance with the objectives to be achieved.

### Tools and Materials

The equipment used to design and test the pyrolyzers in this study consisted of; Welding machines, grinding machines, roll machines, drilling machines, meters, elbow rulers, calipers, vise, pH indicator paper, thermometers, measuring cups, stoves and scales.

The materials used to design and test the pyrolyzers in this study include; stainless plate 2 mm, stainless steel pipe 1.5 inch, stainless steel electrode, galvanized iron 4x4 cm, putty, door hinge, nuts and bolts, LPG, coconut shell and sampling bottle.

### Design

The design is a set of procedures to translate the results of the analysis of a theory to design to describe in detail how the components are implemented, while the construction is the activity of creating new designs and replace or repair the existing design as a whole (R. Pressman., 2002 dalam Buchari et al., 2015).

In conducting designing activities there are some important factors that must be considered diantaranya; strength, stiffness, resistance, corrosion resistance, price, formability (Asikin 2011).

### Functional Pyrolysis Design

Functional design describes the functions that can be performed by the components of the pyrolyzer (Hasanah 2013). The pyrolysis in this study has three main components that have different functions from one another. To explain the function of the components contained in the multi-store pyrolysis condensing system, described as follows:

- a. The pyrolysis reactor functions as a place for the pyrolysis process or the breakdown of chemical compounds from the coconut shell through the heating process, thus causing the decomposition process, namely the breakdown of chemical bonds in thermal terms and the decomposition of coconut shell organic compounds consisting of gas, tar and charcoal.
- b. The condenser functions to change the form of the combustion gas into a liquid form called liquid smoke. The process of changing from gas to liquid form occurs because of condensation or heat transfer in a spiral-shaped pipe which is cooled by cooling water.
- c. The connecting pipe functions to flow gas or smoke from the combustion of coconut shells in the pyrolysis reactor to a room that has a lower temperature (condenser).

### Pyrolyzer Structural Design

Structural design is the analysis of the components of the tools that will be created that has been discussed in the functional design, (Hasanah 2013). Structural design done to determine the shape, size, and

material of each component. Design pyrolyzer with multistage condensation system in this study, can be seen in Figure 1.

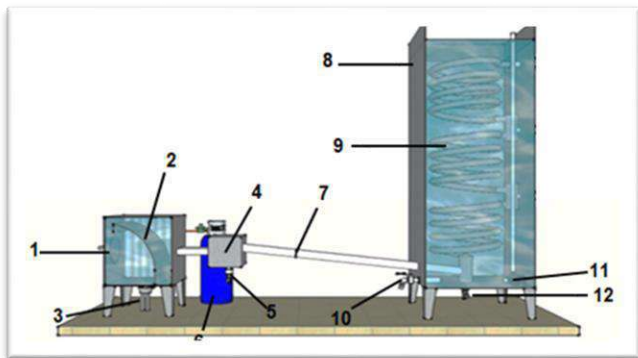


Fig.1: Design pyrolyzermultistage condensation system

Keterangan;

- 1. pyrolysis reactor
- 2. soot separator
- 3. gas burner
- 4. tar container
- 5. tar exhaust
- 6. Gas
- 7. connecting pipe
- 8. condenser tube
- 9. condenser pipe
- 10. Cooling water discharge channel
- 11. liquid smoke distillate channel
- 12. Tar drainage

**Pyrolyzer Performance Testing and Liquid Smoke Quality**

The pyrolyzer test conducted in this study aims to determine the performance of the pyrolyzator with a multilevel condensation system. The tests carried out include; Observations heating temperature, heating rate analysis, yield analysis Liquid Smoke. Meanwhile, testing the quality of liquid smoke is an important parameter to determine the chemical content and product safety for consumers, in considering the selection of natural preservatives are used. The tests performed, among others; Analysis of pH value, Abu Content Analysis, Analysis of Water Content of Liquid Smoke and toxicity.

The results of testing the pyrolysis performance and the quality of liquid smoke produced by pyrolyzers with a multilevel condensation system in this study were also compared with conventional methods used in the CV Wulung Prima liquid smoke industry and previous research.

**III. RESULT AND DISCUSSION**

Design pirolisator in this study, is the result of the collection of data and information about the advantages and disadvantages pirolisator used in

industrial liquid smoke and previous research. The collection of data and information is done through literature studies and field observations, which are then compared on a causal and contributing factors, in order to create the fundamental answer applied into a pirolisator design in accordance with the planned concept. The results of the pyrolysis design with a multilevel condensation system can be seen in Figure 2.



Fig.2: Pyrolyzers with multilevel condensation system

The working principle of a pyrolyzer with a multilevel condensation system is to take advantage of the properties of smoke molecules that tend to flow or move from the bottom up, so that the higher the quality of the smoke molecules the better because they do not contain ash, tar and carcinogenic compounds resulting from burning coconut shells.

**Pyrolysis Reactor**

The pyrolysis reactor is a place for the pyrolysis process or the breakdown of chemical compounds from coconut shells through a heating process with a temperature of 100-500°C. A method of heating the raw material coconut shell in this study, using the system indirectly. The indirect combustion method aims so that the flame does not directly hit the coconut shell raw material but only at the pyrolysis reactor, so it is believed to prevent the creation of Polycyclic Aromatic Hydrocarbon (PAH) compounds.

The parameter used as a reference for calculating the dimensions of this pyrolysis reactor is the capacity of the raw material (coconut shell) used. It is known that the density of coconut shells from the results of preliminary research is 68.5 kg / m<sup>3</sup>, (Hasanah 2013). Specifications pyrolysis reactor to process 10 kg of coconut shell can be seen in Table 1.

Table 1. Specifications pyrolysis reactor

Section	Dimensions	Size
Pyrolysis Reactor	Height	50 Cm

<b>Reactor Door</b>	Length	50 Cm
	Width	40 Cm
	Height	30 Cm
	Width	30 Cm
<b>Stanchion</b>	Height	20 cm

**Condenser**

The condenser is a tool that functions to change the form of the combustion gas into a liquid form, because of the condensation process or heat transfer in a spiral-shaped pipe cooled by cooling water. The condensation process causes the binding of water vapor molecules to become water particles, so that the smoke from the combustion does not come out and pollute the surrounding air and increase the amount of liquid smoke produced from the melting of the smoke from the combustion of coconut shells.

The condenser designed in this study can accommodate 432 liters of cooling water. Specifications condenser in this study are shown in Table 2.

Table 2. Specifications Condenser

Section	Dimensions	Size
<b>Condenser Tube</b>	Height	120 Cm
	Length	60 Cm
	Width	60 Cm
<b>Condenser Pipe</b>	Diameter	1Inchi
	length	1200 cm

**Connecting Pipe**

The connecting pipe functions to flow gas or smoke from the combustion of coconut shells in the pyrolysis reactor to a room that has a lower temperature (condenser). The connecting pipe is equipped with a tar container which functions to prevent tar compounds from being carried by the gas or smoke from the burning of the coconut shell into the condenser.

The connecting pipe is equipped with a union socket which functions as a connection for the two pipes so that the pipe installation can be assembled, so that it can facilitate the maintenance and repair process in case of damage to one of the main components of the pyrolyzer device. The connecting pipe specifications for the multi-level condensing pyrolysis system can be seen in Table 3.

Table 3. Connecting Pipe Specifications

Section	Dimensions	Size
<b>Connecting Pipe</b>	Length	120 Cm

<b>Penampung Tar</b>	Diameter	1 inch
	Length	20 cm
	Height	20 cm
	Width	20 cm

**Pyrolyzer Performance Testing.**

The pyrolyzer performance test in this study was carried out in three treatments, what distinguished each treatment was the volume of coconut shell that would be used as raw material for making liquid smoke. The first treatment (A) was 2.5 kg, the second treatment (B) was 5 kg and the third treatment (C) was 10 kg coconut shell and each treatment was carried out three times. The pyrolyzer performance test was carried out with several test parameters, including the ratio of time to temperature and yield of liquid smoke.

**Pyrolysis Temperature Observation**

Temperature observations conducted in order to determine the rate of warming in the pyrolysis reactor. Observation of temperature is carried out every 30 minutes, during the pyrolysis process by observing the thermometer in the pyrolysis reactor and recording the amount of heating temperature into the observation table. The results of temperature observations during the study can be seen in Figures 3, 4 and 5.

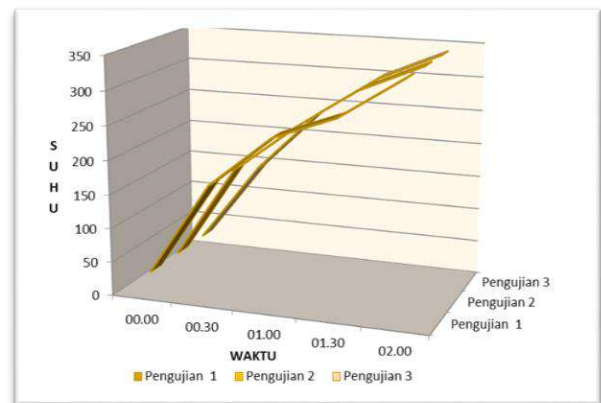


Fig.3: The observation of the pyrolysis temperature with 2.5 kg of coconut shell

Annotation;

- The time required for the pyrolysis process is 2 hours.
- The temperature needed to produce liquid smoke starts at a temperature of 110°C
- Temperature 110°C reached within 12 minutes.
- The heating rate of the pyrolyzer is 1.25 kg / hour

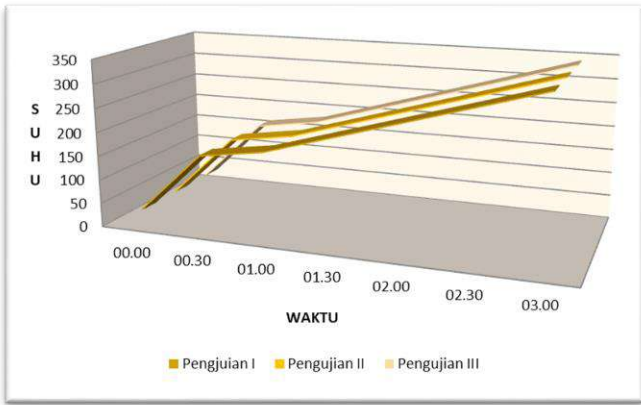


Fig.4: The observation of the pyrolysis temperature with 5 kg of coconut shell

Annotation;

- The time required for the pyrolysis process is 3 hours.
- The temperature needed to produce liquid smoke starts at a temperature of 110°C
- Temperature 110°C reached within 12 minutes.
- The heating rate of the pyrolyzer is 1.7 kg / hour

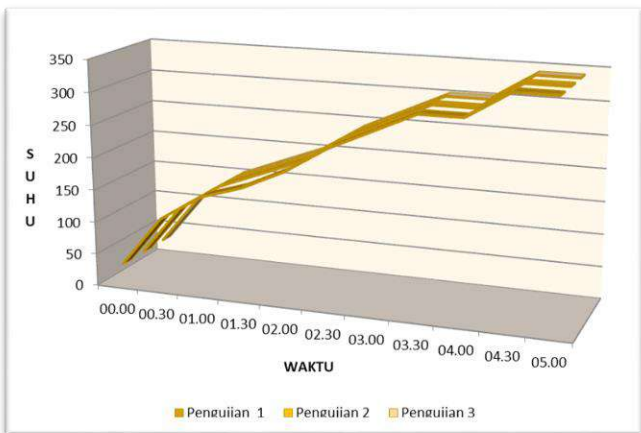


Fig.5: The observation of the pyrolysis temperature with 10 kg of coconut shell

Annotation;

- The time required for the pyrolysis process is 5 hours.
- The temperature needed to produce liquid smoke starts at a temperature of 110°C
- Temperature 110°C reached within 20 minutes.
- The heating rate of the pyrolyzer is 2 kg / hour

From observations made on pyrolyzer with multilevel condensing system, the weight of coconut shell used for the process of making liquid smoke affect the time required. The greater the weight of coconut shell raw materials led to the burning time is increasing.

The temperature needed to produce liquid smoke starts at a temperature of 110°C, in treatment I and II it takes 12 minutes to reach a temperature of 110 sedangC, while in treatment III it takes 20 minutes. To produce the maximum liquid smoke is done at a temperature of 200-300°C, because at that temperature the amount of liquid smoke is greater than temperatures below 200°C. the maximum temperature reached by pirolisator are 340°C, at this temperature the coconut shell is used as a raw material for making liquid smoke had turned into charcoal. When the coconut shell becomes charcoal, the pyrolysis process is stopped, because it affects the yield of liquid smoke.

**Yield of Liquid Smoke**

The variable measured to obtain the yield of liquid smoke is the ratio of the volume of liquid smoke produced to the mass of the coconut shell raw material used. Measurement of the volume of liquid smoke produced was carried out using a measuring cup with a scale of 100 ml, while to measure the weight of the coconut shell using a digital scale. The yield of liquid smoke can be seen in table 4.

Table 4. Yield of Liquid Smoke

Treatment	Repeat	volume of liquid smoke (liter)	Yield (%)
A	I	0,6	24
	II	0,5	20
	III	0,6	24
	Average	0,57	22,7
B	I	1,2	24
	II	1,1	22
	III	1,1	22
	Average	1,13	22,7
C	I	2,4	24
	II	2,3	23
	III	2,4	24
	Average	2,37	23,7

From the results of tests performed, explaining that the value rendemen liquid smoke obtained from pirolisator with terraced condensation system is between 20-24%. The reactor temperature pyrolysis to produce liquid smoke on pirolisator maximum is between 200-300°C, so the longer the process of pyrolysis at temperatures 200-300°C cause decomposition of chemical compounds in coconut shell more perfect, so that the resulting liquid smoke more.

The yield of liquid smoke produced by a pyrolyzer with a multilevel condensation system is 20-24%. The conventional pyrolyzer used by CV. Wulung Prima has a liquid smoke yield of 7%. Meanwhile, the pyrolyzer based on cyclone-redistillation technology (Fathussalam et al. 2019) had a liquid smoke yield of 13.3% and a stratified shell liquid smoke distillation pyrolyzer (Suherman and Alfansuri 2019) had a liquid smoke yield of 12%.

### Chemical Content Testing of Liquid Smoke

This research produces liquid smoke with food grade quality, reddish brown in color, and has a strong odor. Meanwhile, the chemical content of liquid smoke produced from pyrolyzers with a multilevel condensation system is described as follows;

### Liquid Smoke pH Analysis

Measuring the pH value of liquid smoke from coconut shells aims to determine the degree of acidity of the process of decomposing raw materials by pyrolysis. Measurement of pH values was carried out using pH litmus paper with the brand MQuant, which has a measurement range of 0-14 pH scale with a series of 4 (four) colors on each strip. Measurement is done by means of; prepare the liquid smoke sample to be tested, then soak the litmus paper into the liquid smoke sample. After 30 seconds remove the litmus paper and see the color change on the litmus paper. Finally, match and compare it with the acidity table that is listed in the box.

The pH value of liquid smoke as a result of this study is 2, which means that the pH value of the liquid smoke produced by the pyrolyzer with a multilevel condensation system is smaller than the liquid smoke produced by CV Wulung Prima with a pH value of 3. The results of this study meet the quality standard value of liquid smoke because it meets the pH value range of 1.50-3.70. Low pH value means that the liquid smoke produced is of high quality, especially in terms of its use as a food preservative. Overall low pH value affects the longevity and shelf life of a product.

### Ash Content

Ash content testing was carried out using the AOAC 2012 method. The method of testing begins with weighing the sample of 2 grams of liquid smoke, put it in a porcelain cup and place it in a furnace at 600 suhuC for 2 hours. Subsequently, the cup was cooled for 30 minutes in the desiccator then weighed heavy porcelain dish and ash percentages written to 1 decimal behind the comma. The calculation of the ash content uses the following formula;

$$\text{Ash Content} = \frac{W1-W2}{W} \times 100\%$$

Description;

W : footage weight (g)

W1 : Sample weight + Cup after ignition (g)

W2 : Weight empty cup (g)

Ash content testing aims to determine the value of a material left in the liquid smoke. Ash is an inorganic residue from the combustion or oxidation process of coconut shell organic components. The ash content resulted from testing the liquid smoke in this study was 0.21%. The results of the ash content test can be seen in table 5

Table 5. Ash Content Lab Test Results

Parameter	Result	Unit	Method
Ash Content	0,21	% w/w	AOAC (2012) 942.05

### Water Content And Toxicity Test in Liquid

Water content and toxicity tests were carried out to identify components of coconut shell liquid smoke using the Gas Chromatography-Mass Spectroscopy (GC-MS) method. In conducting the test, it was carried out using 30 ml of liquid smoke into a separating flask, then added with 10 ml of dichloromethane and shaken for a while. The sample was allowed to stand for 1 hour and then taken the lower fraction and added to the first, and filtered with Whatman 42 paper with added Na<sub>2</sub>SO<sub>4</sub>.

Testing the toxicity of liquid smoke using Gas Chromatography-Mass Spectroscopy (GC-MS) aims to ensure the food safety of coconut shell liquid smoke produced by pyrolyzers with a multilevel condensation system. Results of laboratory tests conducted on laboratory services unit testing, calibration and certification of Bogor Agricultural Institute (IPB), indicating that the compound benzo [a] pyrene is not found in liquid smoke, for more details the results of the water content and toxicity test in liquid smoke can be seen in table 6.

The compounds identified from the liquid smoke made from coconut shells in this study include:

a. Phenolic compounds.

The biggest component identified was phenol with a value of 56.14%, meaning that phenol compounds constitute the majority of the liquid smoke components produced from coconut shell raw materials. Phenol has a role as anti-oxidant and flavor giver in food, especially smoked fish. Phenolic compounds contained in liquid smoke include 2,6-Dimethoxyphenol 6,89%, 2-Methoxyphenol 6,77%, 2-methylphenol 3,14%, 3-Methylphenol 2,84%, 4-Ethyl-2-methoxyphenol 1,17%, 2-Methoxy-4-methylphenol 1,73%.

## b. Carbonyl compounds.

Carbonyl compounds in liquid smoke have a role in the coloring and flavor of the smoke product. This class of compounds has a unique caramel-like aroma. The types of carbonyl compounds contained in liquid smoke include vanillin, siringaldehyda.

## c. Acidic compounds.

Acidic compounds have an antibacterial role and form the flavor of the smoke product. Acid compounds include acetic acid, propionate butyrate and syringaldehyde

In general, coconut shell liquid smoke produced from pyrolyzers with a multilevel condensation system can be used as a natural preservative and aroma enhancer for food products that are safe for consumption, because harmful compounds are not found.

Table 6. The water content and toxicity test in liquid smoke

Parameter	Result	Unit	Technique
Phenol	56.14	%Area	GC-MS
3,4-Dimethyl-3-pentene-2-one	0.23	%Area	GC-MS
1-Hydroxy-2-pentanone	0.29	%Area	GC-MS
3-Methylcyclopentane-1,2-dione	2.25	%Area	GC-MS
2,3-Dimethylcyclopent-2-en-1-one	0.27	%Area	GC-MS
2-Methylphenol	3.14	%Area	GC-MS
2,4-Dimethyl-1,3-cyclopentanedione	0.22	%Area	GC-MS
Butanoic acid, phenyl ester	0.38	%Area	GC-MS
3-Methylphenol	2.84	%Area	GC-MS
2-Methoxyphenol	6.77	%Area	GC-MS
4-Pentylcyclohexanone	0.30	%Area	GC-MS
3-Hydroxy-2-methyl-1,4-pyrone	0.25	%Area	GC-MS
3-Ethyl-2-hydroxy-2-cyclopenten-1-one	0.57	%Area	GC-MS
2-Ethylphenol	0.31	%Area	GC-MS
Phenol, 2,4-dimethyl-, acetate	0.81	%Area	GC-MS
Benzoic acid	0.09	%Area	GC-MS
1,2-Benzenediol	2.95	%Area	GC-MS
2-Methoxy-4-methylphenol	1.73	%Area	GC-MS
2-Isopropoxyphenol	0.21	%Area	GC-MS
3-Methyl-1,2-benzenediol	0.85	%Area	GC-MS
3-Methoxy-1,2-benzenediol	1.66	%Area	GC-MS
4-Ethyl-2-methoxyphenol	1.17	%Area	GC-MS
4-Methyl-1,2-benzenediol	1.36	%Area	GC-MS
2,6-Dimethoxyphenol	6.89	%Area	GC-MS
4-Ethyl-1,2-benzenediol	0.83	%Area	GC-MS
Vanillin	0.30	%Area	GC-MS
2-Methoxy-5-[(1E)-1-propenyl]phenol	0.05	%Area	GC-MS
Allyl 3-methoxybenzoate	0.36	%Area	GC-MS
3,5-Dimethoxy-4-hydroxytoluene	1.47	%Area	GC-MS
Methylparaben	0.90	%Area	GC-MS
1-(3-Hydroxy-4-methoxyphenyl)ethanone	0.34	%Area	GC-MS
4-Hydroxybenzoic acid	0.41	%Area	GC-MS
Gallacetophenone-4'-methylether	0.78	%Area	GC-MS
1-(4-Hydroxy-3-methoxy-phenyl)-propan-2-one	0.95	%Area	GC-MS
4-Hydroxy-3,5-dimethoxybenzaldehyde	0.26	%Area	GC-MS
1-(4-Hydroxy-3,5-dimethoxyphenyl)ethanone	0.21	%Area	GC-MS
Coniferyl aldehyde	0.33	%Area	GC-MS
1-(4-Hydroxy-3,5-dimethoxyphenyl)-2-propanone	1.00	%Area	GC-MS
3,3,8a-Trimethyl-6-oxodecahydro-1-naphthalenyl	0.13	%Area	GC-MS

#### IV. CONCLUSION

Based on the research results, the pyrolysis design with a multilevel condensation system, it can be concluded that; Pyrolyzers with multilevel condensation systems whose working principle take advantage of the properties of smoke molecules that tend to flow or move from the bottom up, so that the higher the quality of the smoke molecules the better because they do not contain ash, soot and tar from combustion, very suitable for use in the liquid smoke industry, because it can produce liquid smoke yield of 23.7% or 2.3 liters in 5 hours from 10 kg of coconut shell raw material. Liquid smoke generated from research can be used as a food preservative. This is because the pH value of liquid smoke is 2, the ash content is 0.21% and does not contain benzo [a] pyren compounds which are carcinogenic through GC-MS testing. which means it meets the value of the liquid smoke quality standard according to SNI 01-2891-1992.

Based on the results and discussion of research activities engineering and design pirolisator with terraced condensation system, it is suggested for further research to take into account the effect of the condensation pipe diameter to the volume of liquid smoke and the influence of the type of raw materials to product quality liquid smoke produced.

#### ACKNOWLEDGEMENTS

The authors say Thank God for the presence of Allah SWT. Because for all the blessings and gifts of grace that are always given to the author until this good time and opportunity to finish writing this journal and we thanks to the marine and fisheries education center (PUSDIK KP), Ministry of Marine Affairs and Fisheries Republic of Indonesia, who have helped and facilitated the author in conducting this scientific research.

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## Production of an Innovative Tool for the active search of women as a factor of effectiveness in the screening for Cervical Neoplasms: Experience Report

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Received: 30 Oct 2020;

Received in revised form: 07 Jan 2021;

Accepted: 17 Jan 2021;

Available online: 27 Jan 2021

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**Abstract**— Objective: to report on the experience of developing an innovative tool that facilitated the process of actively seeking women as an efficacy factor in the screening for cervical neoplasms. Method: it is a descriptive study, type of experience report, carried out by nursing and medical students from Public and Private Higher Education Institutions in the city of Belém do Pará / Brazil on the experience of building a facilitating tool aimed at preventing cervical cancer. Thus, for the elaboration of the innovative active search tool, three moments were necessary: I- Data collection, II- Operative plan and III - Construction of the tool, in addition

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**Keywords— Uterine Cervical Neoplasms, Papanicolaou Test, Disease Prevention, Innovation, Women's Health.**

to the applicability of technology in women's health care. Results: It was noticed that with the elaboration of innovative technology, the old tool, the record book, is outdated, due to the fact that it offers a discontinuity of care to women who undergo the exam. In addition, the development of this new tool allowed the clarity and agility of monitoring each woman, it allowed to quantify the number of women who take the exam and to know the reasons for not taking the exam. Conclusion: The study showed that with organization and dedication, it is possible that the greatest number of women undergo cytopathological examination of the uterine cervix, as an effective method of prevention and early detection of CC. It is worth mentioning the importance of disease prevention actions through innovative technologies that facilitate health care and, thus, promote continuous and holistic care.

## I. INTRODUCTION

Cancer is characterized by the abnormal growth of cells that have the ability to spread between tissues. Thus, this pathology can occur in more than a hundred different types of cells, dividing quickly and, as a result, becoming very aggressive and uncontrollable, determining the formation of tumors, which can spread to other areas of the body, characterizing metastases (SILVA, FCF, et al, 2020).

In Brazil, cervical cancer (CC) is the second most prevalent neoplasia among the female public, behind breast cancer, responsible for a high annual morbidity and mortality rate. In this sense, the CC is characterized as a public health problem with high rates of morbidity and mortality although the pathology is curable and the health system offers prevention and early detection actions. (Melo, EMF, et al, 2019).

The development of CC causes serious injuries in an interval that varies from 10 to 20 years, and therapy, despite technological advances, is more effective in the initial stages. According to the World Health Organization (WHO), if preventive measures for its control are not taken, cancer will gain the first place in mortality, preferably in developing countries (NAKAGAWA, JTT, Schirmer, J & Barbieri, M, 2010).

Among the types of cancer that exist, CC has one of the highest potentials for cure and prevention when diagnosed in the primary stage of the disease. Thus, the high capacity for prevention and cure is explained by the time-consuming progress of the pathology, with well-determined phases and the facility to identify changes early, providing rapid diagnosis and effective therapy. (Melo, EMF, et al, 2019).

According to the WHO, some chronic infections are risk factors for the development of types of cancer. Thus, a World Health Organization indicates that about 15% of cervical cancers diagnosed between 2010 and 2015 were

the result of infections caused by different types of human papillomavirus (HPV). Thus, infection caused by the HPV virus is often related to cervical cancer, although an HPV infection alone is not necessary to develop this type of cancer (Rodríguez, G, et al, 2019).

In this context, comparing these data with the incidence of approximately 500,000 cases of cervical cancer each year, it can be concluded that, even with HPV infection, cancer is a rare outcome. Therefore, HPV infection is a necessary but not sufficient factor for the development of CC. Thus, there are some cofactors that increase the risk of genital cancer in women infected with papillomavirus: high number of pregnancies, use of oral contraceptives, smoking, HIV infection and other sexually transmitted diseases (such as herpes and chlamydia). Tumor progression caused by normal infection of human papillomavirus cells appears to be regulated by factors related to the virus (type of virus) and factors related to the host (smoking, oral contraceptives, multiparity and immunosuppression) (Carvalho, KF, Costa, LMO & França, RF, 2019).

Thus, the early discovery of the neoplasia and its precursor lesions occurs through the Pap smear, which is a gynecological test of cervical cytology performed to identify changes and precursor lesions of the pathology, as a way of early detection of cancer. An easy, clear, efficient and low-cost test provides tracking of up to 80% of CC cases. The test should be performed on women with an active sexual life, with priority given to those aged between 25 and 64 years, determined as the target population, these ages being explained by the greater number of cases of high-grade pre-malignant lesions, subject to therapeutics and non-development for cancer (Girianelli, VR, Thuler, LCS & Silva, GA, 2016).

Thus, in order to carry out the early diagnosis effectively, it is necessary to implement organized screening programs, with high effectiveness and the lowest possible cost, which help to reduce the incidence rates and,

consequently, mortality due to CC, considering that the early detection (screening) of cancer in asymptomatic women is the primary initiative to prevent this neoplasm (Ribeiro, JC & Andrade, SR, 2016).

In addition, we have to, one of the various duties of the Basic Health Unit (BHU) is the collection of material for the Pap smear, which should be done routinely, as recommended by the Ministry of Health (MH). However, it is known that many women neglect to collect the exam by taking long intervals without undergoing the test. Thus, a way to get around this situation would be to actively seek women to perform a new CC prevention exam (Corrêa, DAD, Villela, WV & Almeida, AM, 2012).

According to the National Cancer Institute (INCA), this research is justified by the continuous incidence of CC with about 16,590 new cases and 6,526 number of deaths among women affected by this disease. Thus, conducting the study is relevant as it enables the discussion of the theme, allowing the dissemination of information as a resource to expand access to women in search of early diagnosis of CC and provides strengthening of self-care in view of the importance of preventing this pathology (Silva, FCF, et al, 2020).

Thus, the work aimed to report on the experience of developing an innovative tool that facilitated the process of active search for women as an efficacy factor in the screening for cervical neoplasms.

## II. METHOD

This is a descriptive research, of the experience report type, carried out by nursing and medicine students from Public and Private Education institutions, from November 10 to 15, 2019. In this context, the action was carried out in a Basic Health Unit (BHU), in the city of Belém-PA, the target audience being all women who undergo the prevention exam, Pap smear, in the unit.

Thus, in order to develop the innovative active search tool, three moments were necessary: I- Data collection, II- Operative plan and III - Construction of the innovative tool. In addition, after the development of the facilitating instrument, it was necessary to apply it during the preventive exam, where the effectiveness of the technology was consolidated.

In the first moment, a survey of information was carried out on the attendance of women in the territory in search of the Pap smear. Thus, it was noticed that the number of patients was low, so there was a need to circumvent the low adherence to the preventive with the reorganization of the service.

In the second moment, the operational plan was carried out, understood as a way to systematize proposals for

solutions to face the problem in question, where a meeting took place with all the people involved in planning (Nursing and Medical Academics, Responsible Nurse and Community Health Agents - ACS). Thus, the division of responsibilities for each category by operation was defined by consensus and the deadlines for producing the product, having established the creation of a form as a facilitating search tool.

In the third moment, the production of the facilitating tool was elaborated, which consisted of creating a specific form for the Pap smear and grouping each document in an alphabetical file. In this way, each form has the presence of a header (patient's name, date of birth, national health card (CNS), address and telephone number), in addition to, in its body of text, covering areas containing: Date, Cytology, Cervical evaluation and exam result. After the patient has performed the exam, her file is manually filed with the binder according to: alphabetical order and completed or open form.

In this sense, each open form, that is, that has no signature that the patient returned to receive the test result, will be kept in organizing bags so that there is a separation of patients who are up to date with the preventive exam those who need to have a greater assiduity in the collection of Pap smears.

Then, having consolidated the production of the innovative instrument, it was necessary to apply it during the preventive exam. Thus, during that moment, the individual form of each patient was used and later stored in the binder in its respective alphabetical category.

## III. RESULTS AND DISCUSSION

With the development of innovative technology, it was observed that the old tool, the record book, is outdated, due to the fact that it offers a discontinuity of care to women who undergo the exam. Thus, it is noted that the results of each patient are dispersed in a notebook full of confused and disorganized notes.

Mendes FRP, et al (2017), considers that there is continuity of care when these are provided in order to complement each other in an appropriate time. Continuity is understood as the provision of care by different providers in a coherent, logical and timely manner. Also, the continuity of care guarantees an improvement in the quality of care provided, contributes to cost reduction and is considered an appropriate strategy and policy that health services must follow. On the other hand, fragmentation of care can result in confusing treatment guidelines for the user, with great potential for errors and repetitions, insufficient follow-up and insufficient preparation for

health professionals. It is essential to reduce the information asymmetry between users and health care providers and make more information available to users of health services.

Thus, it was found that the use of the new tool, allowed the continuity of care, expressing its significance to positively interfere and thus avoiding late diagnoses and traumatic treatments or even the impossibility of cure.

According to Casarin, MR & Piccoli, JCE (2011), the development of cervical cancer generally occurs slowly and goes through different stages, of which the preclinical stage is detectable and curable. The early detection of lesions in asymptomatic women can be diagnosed in the early stages of the disease. In this way, when precancerous lesions and cervical cancer are detected early, they can respond more effectively to treatment. Early diagnosis helps to improve survival, reduce morbidity and reduce treatment costs. Early diagnosis includes three phases, which are awareness and access to care; clinical evaluation, diagnosis and finally treatment.

It is noteworthy that, the development of this new tool allowed the clarity and agility of monitoring each woman, in view of the way it is organized, allowing to evaluate the evolution of each patient in an individual, equitable and holistic way aiming at the promotion of health and prevention of CC.

In this sense, according to Fonseca ACM, et al (2020), the use of educational technologies is essential, as they are intended to promote teaching activities and mediate educational practices with specific types of users in the community. In addition, the use of technology is an essential way of promoting understanding, providing skills improvements and achieving the benefits that only the educational process can provide. Educational technology aims to educate and stimulate critical thinking so that people can gain autonomy and improve the quality of their health.

Thus, it was found that the form promoted a continuous analysis of each woman, allowing to know exactly the date, month and year of the last preventive exams, as well as the results of them, and from there, determine the frequency of the next exams, facilitating the scheduling of the next preventives and active search of women who are not having Pap smears.

In accordance with Aguilar, RP & Soares, DA (2015), the Papanicolaou gynecological exam is a method to track precancerous lesions of cervical cancer and prevent the tumor itself. It is an efficient and low cost method, considered one of the best methods made available by the public health system for the screening of cervical cancer.

In this sense, Gasperin SI, et al (2011), the following preventive inspections are recommended: The first two inspections must be carried out every one year. If these two tests do not show cervical changes, they must be performed every three years. The preventive treatment for women aged 25 starts and lasts up to 64 years. At least two consecutive negative tests in the past five years will end after that age. In view of these recommendations, Casarin, MR & Piccoli, JCE (2011), understand that it is essential that health services guide women about the content and importance of the exam. It should be noted that its periodic performance can reduce the mortality rate from cervical cancer.

In addition, by creating the form, it was possible to quantify the number of women taking the exam and to know the reasons for not returning to the unit to receive the result. Thus, the explanations given are in relation to working for not being able to seek permission, not having time due to household chores, not having the financial resources to get to the unit and among other reasons. Accordingly, critical and reflective thinking was established about strategies adopted to integrate all women in the search for preventive exam.

In this perspective, INCA (2017), highlights that among all types of cancer, CC is the one with the greatest potential for prevention and cure, reaching almost 100% probability, being able to be diagnosed early and treated on an outpatient basis in about 80% of the cases. The implementation of some strategies is essential to reduce the overall incidence of this cancer where these strategies include prevention, early detection and treatment.

Thus, Almeida PA, et al (2010), states that in order to reverse the high incidence of cervical cancer in women worldwide it is essential that they have access to information information. Therefore, the main prevention strategy is screening, where the pathology detection technique is performed using oncotic cytology, through Pap smear gynecological examination. As well as, the adoption of cytopathological exam quality management strategies, reference services for the diagnosis and treatment of cervical cancer percussive lesions, improving the management of early detection actions and among other prevention and early diagnosis strategies are essential to reduce the worldwide incidence of pathology.

#### IV. CONCLUSION

The study showed that with organization and dedication, it is possible that the greatest number of women undergo cytopathological examination of the cervix, as an effective method of prevention and early detection of CC. Hence, it is necessary to have the

implementation and use of innovative technologies that facilitate health care and, with that, promote continuous, holistic and equitable care.

In this context, the test for early detection of precancerous lesions is also important to prevent the development of the disease. The Pap test is a simple, low-cost and very effective early detection method if performed and the results analyzed correctly. However, due to several factors, this test does not reach the entire target population. In this sense, it is essential that women are informed about what this exam is and about its importance. Death from cancer of the cervix is often related to late diagnosis of the disease.

In this way, the research enabled a reflection on the strategies used to facilitate women's access to the exam collection, as well as to understand the main factors that interfere in this process. For this, it is important to understand that cervical cancer is a tumor that can be prevented at different stages.

Therefore, it is concluded that it is evident that health professionals are responsible within primary care, as they are able to analyze the difficulties encountered in carrying out the exam and can seek appropriate solutions through a critical-reflexive posture for the search of a more humanized assistance.

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## The inequality pandemic and its impact on public health

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Received: 27 Oct 2020;

Received in revised form: 30 Dec 2020;

Accepted: 12 Jan 2021;

Available online: 27 Jan 2021

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**Keywords— COVID-19, Health inequalities, Inequity, Collective Health.**

**Abstract— Objective:** This study aims to describe, through a bibliographic review, aspects related to the pandemic caused by Sars- Cov-2 and its impacts on public health, from the perspective of inequalities experienced by vulnerable groups.**Method:**It is an integrative review of the literature through the search for articles in the scientific databases, published in the year 2020. For the treatment of the data, the technique of content analysis was used. 12 complete original articles were selected that answer the central question of the research, which were grouped in tables according to author, title, journal, year of publication, indexation base, objectives, methodologies and evidence. **Results:** The analysis of the literature shows that the main inequalities addressed were about race, gender, social class, working conditions, food security, weaknesses of the health care network, correlation between social class and comorbidities due to chronic non-communicable diseases and listed measures of facing the pandemic. **Conclusion:** It is concluded that it is necessary to mobilize at the global, national and regional levels the means to stop the exacerbation of inequalities in their various types, and consequently health.

## I. INTRODUCTION

In public health, although they are often presented as synonyms, inequality and inequity are different concepts. Health inequalities refer to any observable differences between groups (economic level, education, place of residence, sex, among others) within a population. In turn, inequities are differences that are considered unfair from a value judgment. In this perspective, although the focus is on combating inequities, it is initially up to the scientific community to search for evidence of inequalities, in order to identify the most vulnerable groups, which should be prioritized in public health interventions. [1]

Brazil, specifically, has very significant historical social inequalities. This is reflected in the health of the Brazilian population, making social determinants of health major players in this context. [1]

The pandemic caused by the New Coronavirus SARS-CoV-2, which caused COVID-19, has aggravated existing

problems and brought to light the disparities faced by cities whose social and territorial factors bring together the greatest inequalities and are rapidly emerging as the epicenter of attention of the pandemic. Brazil, being a country of great territorial extension, is marked by enormous social inequality and vulnerabilities of the most different dimensions among its five regions, suggesting the existence of a different risk for COVID-19. [2]

The health sector's weaknesses are exposed in the face of the pandemic, in the midst of an unprecedented health and political crisis, guided by yet experimental guidelines, health professionals are one of the groups most affected by the pandemic and suffer from work overload and illness as a consequence of the population's non-compliance with social isolation and health recommendations, which culminates in a high rate of illness and reduction of beds. In addition, the lack of basic investments in infrastructure and inputs such as Personal Protective Equipment and little access to diagnostic tests aggravates this scenario. [3]

Therefore, characterizing social and spatial inequalities in cities is fundamental not only for understanding the dynamics of the transmission of COVID-19, but, above all, for the design of coping actions involving appropriate intersectoral public policies for disease prevention.

Thus, this study aimed to describe, through a bibliographic review, aspects related to the pandemic caused by Sars-Cov-2 and its impacts on public health, from the perspective of inequalities experienced by vulnerable groups.

## II. METHOD

The research is an integrative review type, which has the purpose of gathering and synthesizing research results on a delimited theme, in a systematic and orderly manner, being an instrument for the deepening of knowledge about the investigated theme, allowing the synthesis of multiple published studies and general conclusions about it. [4]

In carrying out this review, six steps were used: selection of hypotheses or guiding questions for the review; selection of studies that will compose the sample; definition of the characteristics of the studies; categorization of studies; analysis and interpretation of results; and, report of the review. [5]

The guiding question for the elaboration of this integrative review was: What are the scientific productions available on aspects related to the pandemic caused by Sars-Cov-2 and its impacts on public health, from the perspective of inequalities experienced by vulnerable groups?

The survey of bibliographic studies took place during the month of January 2021 and five databases were chosen: Virtual Health Library, Scientific Electronic Library Online (SCIELO), PubMed and Google Scholar.

Following, the validated DECS descriptors were used: “COVID-19”; “Inequalities in Health” and “Collective Health”, using the Boolean operators AND, in Portuguese, Spanish and English, published in 2020.

For data collection, it was decided to use the instrument validated by Ursi. [5] The analysis of the selected studies took place in a descriptive manner, in order to enable observance and description of the data, thus, it was possible to gather the synthesized knowledge on the subject in question. Based on that, two empirical categories were elaborated, which will be presented and discussed below, in which Bardin's content analysis method was used to explore the content. To guarantee the success of this study, it was decided to describe and distribute the results in tables, highlighting the main findings of each research. As for the discussion, it was carried out in a descriptive way, in order to achieve the objectives of building an integrative review.

## III. RESULTS AND DISCUSSION

In the present integrative literature review, a total of 3,535 were found, which after reading the titles and abstracts, arrived at the number of 12 original scientific articles that rigorously met the selection of the sample previously established and showed approximations with the object of this study. These were organized in alphanumeric codes, from CN01 to CN12, for better presentation and understanding of the results.

Tables 1 and 2 show the characteristics of these studies, in which articles in Portuguese (66.6%), bibliographic review (75%), published in national journals (83.3%) and indexed in the database are predominant. SciELO data (83.3%).

Table 1: Distribution of studies.

Nº	Base	language	Author. Title. Periodic. Year	Objective	Methodology
CN01	Google Scholar	Portuguese	INSFRAN, Fernanda Fochi Nogueira. MUNIZ, Ana Guimarães Correa Ramos. Mothering and Covid-19: gender inequality being reaffirmed in the pandemic. Diversitates Int. J.2020.	Reflectongenderinequalityand sexual divisionof labor reaffirmed in the biggest health crisis experienced in thelast hundred years: the pandemic by Covid-19.	Presentation of spontaneous initiatives to create a support network - host groups on social networks, mothers' circles, psychological listening experience.



CN02	SCIELO	Portuguese	ALPINO, Tais de Moura Ariza. et al. COVID-19 and food and nutritional (in)security: action by the Brazilian Federal Government during the pandemic, with budget cuts and institutional dismantlement. Cad. Saúde Pública. 2020.	Analyze the first actions, at the federal level, by the Brazilian government to mitigate the effects of the pandemic that may have an impact on food and nutrition security, considering the recent institutional changes in policies and programs.	Narrative view of the literature and used as information sources the bulletins from the Operations Coordination Center of the Crisis Committee for Supervision and Monitoring of the Impacts of COVID-19 and home pages of sectoral ministries, from March to May 2020.
CN03	Pubmed	English	BROWNSON, Ross C., et al. Reimagining Public Health in the Aftermath of a Pandemic. American Journal of Public Health. 2020.	Outline the next public health challenges and transitions and the actions needed for the next 5 years to reinvent our public health systems.	Literature review
CN04	SciELO	Portuguese	GOES, Emanuelle F.; RAMOS, Dandara O.; FERREIRA, Andrea J. F. Racial health inequalities and the COVID-19 pandemic. Trabalho, Educação e Saúde, Rio de Janeiro, 2020.	Recover historical aspects and their relationship with the vulnerability conditions of the black population and present an agenda of specific actions to combat racism and its devastating consequences in the context of Covid-19.	Literature review
CN05	SciELO	Portuguese	SANTOS, José Alcides Figueiredo. COVID-19, fundamental causes, social class and territory. Trab. Educ. Saúde. 2020.	Mobilize the theory that considers social conditions as fundamental causes of health, in conjunction with the notions of social class and territory, using this interpretative framework of reference in reflections on relevant aspects of the trajectory and the distribution of the effects of the Covid-19 pandemic in the country.	Literature review
CN06	SciELO	Portuguese	GONDIM, Gracia Maria de Miranda. Decipher me or I'll devour you: Health Surveillance puzzles in the Covid-19 pandemic. Trab. Educ. Saúde. 2020.	Reflect on conjunctural elements (economic-political and socio-environmental) necessary to understand technical surveillance interventions.	Literature review
CN07	SciELO	Portuguese	ESTRELA, Fernanda Matheus. et al. Covid-19 Pandemic: reflecting	Reflect the impacts of COVID 19, considering markers of gender, race and	Exploratory study, with emphasis on the analysis of selected publications, based

			vulnerabilities in the light of gender, race and class. <i>Ciência&amp;SaúdeColetiva</i> , 2020.	class.	on systematized search on official websites, as well as on the PubCovid-19 platform.
CN08	SciELO	Portuguese	DEMENECH, Lauro Miranda. et al. Income inequality and risk of infection and death by COVID-19 in Brazil. <i>REV BRAS EPIDEMIOL.</i> 2020.	To evaluate, through spatio-temporal analysis, if the economic inequality of the Federative Units (UF) in Brazil may be associated with the risk of infection and death by COVID-19.	Ecological study, based on secondary data on incidence and mortality rates for COVID - 19. The data were analyzed at the state level, with the Gini coefficient as the main independent variable. A spatial dependence diagnosis of the data was performed and the spatial regression lag model was used, when applicable.
CN09	SciELO	Portuguese	COSTA, Simone da Silva. The pandemic and the labor market in Brazil. <i>Revista de AdministraçãoPública.</i> 2020	Briefly present the consequences of COVID-19 for the Brazilian labor market, highlighting the impacts that the crisis has on workers who live off informality.	Literature review
CN10	SciELO	English	FREITAS, Carlos Machado de. SILVA, Isadora Vida de Mefano e. CIDADE, Natália da Cunha. COVID-19 AS A GLOBAL DISASTER: Challenges to risk governance and social vulnerability in Brazil. <i>Ambiente &amp; Sociedade.</i> 2020.	Understand how these threats undermine risk governance capacity and expand and intensify social inequalities, making Brazil the new epicenter of the global disaster by COVID-19.	Literature review
CN11	SCIELO	Portuguese	ORELLANA, Jesem Douglas Yamall. Explosion in mortality in the Amazonian epicenter of the COVID-19 epidemic. <i>Cad. Saúde Pública</i> 2020.	Analyze the excess in general mortality, according to Epidemiological Weeks (SE), in order to identify changes potentially associated with the epidemic in Manaus.	General mortality data and groups of causes were obtained from the National Civil Registry Information Center and the Mortality Information System, for 2018, 2019 and 2020. Age group, sex, place of death, SE, year were analyzed - calender and causes of death.
CN12	SCIELO	English	TRAVASSOS, Luciana R. F. C. MOREIRA, Renata M. P. CORTEZ, RayssaSaidel. The virus,	To raise interpretations that relate the evolution of the pandemic with the inequalities already present in	Reviews that dialogue with the perspective of environmental justice, discussing some impacts of

			the disease and the inequality. Ambiente & Sociedade. 2020.	the urban space of São Paulo and with the different existing conditions to adhere to isolation.	inequalities in the lives and deaths of residents of São Paulo, such as the distribution of urban characteristics, work, comorbidities, access to health and race equipment, which maintains a center-periphery. This is an exploratory study, with open hypotheses.
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Source: Research protocol, 2021.

Table 2: Evidence from the studies.

N°	Evidence
CN01	It is understood that only the collective path, where sorority is present as a form of care and resistance, can lead to overcoming inequalities, intensified in this pandemic context. In collective actions, as a result of spontaneous and / or institutional initiatives, a horizon for overcoming gender inequality was seen.
CN02	The actions were systematized according to the guidelines of the National Food and Nutrition Security Policy. The creation of institutional arrangements for crisis management was identified. Among the proposed actions, those related to access to income, such as emergency aid, and food, such as authorization for the distribution of food outside the school environment, with federal resources from the National School Food Program, stand out. However, setbacks and disassemblies in the area of food and nutritional security can compromise the Federal Government's response capacity in the context of COVID-19.
CN03	Three phases for public health have been envisaged over the next 5 years: (1) reactive crisis management, (2) efforts to maintain initial gains, and (3) efforts to sustain and improve progress. A reinvented public health system will depend heavily on leadership and political will, rethinking risk at the population level, employing 21st century data science, and applying new communication skills.
CN04	The social protection policies implemented in the face of the Covid-19 emergency are needed to ensure equity, also reaching quilombola communities, slums and suburban populations who, in order to receive emergency aid from the government, need to be exposed to infection in the agglomeration of communities. hours of queuing at banks and lottery shops. In addition, ensure that access to Covid-19 diagnostics is equally distributed to the population and that testing initiatives have sufficient capillarity to cover the rich and impoverished areas of cities with equal effectiveness. Finally, greater transparency must be demanded from the bodies responsible for pandemic data in the country so that they: include race or ethnicity markers in the data referring to the entire course of the disease, from testing, hospitalizations and deaths; maintain a systematic and agile routine of disseminating these data to society and expand the testing capacity in the country and do it differently in areas of greater vulnerability, such as people deprived of their liberty, the populations living and surviving on the streets and quilombola communities.
CN05	There is a social determination of the guidelines or provisions that can impact actions in the face of a pandemic. Motivation and the ability to change day-to-day routines, to adopt more systematic hygiene practices, the level and direction of the influence that the family and the closest environment has on people, the perception and evaluation of risk of illness and death do not vary only between individuals, as they are socially formed and conditioned within groups. Economic constraints are quite different between groups. They have been stronger in those who have less and need more. Added to this is the disorienting effect of the acts and speeches of a recently elected president. This action may be affecting the popular strata more, at least in absolute terms, as they are in greater numbers. Objective constraints, behavioral guidelines and cognitive elements have contributed to

	reinforce the distribution of the disease at the base of the social pyramid.
CN06	The crisis of the new Coronavirus and the pandemic as a metaphor exposed the structural and historical inequalities of class struggle, determined by the unequal distribution of society's material wealth, colonialism and patriarchy, which, over the centuries, have forged invisibilities and demographic-territorial segregations (poor, black, women, LGBTQIA +, Indians, quilombolas, ribeirinhos, caçaras, elderly). These are current geopolitical issues, of global reach, analyzed by theorists of political economy, who point out the impossibility of life on the planet without solidarity and socio-environmental justice. Humanity needs to return to territory and nature, as dimensions inseparable from the human; giving visibility and a voice to the periphery for its innovative-transforming-revolutionary potential; incorporating new paradigms to the technical-assistance and management structures of public health; learn to act differently for and with the different; articulating the one and the multiple in complex, adaptive systems to care for people, groups and communities; and to establish synergies and other forms of communication, multidirectional and polyphonic, between peoples as a dialogic process constituting freedom, democracy and social justice.
CN07	It revealed that the markers of gender, class and race are presented as a vulnerable condition to the exposure of COVID-19 in the most diverse world scenarios. This context reveals the historical need to implement strategies to improve the lives of this population. To this end, it is necessary to adopt socioeconomic policies of greater impact and greater coverage, expanding access to better health, education, housing and income.
CN08	The incidence and mortality rates for COVID-19 were increasing in all Brazilian states, having been more accentuated among those with greater economic inequality. The association between Gini coefficient and COVID-19 incidence and mortality remained even when taking into account demographic and spatial aspects. Economic inequality can play an important role in the impact of COVID-19 in Brazilian territory, through absolute and contextual effects. Structural policies to reduce inequality are essential to face this and future health crises in Brazil.
CN09	The new coronavirus has had profound impacts on public health and the Brazilian labor market. In a context of paralysis of productive activities, informal workers have lost their livelihood, and many companies have already started to lay off employees with a formal contract, with a consequent increase in the informal rate of the Brazilian economy. Furthermore, with the fall in employment and the increase in defaults, the subsequent cancellation of health plans will tend to burden the already deficient SUS. The Brazilian government has been responding very timidly to the problems arising from the crisis and is going on a path that does not contribute to a quick exit from it. Formal and informal workers need social programs that generate jobs and income, promote an improvement in the living conditions of communities and precarious settlements, as well as need social protection. Such measures contribute to improving the health and quality of life of the poorest population, as well as leveraging several other sectors of the economy, such as civil construction. Inevitably, all resources aimed at financing these programs will increase the public deficit. But in the long run, with the resumption of growth and jobs, there will be an increase in GDP and an increase in revenue.
CN10	This global disaster and other futures do not turn into a humanitarian crisis, we are facing a challenge that requires profound changes in the driving forces that produce global disasters through inequities and vulnerabilities, as well as the reduction of national and international risk reduction governance capacities. We live in a context in Brazil where the threats of the political, social and economic have intersected with the hazards caused by the SARS-CoV-2 virus. These threats undermine risk governance capabilities and widen and intensify social inequalities, making Brazil the new epicenter of the global disaster by COVID-19 and a potential humanitarian crisis in poor areas.
CN11	An excess of overall mortality was observed with age, especially in individuals aged 60 years and over. The explosion of general mortality in Manaus and the high proportion of deaths at home / public roads exposes the seriousness of the epidemic in contexts of great social inequality and weak effectiveness of government actions, especially those aimed at tackling social inequalities and guaranteeing and strengthening of the Unified Health System.
CN12	The data and discussion demonstrate how the infection by SARS-CoV 2 and the death resulting from COVID-19 overlap with other territorial inequalities in the municipality of São Paulo. Thus, the pandemic can be an

opportunity to bringing the fight against inequalities to the center of the debates and the territorial planning and public policy agenda. The multiple dimensions of inequalities that intersect the lives affected by environmental injustices are essentials to be observed in order to adequate each territorial intervention with existing conflicts. Therefore, critical approaches to ecological crises have responses to conflicts between nature and society. It is opportune to recover the model of urban development, subordinated to environmental justice, in which it is necessary to: democratize the territories; fight socio-spatial segregation; defend the right to access urban services and equipment, including health equipment; overcoming social inequality; and reduce socio-environmental vulnerability.
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**Source:** Research protocol, 2021.

The analysis of the literature showed in **article CN01** the benefits of actions such as supporting, sustaining, supporting, establishing, assisting and helping, which are able to comfort an individual. However, in the case of women-mothers, support can be synonymous with saving, especially in the current pandemic period, which brought chaos and fear from the physical to the soul. The extreme situation that humanity is experiencing has generated many reflections in the fields of health, economics, politics, human rights, although the oppressions against women remain potentiated, as well as the feminist struggle for gender equality. [6]

Reproductive work, which involves maintenance and care, which has always been fundamental, in this time of health crisis is a priority for survival. However, it continues to be devalued. Thus, the overload of tasks cannot be accepted or naturalized, as a result of the unjust sexual division of labor, accompanied by the historical devaluation of these tasks. [6]

This study reports on the experience of women-mothers who met, supported and continue to support each other, even if virtually, due to the suspension of face-to-face meetings due to the need for physical distance. However, collective actions, the result of spontaneous and / or institutional initiatives, see a horizon for overcoming gender inequality. [6]

In groups, whether virtual or in person, thousands of women have reflected on their daily experiences and questioned the sexist values forged by their families and society as unique and irreplaceable. The fight for gender equality is collective and is supported by these networks, which little by little are deconstructing the plots of patriarchy. [6]

**Article CN02** reports on the Federal Government's response capacity in the context of COVID-19 and the setbacks in recent years. The first of these concerns the capacity for emergency responses to the pandemic for what remains of the National System of Food and Nutritional Security (SISAN), after so many dismantles,

emptyings and institutional dislocations, in addition to budget cuts. Faced with the extinction of the National Council for Food and Nutritional Security (CONSEA) and the ineffectiveness of the Interministerial Chamber for Food and Nutritional Security (CAISAN), the challenge of guiding actions and monitoring the impacts of the pandemic on food and nutrition security, in an articulated manner, is set. [7]

Another challenge lies in the participation of civil society in the process of planning and monitoring the realization of the Human Right to Adequate Food (DHAA), which is currently restricted to the possibility of financial donations within the scope of the Federal Government. [7]

It is noteworthy that the intersectoral perspective and the involvement of different institutional actors and civil society are central aspects in the consolidation of SISAN and were intentionally disjointed. The Federal Government's actions to mitigate the effects of COVID-19 hitherto proposed lie in emergency measures that focus mainly on access to income and food. [7]

However, the guarantee of DHAA and the achievement of food and nutritional security require, in addition to intersectoral articulation, coordinated actions that not only seek to mitigate the effects of crises, but measures in the medium and long term that can guarantee the constitutional right to food. The population's feeling of insecurity in the face of uncertainties in the context of the pandemic is amplified by the political crisis that has taken place, in addition to the contradictory orientations of the Government. [7]

The food and nutritional security agenda has been strengthened in the country in the last 15 years, and in the last three years its dismantling has been happening with the extinction of CONSEA and other setbacks, such as policies to encourage family farming, access to water and supply directly affecting the realization of food and nutrition security and DHAA. [7]

Finally, this moment of the pandemic highlights the biggest problem in Brazil, social inequalities. These, in turn, exacerbate the effects of COVID-19 on the population's living conditions. Thus, it is necessary to think, discuss and formulate national public policies that are based on the economy and social protection, but that are articulated with the guidelines of the National Food and Nutrition Security Policy (PNSAN) in the perspective of guaranteeing the DHAA. [7]

**Article CN03** addresses the immediate health and social needs that point to the urgent need to redouble the commitment to prevention and investment in public health. The unresolved public health mission complicates and worsens the effects of the COVID-19 pandemic. Without explicit attention to the social determinants of health, the consequences of the immediate results of COVID-19 for society will be even greater inequities in health. [8]

To inform a new vision for public health and begin to face the challenges, a broad group must be brought together to plan reinvented public health. The members of the planning groups must include not only scientific leaders and public health educators, but, more importantly, those who would finance and execute the conclusions of this commission, such as policy makers, professionals, business leaders, among others. [8]

There are several stakeholders and professionals who are essential to these planning efforts. Representation is also needed from the public, especially those who experience inequalities in practice. Any effort should include a plan for implementing and evaluating the actions. The core elements of any plan must include continuous refinement and sustainability. The lessons from COVID-19 present an opportunity and an urgency to reimagine public health. [8]

It must be recognized that public health is a public good that deserves greater investment, in which all the silos of the health system must be reached, the burden and costs of precarious health must be reduced and science is advanced to identify and respond more quickly to threat, emerging in our changing world. [8]

**Article CN04** reports that racism is a structuring system, generating behaviors, practices, beliefs and prejudices that underlie avoidable and unfair inequalities between social groups, based on race or ethnicity. And, institutionally, it obstructs access to goods, services and opportunities, being underlying the rules that guide the actions of these institutions. It is worth mentioning that racism is a social determinant of health, as it exposes black women and black men to more vulnerable situations of illness and death. [9]

In health care, racism can manifest itself in several ways, such as institutional, which most often occurs implicitly, when society maintains and reproduces a set of negative social stereotypes about the black population. Implicit prejudices are stereotypes or preferences for or against groups of people, according to which health workers (s) will determine how the care, attention and care of people will be, given their racial belonging, creating them a hierarchy in attendance. [9]

As a result, the black population is at greater risk of disparities in access to services in the face of the pandemic, in the quality of care received, access to diagnostic tests and health outcomes. In the United States, the Covid-19 pandemic has already presented itself in a racialized way, in which African-Americans were discharged in the scenario of illness and death due to the new coronavirus. These disparities have serious implications for the course of the pandemic, as insufficient diagnosis in a community leads to a greater risk that asymptomatic infected individuals will not go into isolation and that symptomatic individuals will start treatment late, worsening their healing prognosis and increasing chance of death. In the analysis of mortality by Covid-19 in New York the rates are 22.8 and 19.8 among Hispanics and blacks, respectively, while the rates for whites and Asians are, respectively, 10.2 and 8.4. [9]

In Brazil, it is known that blacks and blacks will suffer more severely from the impacts of the pandemic and its various negative outcomes, considering the history of lack of rights. Allied to this, national data have pointed to a higher prevalence of chronic and neglected diseases among the black population, the result of the greater social and economic vulnerability in which it is exposed and the lower access to health services. [9]

The pandemic reveals how unequal Brazil is and has made little progress in overcoming racism. However, to contain the expansion of the pandemic in the country and take the next step, it will be necessary, first of all, to face racism and inequalities, because, after all, the black population represents more than half of the Brazilian population. [9]

The country needs social protection policies implemented in the face of the Covid-19 emergency to ensure equity, also reaching quilombola communities, slums and suburban populations who, in order to receive emergency aid from the government, need to be exposed to infection in the agglomeration of communities hours of queuing at banks and lottery shops. [9]

It needs to ensure that access to Covid-19 diagnosis, whether by rapid test or immunological reaction test, is distributed equally to the population. Finally, greater

transparency must be demanded from the bodies responsible for pandemic data in the country so that they include race or ethnicity markers in the data for the entire course of the disease; maintain a systematic and agile routine of disseminating this data to society and expand the testing capacity in the country and do it differently in areas of greater vulnerability, such as people deprived of their liberty, people living on the streets and quilombola communities. [9]

**Article CN05** shows that social conditions represent fundamental causes of health and disease, by determining access to important resources that can be used to prevent risks or minimize the consequences of diseases and by affecting multiple health outcomes through different mechanisms. The flexible and multi-purpose nature of economic and social resources means that they can be used in different ways in different situations to promote the health of its holders or to minimize the consequences of the disease when it occurs. [10]

Social conditions impact on the distribution of health status through inequalities of mobilizable resources, social selectivity in exposure to risks, the social constitution of health dispositions or preferences, discrepancies in the ways in which institutions process individuals and asymmetries for the health of spillovers, or indirect effects, of the costs and benefits of apparently unrelated exogenous processes. [10]

In the context of a dynamic system of changes in diseases, treatments, risks and protective factors, the general association between social conditions and the distribution of health is reproduced over time by translating the advantages in resources from one situation to another and through socially selective processes to replace the closest mediating mechanisms in the causal chain that leads to health and disease. [10]

Health disparities are fueled as a result of the social expansion of the ability to control health conditions. The existing social and economic inequalities make the benefit of the new capacity developed more appropriated by those segments of the population that have more resources, information and opportunities. [10]

The way of understanding social inequality has important implications for the study of health inequality. Inequalities are of different types and can influence health in different ways. Social class represents a specific type of social division based on property relations and the social division of labor. Divisions constituted by the inequality of rights and powers over valuable resources generate asymmetric relations of advantages and disadvantages between categories. [10]

There is a fundamental question of socially determined conditions and dispositions, or of lifestyles and health, which can affect the distribution of chronic diseases or adverse conditions associated with smoking, physical inactivity, stress, environmental problems, food, health care and others influential factors. [10]

A recent study of almost 17,000 cases of people hospitalized with Covid-19 in England showed that pre-existing health conditions, both comorbidity and obesity, have a significant independent association with increased hospital mortality. This means that the fatal outcome in the most severe cases, when it regresses in the causal chain, is not randomly distributed. [10]

In addition, clinical observation seems to reveal that prompt treatment has implications for disease progression. An English study showed that 17% of hospitalized patients required critical care. Mortality is higher in patients who are in general beds, and who have not had access to the Intensive Care Unit (ICU). Differences in the processing of people by health institutions greatly affect the progression and the final outcome of the disease. [10]

**Article CN06** addresses that, with regard to the Covid-19 pandemic, territories around the planet were on the alert and the geopolitical game became more complex and placed the health crisis at the center of the globalization process, under the urgency of radical changes in everyday life. Countries, economic blocs, financial organizations and conglomerates, preventive or negative about the deleterious effects of the virus, ran in search of economic solutions and control measures, capable of reducing, as much as possible, the negative effects on the economy and the health of the populations. For the first time, the world has realized the fragile balance in which we are immersed and the value of universal health systems and public policies supported by the State, to ensure health security and social well-being. [11]

Uncertainties, vulnerabilities and ambiguities are current challenges that demand responses from governments and short, medium and long-term interventions that take into account the urgency of radical changes in the ways of producing and reproducing life in the different essential areas of human activities (water, habitation, transport, health, education, agriculture, among others), to preserve life. [11]

The epidemiological, economic and humanitarian scenario, which is triple threatening, demanded, from international health authorities and national governments, protective actions of surveillance and control, with a central focus on the practice of social isolation / removal that it recommends to all people to remain in their homes, and quarantine, for suspected and confirmed cases. These

measures aim to reduce the spread of the disease and prevent the immediate collapse of the hospital network (public and private), unable to respond, in time, to the geometric increase in the number of infected and to safely care for patients. [11]

Brazil adds, to the multiple faces of the current global health situation, other epidemic ailments and serious socio-environmental vulnerability that perverse exposes a significant portion of the population living in precarious and exceptional territories. These 'invisible' subjects to the world of neoliberal capital and policies live in inadequate housing conditions and urban infrastructure and survive on informal-unprotected work to meet basic human needs. They are vulnerable people, families and social groups, with a greater chance of exposure to risks in intra and peridomestic spaces; subjected to social isolation and quarantine and under multiple threats, they suffer the uncertainty of the disease and the imminent loss of family income. [11]

The Ministry of Health's Contingency Plan for Public Health Emergency of National Importance (ESPIN-Covid-19) indicates different strategies and technologies that should be incorporated into Health Surveillance actions in the Containment and Mitigation phases. However, the fragmentation between surveillance actions, specialized care and primary health care remains, and the precariousness in the integration of the three spheres of management of the system. [11]

The gap between recommendations, interventions and real needs of the territories for protection, risk control and solutions to vulnerabilities is evident, given the speed of infection / response and the homogeneity of diagnoses, which reveal numbers (infected, cases and death), without the corresponding accuracy to the different contexts of life of the populations, in the regional, state and municipal scales. [11]

Furthermore, they forget that the institutional actors who carry out most of the disease surveillance and control actions are medium-level technical workers, with great capillarity in the territories, but without experience in emergency situations, being exposed to uncertainties and pressures of all kinds: lack of guidance and training to face the problem; joblessness; and the absence of adequate technologies to develop your work safely and resolutely. [11]

Social isolation / removal and quarantine as health surveillance devices and protective measures to contain the spread of the SARS-CoV2 virus require translation of knowledge to be incorporated into the daily lives of the population. They demand questions to clarify gaps and to get answers about people's insecurity and health care; the

profusion of false information and the negation of the seriousness of the disease; the non-appropriation of technical guidelines resulting from the inappropriate use of information and communication; the necropolitics that vulgarize life and human rights; and the inability to translate scientific knowledge into popular knowledge. Without explanation for the installed chaos, the macabre statistics reveals the vertiginous increase of cases and deaths in vulnerable territories, subjected to the plundering of citizenship and all sorts of inequities. [11]

**Article CN07** reports that in the face of the exponential growth of COVID-19, it is important to reflect on the vulnerability of specific groups. Although the SARS-COV-2 virus does not have a contagious selectivity, the impacts of the infection will be felt in different ways depending on race, class and gender. Such markers, due to socially produced inequalities, affect people in different areas of their lives in addition to health. [12]

Being infected is the same for people, however, there are differences in preventive measures and the possibility of worsening signs and symptoms. Regarding the class, it is observed that the low level of education associated with extreme poverty has a direct impact on non-compliance with public health instructions. [12]

With regard to the field of work, in addition to those who cannot meet restrictive measures because they depend economically on these earnings to survive, there are others who perform essential activities and, therefore, are exposed. An example of this audience are men with high rates of disease incidence, which may be related to the provision of their homes. [12]

Little is discussed about the gender impact of the Covid-19 outbreak, in which we observe a neutral position in public policies, as if men and women were infected and affected equally. In Brazil, class cuts are also linked to race, since according to data released by the Brazilian Institute of Geography and Statistics, in 2018, through the research "Inequalities Social by Color or Race in Brazil", 75% of people living in extreme poverty are self-declared as black or brown. [12]

Countries' social inequities organize their societies in ways that make them extremely vulnerable. Thus, the socio-economically disadvantaged are represented by racial and ethnic minorities who work in casual jobs and lack the financial resources necessary for self-isolation. In contrast, an increasingly small and select elite demonstrates the power of privilege in a pandemic, in which the most vulnerable will be the most affected. [12]

Still dealing with race as a social marker, racial capitalism is a fundamental cause of health inequities. A study carried out in the Detroit city of the USA with only



14% of its population being black, showed that 40% of COVID-19 mortality are black. This may be related to the high rates of comorbidities in this population, which makes them vulnerable to the worsening of COVID-19. [12]

These differences are evidence of structural racism that makes life difficult for black men and women from access to tests to detect the virus to treatment of the infection, facilitated by the power, money and prestige that can alleviate the consequences of the disease. [12]

The homeless, the poorest and the black are clearly more vulnerable to the consequences of COVID-19. Living on the street exposes you to countless sickening situations, being more latent in the pandemic. The difficulty of access to health services, added to the prejudice, reflects in even greater impacts. There is an urgent need for strategies to be created worldwide to increase access to health for this population. [12]

**ArticleCN08** highlights the negative impact of economic inequality in facing the COVID-19 pandemic in Brazil, in which more unequal states showed more marked progression in incidence and mortality rates, while among the less unequal there were subtle increases. Even taking into account demographic and spatial aspects, the Gini coefficient was associated with an increase in the incidence and mortality rates of this disease. [13]

Economic inequality can have a significant impact on the health of populations, in addition to the effect of poverty itself. In the case of COVID-19, this appears to be due to at least two distinct effects: the absolute and the contextual. [13]

The absolute effect concerns the direct impact of income distribution on health outcomes. Small changes in the income of the poorest individuals produce significant changes in health outcomes, whereas among the wealthier the same change in income does not produce a major change in the standard of health. The contextual effect, in turn, shows that people living in unequal societies end up paying a health tax. In unequal locations, public health, safety, sanitation and urbanism structures are worse, conditions that degrade the quality of life of all, but which impact more severely the less favored in our social structure. [13]

The unequal distribution of opportunities can allocate individuals in different socioeconomic positions, according to their social group, sex, gender and ethnicity, creating cascading difficulties in accessing education, work and income. People at greater socioeconomic disadvantage tend to have differential exposure to the virus (because they have poorer quality housing, live in a larger number of people in smaller residences, use public transport with

greater agglomeration and have job insecurity, which makes social distancing difficult), differential susceptibility (because of food insecurity and food with poor nutritional quality, increased psychological stress and difficulty in accessing health professionals) and differential consequence (less social capital and reduced options for primary prevention and treatment). [13]

Together, exposure, susceptibility and differential consequence can produce higher rates of illness and death in these subgroups. Such an effect has already been observed in the National Household Sample Survey to assess the impact of COVID-19, which showed that blacks and browns, poor and uneducated, in addition to being more likely to be infected, also felt the economic impacts more severely of the pandemic. It is estimated that the risk of dying from COVID-19 may be up to 10 times higher among individuals living in the most vulnerable neighborhoods in the same city, and that blacks are 62% more likely to be victims of the virus. [13]

These findings underscore the urgency of developing intersectoral policies aimed at reducing economic inequality. Emergency financial assistance for the most vulnerable people was a positive short-term measure. However, long-term structural measures are essential for this and future health crises to have a reduced impact on the Brazilian population. [13]

**Article CN09** reports that the pandemic affects the population that lives in informality with greater intensity and lives in precarious areas, that is, that has low and irregular incomes, without access to drinking water, decent housing, private health systems and social protection linked to the formal contract, such as vacation, minimum wage, 13th salary, Guarantee Fund for Time of Service (FGTS), maternity leave, medical leave and unemployment insurance. [14]

In 2009, informality in Brazil exceeded 50%, while in 2017, it was around 40.8%. In this context, in addition to the health crisis, one of the consequences of the pandemic is the increase in unemployment and, therefore, the increase in informal work, outsourced workers, subcontractors, flexible workers, part-time workers and the subproletariat. This population will need to be assisted with policies aimed at protecting them from hunger and poverty, that is, they will need to be inserted into a social protection network. [14]

According to the International Labor Organization (ILO), the impact on income-generating activities is especially severe for unprotected workers and for the most vulnerable groups in the informal economy. The economic crisis resulting from the coronavirus has been destroying several jobs in Brazil and abroad. The urgency of the

situation requires the adoption of public employment and income transfer policies to protect workers who live in informality while activities are paralyzed. [14]

In the long run, however, the country needs a development policy that implies abandoning fiscal austerity and increasing spending on existing social programs, in order to protect millions of workers who live in informality and live in precarious communities or settlements. , not to mention the street population. [14]

The pandemic showed, for example, two serious problems that prevent the fight against the disease in Brazilian slums: the lack of basic sanitation and the high density of human beings per square meter. Thus, directing resources to health and sectors identified as bottlenecks is essential to boost the economy with the generation of formal jobs. [14]

The crisis calls on the State to carry out sectorial policies, mainly in social and urban infrastructure, such as the resumption of works under the Program for Accelerating Growth in Favelas (PAC-Favelas). Spending in this sector is primarily responsible for promoting sustainable growth in the economy, in addition to generating positive externalities, which allow raising the productivity of other investments and adding gains in scale and scope to various activities. In fact, public spending on infrastructure works as a factor in reducing social and urban inequality, as well as contributing to improvements in the preventive health of the population. [14]

The federal government has at its disposal several programs focused on the social and economic field that were able to reduce social inequalities at the beginning of this century, such as PAC; the Minha Casa, Minha Vida Program; the BolsaFamília Program and the Employment and Income Generation Program (PROGER), with resources from the Worker Support Fund. These programs can and must be expanded in order to make the economy resume its long-term growth. [14]

**Article CN10** states that the COVID-19 pandemic must be treated as a global disaster and requires a focus on processes, from the global to the local level. The first aspect to consider is the rapid spread of SARS-CoV-2 due to the intensification of global flows of people and goods, leading to an exposure of the world population. [15]

On the one hand, a model of economic inequality, concentration of income and a growing poor population exists, increasingly concentrated in urban areas and their peripheries, in precarious living conditions. On the other hand, the weakening of global governance institutions and capacities to deal with disasters and pandemics that require coordinated policies and actions. [15]

These global driving forces have been replicated at national levels, and in countries that are on the periphery of the global economic system, such as Brazil. These processes have intensified social inequalities and the concentration of income, resulting in a large vulnerable population with precarious living, working and income conditions. The vulnerable population is the most dependent on the actions carried out by the Unified Health System (SUS), health care for groups with a higher risk of COVID-19, such as the elderly and people with chronic diseases. [15]

They are also the ones who will suffer disproportionately from the impacts of the disease due to underfunding and disruption of the SUS within their health surveillance, testing and tracking capabilities, as well as primary health care, hospitals and intensive care units (ICUs). [15]

This means that COVID-19 brings new risk scenarios and worsening health situations, compromising the health sector's response to daily risks and may override risks of new health emergencies and disasters that may occur during the pandemic. As an example, we take the State of Amazonas, which has a larger territorial extension than the United Kingdom, Italy and France combined and which has 62 municipalities with a concentration of hospital structures in the capital. [15]

At the same time, we must consider that June and July are the months of flooding that affect the riverside populations, located in the most distant municipalities (sometimes up to 1000 km), whose access to these places can last up to three days. When considering the overlapping of COVID-19, health, floods, poor food security and nutrition, it is clear that the impacts of the pandemic go far beyond those caused by the SARS-CoV-2 virus. [15]

Regarding the challenge of risk governance, they require urgent decisions in uncertain conditions. In addition, the national and local, social and political heterogeneity of competing interests with short and long term impacts must be taken into account, leading to an extremely complex process in the management of risks and governance of these events. [15]

The health sector plays a fundamental leadership role in the risk management of a pandemic, a process that includes and depends on the participation of all segments of society, to work in a coordinated and coherent way in order to gain people's trust, which is a prerequisite for risk governance. Actions such as the consistency of official documents, press conferences and actions carried out by the health sector, as well as by various government sectors, in particular, the one who, in any democratic country, must

express leadership in the face of a pandemic, the president. The lack of coherence within the Brazilian government through contradictory or inapplicable messages results in an incomplete response to the pandemic. [15]

As for the challenges of social vulnerability and disasters in general, such as that caused by the pandemic COVID-19, due to its dynamics and characteristics that demand decisions under conditions of urgency and uncertainty, they require not only congruence and trust, but also the expansion of social participation and of shared knowledge. They make it possible to incorporate both the daily experiences of communities as part of addressing current vulnerabilities, and better preparedness and awareness of future risks. [15]

The lack of specific positioning of the federal government for the situation of such areas, lead to initiatives of self-management by popular movements. It shows, on the one hand, the absence of state and municipal policies that address these vulnerabilities, and on the other hand, the capacity for local and regional service, pointing out ways that can be incorporated into public policies. [15]

**Article CN11** highlights the fragility of the health care network in Manaus and neighboring municipalities, added to the marked social inequality, which help to understand the critical situation of the COVID-19 epidemic. Regarding age, almost 70% of deaths occurred in people aged 60 or over, with comorbidities being more prevalent in this segment and have been associated with a poor prognosis. [16]

Another aspect concerns the differentials by sex, with a higher risk of mortality among men, although the lower lethality may be associated with a greater perception of the symptoms of the disease and the demand for health services in women, as men would only do so in the phases more severe, where therapeutic resources are generally less, and that higher levels of IgG antibodies in women could partially explain the higher lethality among men. [16]

An explosive increase in mortality due to respiratory problems, common complications of COVID-19, was observed during the epidemic. There was also a significant increase in mortality from other causes, a possible consequence of factors such as the patient's postponement of treatment as a means of avoiding exposure to the virus in hospitals. [16]

This study exposes the seriousness of the epidemic in contexts of great social inequality, weak public policy effectiveness and fragile health services. In this scenario, reinforcements must be implemented quickly by managers from the three spheres of government, in order to contain or mitigate the harmful effect of COVID-19, especially in

more precarious areas, where the impact of the pandemic on mortality tends to be more accentuated. [16]

**Article CN12** concludes that in the SARS-CoV-2 outbreak its standard contagion follows global socioeconomic flows. These movements follow global connections, the virus reaches countries through their most globalized cities and, from there, expands on the country's regional networks, focusing mainly on one or two regions in each country. [17]

The most effective measure for containing transmission is self-isolation, quarantine and blocking, leading to a significant reduction in cases. Second, frequent cleaning of spaces and people. Therefore, two dimensions of inequality emerge to influence the spread of the virus: housing and neighborhood conditions and the social division of labor. [17]

In large Brazilian cities, peripheries and precarious areas have a denser population, with significant home congestion and the absence or deficiency of urban infrastructure, as pointed out by environmental studies. This high-risk population is one that relies heavily on commuting to work, since they are in the lower income classes. [17]

Regarding the disease, the dimensions that expose territorial inequalities are different, especially the presence of comorbidities and access to health. The most prevalent comorbidities for deaths due to COVID-19 are hypertension and diabetes, chronic diseases that are intensified by inequality. Poverty and inequality are the main factors of morbidity and early death worldwide. It was found that the individual socio-occupational categories influence the relationship between the level of physical activity, alcohol and tobacco consumption and the presence of these comorbidities. In Brazil, some studies relate demographic characteristics to the incidence of chronic diseases. [17]

Unequal access to health care during the pandemic, can also explain the relationship between inequalities and comorbidities, aggravated in the COVID-19 crisis. The distribution of medium and high complexity care is provided by networks of micro and macro health regions, therefore, the concentration of beds is not causally linked to territorial inequalities. On the other hand, the availability of public beds in relation to private beds is considerable, since the differences in demand between SUS and private intensive care beds also show an irregular center-periphery pattern. [17]

Another fundamental factor is related to environmental injustice, which has been expressed by the racial segregation bias in deaths by COVID-19. Activists and social movements publicly denounced the growing

infection among the black and poor population, and their greater difficulty in accessing adequate treatment. Infection and registered deaths of blacks increased five times in April, while for whites, three times. [17]

#### IV. CONCLUSION

From this study it was possible to understand about the magnitude of inequalities and inequities related to the pandemic caused by Sars-Cov-2 and its consequences on public health, experienced mainly by the most vulnerable groups.

Furthermore, it is concluded that it is necessary to mobilize at the global, regional and national levels the means to stop the worsening of socioeconomic inequalities, and consequently health, which will come as a result of the economic contraction.

Economic policies, especially the model for allocating resources in relation to areas that have proved essential for coping with the pandemic (health, science and technology, education and social protection) should be reviewed to increase the protection of countries against future shocks. The recovery of employability will need to be made while seeking to mitigate the effects of changing technological standards on production, which already tended to have perverse effects on employability.

Health economists have argued that the activation and prioritization of a medical industrial health complex, properly designed and implemented, can be part of the solution, bringing economic dynamism and improving the capacity to respond to existing health problems, which harm the population, and other epidemics that are likely to come.

Finally, it is necessary not to neglect the individual dimension in which life at the end takes place, despite being strongly influenced by the broader phenomena mentioned. Therefore, the perspective of social interdependence helps us to configure an economy of affections, articulating the collective and individual dimensions. An approach that helps us to develop a more integrated view of the phenomena, in the years we lived with COVID-19.

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# Tolerance deviations of the exhaust system regarding to template manufacturing errors with application of 6-Sigma

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Received: 09 Nov 2020;

Received in revised form:

11 Jan 2021;

Accepted: 20 Jan 2021;

Available online: 27 Jan 2021

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**Keywords— Exhaust, Template, Six Sigma,  
Manufacture, Automotive Industry.**

**Abstract—** This article aims to explain the negative impact of tolerance deviations in exhaust systems due to template manufacturing errors. It also attempts to present the application of Six sigma as a solution for the issue since it helps to correct those errors of the templates. Six Sigma is a quality management methodology, that when applied correctly, helps to achieve greater standardization, which in turn improves the quality of exhaust system. It also ends up positively impacting work culture and increasing customer satisfaction. The article is based on the comparison between estimated productivity and estimated losses. Due to confidentiality reasons all data was estimated. The research also focused on 6-Sigma solution method for the automotive industry. The results obtained proved the benefits of the application of Six Sigma.

## I. INTRODUCTION

The exhaust system is responsible for part of the engine's performance, reduction of the greenhouse effect attack and noise generated. Because of that, the automotive industries are increasingly seeking and developing new components, so that their functions are improved in terms of market and cost-benefit. According to CHOLLET (2002), for the components to perform their functions as designed, it is necessary that during its assembly and manufacture there are no deviations above the acceptable, as they would negatively affect the vehicle set. To ensure deviations within an acceptable limit, quality tools are used that aim at standardization, organization, discipline, cleanliness, the correct selection of materials and the employee's safety during assembly. Although, according to Sachin (2017), global competitiveness is making the manufacturing industries going through a tough challenge to produce high quality and customized products at low cost to meet the rocketing market demand.

Directing the combustion gases from inside the engine to a location away from it, is one of the functions that aim to remove, as much as possible, all combustion products from the cylinder after the explosion in the most efficient way possible. As noise is a comfort item and needs to be attended to reduce noise pollution, the exhaust reduces the noise caused by the engine, through mufflers, reducing from 125 dB to 50 dB and also reduces the amount of toxic pollutants that are emitted into the atmosphere, thanks to the catalyst, which promotes the oxidation of carbon monoxide and hydrocarbons, the reduction of nitrogen oxide, causing oxygen, nitrogen, carbon dioxide and water to be eliminated by the exhaust.

The engine power is directly influenced by the exhaust system, because by increasing the amount of air sucked into the cylinder during intake, the movement of combustion gases through the exhaust system causes a suction effect in the intake of fuel air, achieving high values of volumetric efficiency, thus resulting in higher powers.

The manufacturing of the exhaust system is directly connected to the conditions of the template. Yet, the template is a guide for the curvature and alignment of the exhaust pipe when being welded to the other components of the system. The operator uses the template to follow the calculated drawings to achieve greater process efficiency and avoid interference with other parts of the vehicle. “6-Sigma” is one of the most used quality management methodologies in the industrial branch due to its high efficiency and ease of application in the process and implementation in the workforce. “6-Sigma” aims at the improvement and inspection from the beginning to the end of the process and in all stages and connections to it.

This way, the exhaust system is of great importance to the automobile industry and demonstrates direct interconnection in other parts of aesthetics, such as bumpers, chassis and clamps. A problem in any of these components affects all nearby areas, producing a “chain reaction” effect. For this reason, the work aims to achieve improvements in performance, ergonomics, practicality and implantation of design and assembly patterns of the exhaust system, by using the “6-Sigma” quality management methodology.

## II. THEORETICAL FOUNDATION

### Welding process

According to MACHADO (1996) “Welding is one of the oldest joining, coating or maintenance processes in industry. In the end of the 19th century, elements and objects of same or different materials, were joined together by depositing a heated component, called welding”. The welding process is applied in the foundry, machinery and metallurgy industries and has several ways and methods of joining two materials.

- **Metal Inert Gas (MIG) Welding**

According to OKUMURA (1992) “The MIG welding type is an electric arc process between the part and the uncoated electrode, called welding wire. The electric arc joints the wire in the base metal, forming a fusion puddle that has a gaseous protection by an inert gas like Argon or Helium that prevents gases from the atmosphere from penetrating the weld, causing oxidation or damaging it, for example”.

The advantage of this type of welding is that it can be done in all positions, regardless of the angle. It is a semiautomatic process, which both man and machine can perform- it is easy to operate, it has low production costs and its components have high deposition rate of weld metal, high welding speed, short time, good finish and excellent

weld quality, therefore, widely used, mainly in the automobile industry.

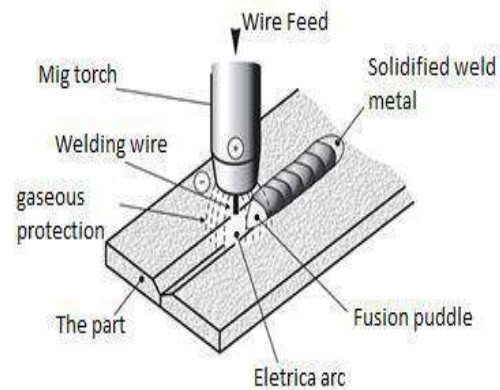


Fig.1: Detailing of the MIG welding application.

Source –ESAB, 2014.

- **Exhaust System Welding**

According to CHOLLET (2008) “The exhaust system consists of several components such as exhaust manifolds, catalytic converter, silencer, muffler, discharge pipe and the connection pipes. In order to interconnect these parts, they need to be welded in a correct and standardized way, so that the functionalities of the components are preserved with quality and safety”.

The beginning of the welding process of the exhaust tubes is based on the technical drawings of assembly and the fixation of the components on clamps and jigs. Clamps and jigs serve as manufacturing guides so that, after two pre-steps, objects interconnected are welded by welding in point. If the position, angle, or alignment are incorrect, there is chance to correct them before welding, since points are used just as a guidance.



Fig.2: Continuous welding of exhaust system pipe.

Source – FERREIRA, 2014

In the next step, the positions of the points as well as the alignment of the system are checked and compared to the technical drawing. If the tolerance deviations are within

the acceptable range and do not compromise the use of the exhaust system, continuous welding can be applied in the connection areas between exhaust components. If the tolerance deviation are above acceptable, it can affect car performance, emissions, noise level, vehicle assembly and maintenance in workshops or dealerships.

The continuous welding offers the necessary mechanical and thermal resistance. During its operation there is no leakage or penetration of gases from the atmosphere. Leakage and penetration negatively influence the level of pollutants expelled to the environment and as well as vehicular performance, which an accidental event may occur, leading to damage other vehicles and people, as well as causing vibrations that may generate cracks in the welded points.

### Exhaust System Operation

Second BRUNETTI (2012), “The exhaust system does not perform complex tasks. It has a linear construction, where each component (collector, flexible, catalyst, tubes, dampers and mufflers) are assembled in sequence so that each part performs its specific activity for the system”. Basically the exhaust system plays four major functions to improve the performance of an engine:

- **First Exhaust System Function:**

The first and perhaps the most obvious function of the exhaust system is that it was initially developed to direct the combustion gases inside the engine to a location away from the engine. Thus, the exhaust system was designed to remove all combustion products from the cylinder in the most efficient way possible, after the explosion. The better the cleaning of the gases, the better the engine function.

- **Second Exhaust System Function:**

The second function of the exhaust system is to reduce the noise caused by the engine. Currently automobiles such as cars, trucks and even motorcycles are mainly responsible for noise pollution. With the use of silencers in the system, the intensity of the sound coming out of the engine can be reduced by up to 50 dB. Taking into account that the noise emitted by engines can reach 125 dB, reducing it to 50 dB is quite significant.

- **Third Exhaust System Function:**

The third function of the exhaust system is to reduce the amount of toxic pollutants that are released into the atmosphere. The system component that reduces the toxicity of the substances generated by combustion is the catalyst. The catalyst promotes the oxidation of carbon monoxide and hydrocarbons as well as the reduction of nitrogen oxide, causing them to be eliminated by escaping oxygen, nitrogen, carbon dioxide and water.

- **Fourth Exhaust System Function:**

The fourth function of this system directly influences the power produced by the engine. The function is to increase the amount of air drawn into the cylinder during intake. The movement of the combustion gases through the exhaust system causes a suction effect on the intake of the combustible air, achieving high values of volumetric efficiency. This is due to the appearance of negative pressure during the movement of gases through the exhaust. The greater the mass of combustible air admitted to the cylinder, the greater the power of the engine.

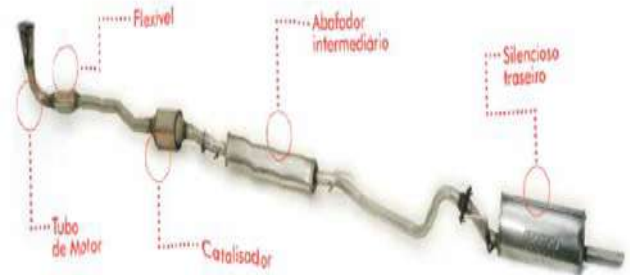


Fig.3: Exhaust System Breakdown

Source – VTN, 2006

### Exhaust System Exhaust Process

According to CHOLLET (2002) “The exhaust system process begins with the exhaustion of the gases from the internal combustion engine, where the gases are directed and stored in the exhaust manifold, passing through the exhaust pipes, through the catalyst and then through the gasket flexible, muffler and silencer until released to the environment. In the exhaust manifold, there is an outlet for each of the cylinders that sends these gases to a pipe, in which the exhaust of each cylinder meets.”

After this encounter, this flow passes through a tube that goes into the catalyst, which is the device responsible for the reaction of CO and NO<sub>x</sub> with O<sub>2</sub>. The gases are transformed into CO<sub>2</sub>, N<sub>2</sub> and O<sub>2</sub> respectively.

- **Exhaust System Materials Application**

The exhaust system has a direct relationship with performance, economy and impact on the environment. The exhaust system also reduces the outlet temperature of the gases as well as reduces exhaust gases that are harmful to human health. For example the oxygen sensors called lambda probe acts directly in the engine system performance when activated once the oxygen amount in is above acceptable in the exhaust system, helping the engine reach a better efficiency and reduce the impact on the environment.

The gases resulted from the combustion still need to reduce its temperature and noise resulted from the engine functioning. For this, the gases pass through two devices that absorb all type of frequencies. These devices are called damper and muffler, which respectively play the role of reducing high frequencies, as well as medium and low frequencies.

- **The Importance Usage Of Damper And Muffler For Exhaust System**

The operation of the damper and muffler is identical, as they expand the spaces for the passage of gases. There is a chamber inside the muffler called Helmholtz, which creates an internal resonance and superposition waves. However, it is only actuated when it has greater gas passages usually from high accelerations and larger engines that generate a greater combustion.

Another device, which not all cars have, is the decoupler that reduces vibrations. It is a flexible or spherical joint that reduces vibrations by monitoring the passage of gases after catalysis. The higher the temperature of these gases are, the more it expands the decoupler to prevent leakage and direct the gases along the discharge pipe.



Fig.4: Spherical Joint

Source –

[http://www.gknservice.com/typo3temp/fl\\_realurl\\_image/vl-i-joint-04-a7.jpg](http://www.gknservice.com/typo3temp/fl_realurl_image/vl-i-joint-04-a7.jpg)

### Exhaust System Legislation and Requirements

The levels of emissions and the structure of the exhaust system are being increasingly targeted and considered as mandatory items to be strictly followed by legislation such as PROCONVE and EURO. The design of the exhaust system is directly related to the car height from the ground, crash test and deformation of the car in crashes. As mentioned previously, the exhaust system transports and filters gases, reduces noise and prevents intrusion of gases. In addition to all those important roles, the exhaust system also should not come into contact with fuel lines or electrical parts, otherwise it would catch on fire.

### Six Sigma Methodology

According to ARANTES (2012), "Six Sigma is a set of tools and strategies for improving the process as well as decreasing its variability. Its use improves the process efficiency and generates savings." It also is a highly disciplined and culturally changing management strategy that seeks perfection in processes as well as great productivity. It is a data-based tool, with great commitment to leadership and use of the DMAIC methodology.

The Greek letter  $\sigma$  (Sigma) represents the standard deviation, so the smaller the standard deviation is, the less dispersion of results it will have as well as values closer to the mean and more stable process. This way, it helps to evaluate the quality level, customer dissatisfaction or defect by dispersing results with the aid of Box plot. Six Sigma represents six times the standard deviation, which indicates a process that, according to ECKES (2011), "is a process where only 3.4 defects per million opportunities occur."

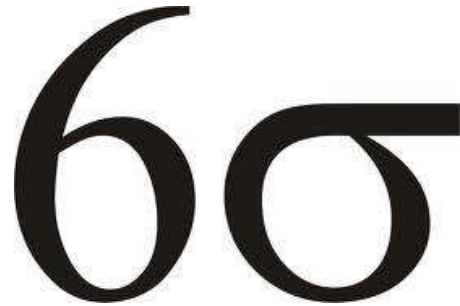


Fig.5: Six Sigma Methodology Symbolology

Source –

<http://api.ning.com/files/5AOnukCMO3WaaXUZMY52mCIA4j97SkMoiQOwjluERevILQooqxzWv-YVfkiyqXi1qQ1mqd6wapo9J1IHVnrzvmr-TvcF0Dxe/sigma.jpg>

### DMAIC Methodology

The DMAIC methodology aims to solve problems and improve processes, which is divided into five stages: Define, Measure, Analyze, Improve and Control.

#### Define:

This stage is responsible for the scope of the project to be worked on, the team, the roles of each of the parties involved and the scope of this project, as well as the schedule and understanding the customers' needs and expectations. According to ECKES (2001), the leadership support on the choice of projects is fundamental to guarantee the human or financial resources of a business, and secure the product development. He also warns about choosing projects that have little impact on the organization's business, so it is necessary to be careful while



choosing which operation to work on and not to deviate from the focus.

In this stage, it is defined the issue to be solve. It includes developing a problem statement as well as identifying objectives, resources and project milestones.

• **Measure:**

In this stage, it involves more numerical studies and data analyses. It is focused on measurement system validation and gathering root causes. The data is measured quantitatively or qualitatively and the indicators will have a positive impact at the end of the project and it is of great importance in determining the current performance of the process. As the major difference between Six Sigma and the other methodologies is the validation of improvement, the entire process is based on data to point out trends and concrete values of the process.

It takes knowledge in statistics to demonstrate only what is necessary to obtain reliable means of measuring the process through its variables. It is highly needed to validate the reliability of the obtained results to have meaningful conclusions that lead to the correct path and avoid any kind of rework or loss of time.

When defining- what is measured, ensuring reliable means of measurement, determining the results obtained and validating the data- the next step is the data collection plan that according to ECKES (2001) and WERCKEMA (2012) consists of:

- What to measure: What kind of processes need to be measured to solve the problem in question?;
- Measurement Type: What will be measured in this process? The results, the inputs, the process itself or its time?;
- Data type: Continuous data (measurements, time, weight) or discrete (Yes / No, Good / Bad);
- Operational definition: The end and the beginning of the measurement. It is important to standardize measurements using the same collected database;
- Data collection form: It depends on the type of data to be measured. It can be a control chart, verification sheets or any other form that is more suitable for the type of data to be measured;
- Sampling: Define the amount of data to be measured, such as a batch.

For greater focus on the problem, statistical tools such as Pareto graph and Histograms are used.

• **Analyze:**

In this stage, the true causes of the problem will be discovered. For each of the goals, the analysis phase must indicate an answer as a solution. According to ECKES (2001) and WERCKEMA (2012), the objective of the analysis phase is to examine the data taken in the “Measure” phase and from that stage, find the source of the problem.

The combination of data analysis and process investigation to identify the root cause of the problem is what makes Six Sigma's analytical power quite efficient. In the analysis phase, statistical analysis tools common in the Measure phase are used, such as: histograms and Pareto diagrams. According to ECKES (2001), the participation of the whole team is fundamental in this process because it aims to find the root cause of the problem and this flows better through brainstorming.

The tool that is most used in the Analysis phase is the Ishikawa Diagram, also known as Fishbone Diagram or Cause and Effect Diagram. This tool is very efficient, it uses brainstorming based on these questions "what, where, how and why", as a way to find the root cause of problems through the Cause and Effect Diagram. With that, the possible root causes or effects are directly related to the problem as shown in the figure below.

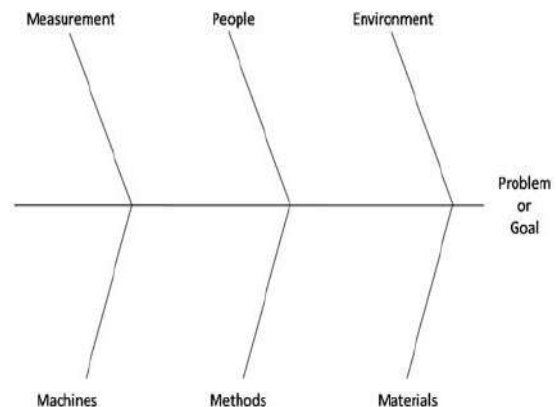


Fig.6: Fishbone Diagram

Source: <https://www.spcforexcel.com/spc-blog/what-cause-and-effect-fishbone-diagram>

ECKES (2001) divides the Analysis Phase into three stages:

- Openness: generally all the chances of causes are raised by brainstorming;
- Bottleneck: prioritization of causes and clarification of ideas to reduce the number of possible causes;
- Closing: Where the real cause of the problem is identified based on the data. The analysis can often point to several causes, which makes it difficult to

make a decision as to which cause would be the most relevant and which should be attacked.

- **Improve**

After defining, measuring and analyzing the root causes of the problem as well as reaching a conclusion, there is a need to raise hypotheses for the improvement phase. Some fundamental questions should be asked at this stage, for instance:

"What possible actions or ideas help to address the root cause of the problem and achieve the desired goal?"

"What possible ideas form solutions with viable potentials?"

"Which solution is most likely to achieve the goal with the least problem and cost?"

"How will the chosen solution be tested to confirm its effectiveness and subsequent implantation?"

In order to prioritize matrices, brainstorm or even by applying trial and error, one should start from a wide group of possible solutions, choosing the ones that bring the best benefit, taking into account the possible improvements in other processes. The choice of solutions must take into account the execution time, resources used, ergonomic and safety impacts as well as any other necessary factor. There is a need to create plans for deploying process improvement. According to ECKES (2001), three crucial factors stand out in the implementation of a solution:

1. Planning: A consistent plan is essential to implement the plan, avoid unforeseen events and motivate the team;
2. Piloting: Experimenting with solutions on a smaller scale is essential to avoid wasting resources on solutions that will not bring good results;
3. Problem Prevention: Always predict the worst case.

According to WERCKEMA (2012), after the execution of the action plan, the next step will depend on the achievement or not of the idealized goal. If the result was positive, the next step is to replicate the solution on a large scale. Otherwise, it is possible to review the chosen solution, or even return to the analysis step if it is clear that the cause being attacked was not the root cause of the problem.

- **Control**

The Control phase aims to ensure that maintenance of the performance was achieved by using standard operating procedures that guarantee the uniformity of the activities that are part of the process. Quality audits are especially useful to ensure the efficiency of the

standardization of processes, ensuring the maintenance of results and the permanence of the adopted standard. In addition, it is also necessary to raise awareness through training, use of clear visual language, lectures, meetings and error-proof devices such as sensors, greater supervision and attention to employees.

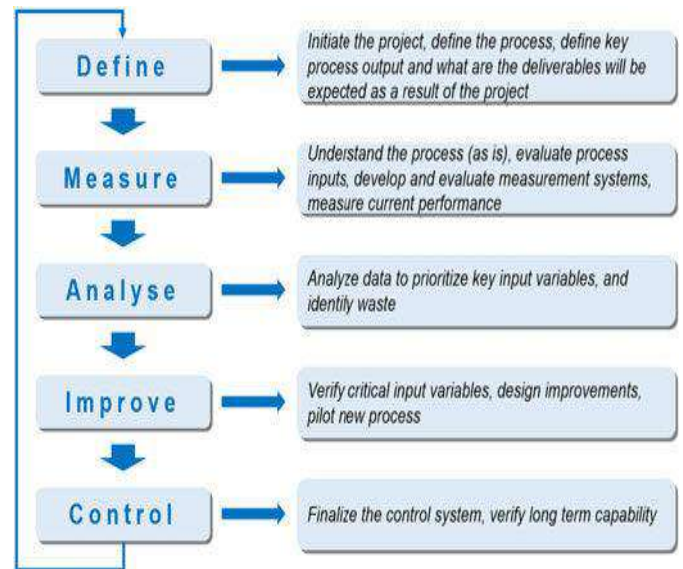


Fig.7: Brief description of the typical lean Six Sigma DMAIC phases.

Source: [https://www.researchgate.net/figure/Brief-description-of-the-typical-lean-Six-Sigma-DMAIC-Define-Measure-Analyse-Improve\\_fig1\\_32003674020](https://www.researchgate.net/figure/Brief-description-of-the-typical-lean-Six-Sigma-DMAIC-Define-Measure-Analyse-Improve_fig1_32003674020).

### Case study

After completing the design project, choosing materials and meeting the emissions and noise requirements, tests were started on the first vehicles. However, some issues were noticed during the manufacture of the exhaust system, and true cause of these issues were unknown. It is not guaranteed that 100% of the lot will be manufactured as planned but there are tolerances due to inherent deviations from the process itself. Those deviations have no effect on the car's performance, level of emissions, noise, risk of accidents or problems on the crash test.

The teams of exhaust system, production, operation, maintenance and quality decided together that the application of Six Sigma would be the best option to solve the problem.

Six Sigma comes to play when a problem is chosen to be improved. In the definition step, it is needed to understand the size of the problem and also measure the

efficiency of the current process. In the measurement step it has to be defined the root cause and also analyze the data in order to finally define a possible improvement in the process at the stage of analysis. After these three initial steps, improvements are implemented and validations of the new process are sought by measuring again the obtained data through Pareto and Ishikawa graphs. It is finally possible to control the implemented improvement when updating documents as well as increasing the security and reliability of the process.

During the definition of the project it was necessary to choose the team members with their respective functions and positions, resources (which could not be informed in financial terms due to confidentiality), as well as the collection of all technical drawings, maintenance reports and also the previous problems in order to finally define what were the possible causes of the problem. Due to confidentiality reasons, all data and information was estimated and focused on 6-Sigma solution Method for the type of issue in the industry.

In this case study it was decided to act on the manufacturing errors of the template for the assembly. The templates for the assembly did not go under maintenance as foreseen by the manufacturer or programmed by the company due to the rush and the need for high batch production. Unfortunately the operators are sometimes not obliged to make it a priority to strictly follow the technical drawings, angles and positions for each of the exhaust pipe components. Thus, certain adaptations usually are made in the templates to accelerate the process and also manufacture the maximum amount as possible of exhaust systems as well as achieving production goals.

To measure the size of the problems found in the batches produced and assembled in the vehicles, the data measuring deviations in alignment and positioning of the exhaust system components were collected as well as the data on how they were produced to then determine the level of process quality. The following conclusion was drawn:

Table 1 –Collected data to evaluate deviations throughout the process.

Production Batch "XY"	Amount of deviations	Beginning of Quality Process	End of Quality Process
Number 1 to 20	1	1	0
Number 21 to 40	5	2	3
Number 41 to 60	12	4	8
Number 61 to 80	20	8	12
Number 81 to 100	29	13	16
<b>Total</b>	<b>67</b>	<b>28</b>	<b>39</b>

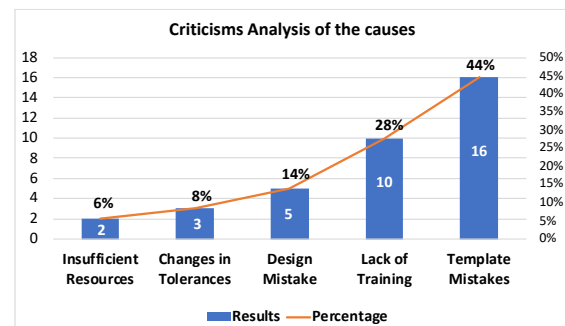
\*Acceptable Level: 6 deviations every 100

Source - FERREIRA, 2014

As shown in the table above, the quality level of the products was below acceptable, since the number of deviations exceeds more than ten times the acceptable value throughout the entire process. The use of brainstorming and 5W was also necessary for greater involvement and knowledge of the subject for those involved as well as for a greater chance of finding the possible root cause based on the hypotheses. After the brainstorming and 5W process, the causes could be pointed out through graphics for a later determination of the best solution for the problem in question.

The result of the 5 major critical causes was reached from the analysis of possible root causes and also through the involvement of the team. The following conclusion of the Top 5 was drawn:

Table 2 –Criticisms Analysis of the causes using Pareto chart



Source - FERREIRA, 2014

By relying on data, the team determined that the possible root cause of the problems with deviations from tolerances is the template errors. Based on that, the team members began to think of viable solutions that generate profits for the company. This stage of the improvement process is critical, because, from this moment on, it is evaluated whether the solutions will reach the goals established for the company; if it does, it will be applied on a large scale; if it does not, it should return to the previous steps to better assess the causes, think about other hypotheses or even change the type of data collection.

Those involved should ask themselves what actions or ideas would help to solve the problem, which ones would be feasible, which would be the best in terms of simplicity, practicality and cost, and how it will be tested for later validation and permanence of the solution. But it is important to emphasize that this action will not be exclusive for this process but for others too. To this end, action plans are made to determine the consistency of the solution in practice, motivate the team, prevent unforeseen events and the worst situations, as well as small tests for real validation

of actions, before being applied in the process or on a large scale, generating prejudice and loss of time and focus.

Finally, once the improvement action plan has been approved, consolidated and implemented, the last and important stage of Six Sigma will be the control of improvements. The reason to do the control is to ensure that this plan is maintained and followed by the process as well as prevent errors being repeated. The control is made by documentation, rules, supervision, training, use of sensors, continuous action of the maintenance team, operation, design and production by inspecting the manufacture and assembly of the exhaust system and ensuring that Six Sigma is efficient and reliable for the company. It brings quality products at higher levels of satisfaction to the customer, seeking the perfectionism.

#### Comparison of the templates used to manufacture the exhaust system

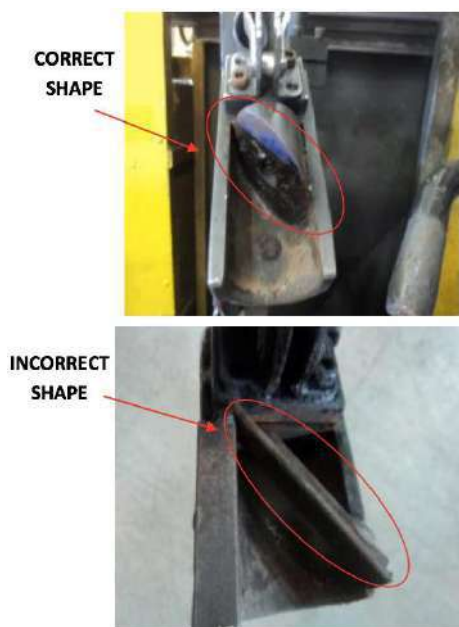


Fig. 8: Difference between correct and incorrect shapes

Source: OTIMAEG, 2013.

The tolerance deviations occurred due to irregularities in the surface of the templates, that are used for the welding and manufacturing processes of the components to the exhaust pipe, as indicated above. As noted, the semi-spherical shape offers the correct curvature to the pipes for better absorption of noise, vibrations and temperature before and after the passages of the components. These components are, for example, catalyst, muffler, silencer and flexible gasket. This type of jig is ideal to meet the requirements and regulated noise and environmental targets as well as the best performance and maximum vibration absorption.

In the incorrect triangular format, the technical design cannot be strictly followed, which compromises all components in their life time. Its positioning and functionality directly impacts the level of polluting gases emitted in the environment as well as the level of noise at the outlet exhaust pipe and the vehicle's power output. It can also cause serious damage to the car, failures during use, leaks or even fires.

#### Verification of impacts on production and cost, due to the lack of standardization of exhaust systems

The assembly of the exhaust systems, that suffered from deviations of permitted tolerances during their manufacture, causes issues such as loss or stop in production as well as injuries to operators. There were also adaptations to get the exhaust systems fitted in their determined positions on the chassis in order to reach the goals of production levels.

This type of attitude causes malaise in the work environment and a deficit, since the number of vehicles produced in one shift is reduced, their quality as well as an increase in their final cost. These facts occur because of the need to produce the largest quantity in the shortest amount of time to beat the competition. This attitude is not aimed at the satisfaction of employees or the consumer market. That's why it is recommended to use quality tools for solving and maintaining problems.

#### Implementation of Six Sigma to control and improve the production chain

The change in the company X's attitude when adopting the "6-Sigma" tool will positively impact the production process, satisfaction, control, and, consequently, long-term profit. This tool aims to define what the problem is, how the resolution project will be, what methods are applied to achieve the project design goals, the impact on productivity and the impact on the worker safety. It also requires active control through supervision and progress indicators (in relation to the previous production). Its gains will probably not be seen quickly. However, about two years after its application, the production will certainly show its real impact.

### III. OBTAINED RESULTS

It can be seen that the deviation of tolerances is directly related to following the technical welding standards, the design for this and the correct use of the template, which serves as a guide to avoid deviations greater than those of the calculated tolerances. Table 1 shows an estimated comparison of the impact of deviation from tolerances related to what was designed and manufactured,

in relation to the ergonomics of operators on the line, in vehicle losses and productivity.

Table 3 –Comparative between projected and manufactured exhaust system values

Informations	Projected Exhaust System	Manufactured Exhaust System
Tolerance Deviation	$\pm 3.21\text{mm}$	$\pm 4.78\text{mm}$
Cost	\$ -	\$ -
Productivity	97% $\pm$ 0.8%	76% $\pm$ 2.1%
Assembly Losses	Every 1.2 cars per thousand vehicles produced	Every 3.7 cars per thousand vehicles produced
Ergonomics	No fatigue/stress. Operator in ideal position	27 out of every 100 complained of problems related to ergonomics
*Informations taken from vehicle assembly line		

Source – FERREIRA, 2014

As measured in quantitative terms, tolerance deviations result in productivity drop as well as increased losses of resources, profits and labor. Another item that affects the result is the fact that the templates and welding machines were possibly not maintained as planned by the manufacturer or even not programmed by the company. Also, sometimes, the operators are not obliged to strictly follow neither the technical drawings (angles and positions for each of the exhaust pipe components), nor the maintenance plan of the machines.

This way, the evaluation of the reasons for these deviations must be carried out with the aid of Six Sigma, to achieve the greatest number of possible causes of these problems, so that they can be measured, analyzed, implemented and controlled, with the use of training, discipline, cultural change, in order to achieve perfection in processes, validate data and demonstrate it to management for approval or expansion of improvement through quality indicators.

#### IV. FINAL CONSIDERATIONS

After conducting research based on concepts, applications and features of the exhaust system, jigs, welding processes as well as how the Six Sigma tool could be applied as a way of improving the system, it can be concluded that from an industrial point of view, in a long term, the change results in greater financial profit in sales, client satisfaction, safety and product quality. Although, in a short term, those benefits may not be seen so clearly due to time and cost of implementing the new process.

The exhaust system is a vehicle item of extreme importance not only to obtain cars with better performance but also to reduce environmental impact and noise pollution. Any deviation in its manufacturing process, above what is allowed according to engineering specification, can cause decrease in production, because the

assembly process can suffer from lack of standardization, making it difficult to put the parts of the item together. It affects the employees ergonomics, who will assemble the item in the car or even do its maintenance. All of these also contributes to employees' lack of attention, even forgetting an important item during the assembly process. In other words, it generates a type of "chain reaction", where an error leads to another error, further worsening the situation.

Therefore, supervising, controlling and improving the manufacturing process, modifying and detecting common problems on the template, observing the way technical drawings are being interpreted and applied, verifying what type of welding is being used and also checking the state of the welding machine, provide an improvement in the workforce as well as better rigor and compliance with the norms and standards of the company, resulting in major gains in the long run.

All the facts mentioned above can be explained by the fact that with decrease in production losses, less deviations in equipment tolerance as well as better maintenance and control of activities, generate higher quality and productivity, since the work environment becomes cleaner and more orderly. In addition to that, the employees also adopt a better attitude towards work after the application of Six Sigma. They work more willingly and show greater performances.

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## Elaboration of a damage map the facades of a public building in the city of Triunfo/PE

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Received: 03 Nov 2020;

Received in revised form:

13 Jan 2021;

Accepted: 19 Jan 2021;

Available online: 30 Jan 2021

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**Keywords** – Guarany Theater Cinema,  
Pathological manifestations, Facades,  
Damage map.

**Abstract** – This research seeks to identify and explore the main pathological manifestations found in the facades of Guarany Theater Cinema, in the city of Triunfo/PE, with the objective of elaborating a damage map. For the purposes of analysis, visits were made to the historic building to inspect the facades, as well as the capture of photographs that identify and guide pathological manifestations. Cracks and stains resulting from infiltration were found, but the existence of vegetation and places with deteriorated paint and plaster was still localized. This study enhances that analyses of a given constructions extremely important for the production of a damage map that assists, for example, in a possible project of restoration and preservation. In short, studying a construction with immeasurable historical, artistic, cultural value and of great relevance is necessary, not only for the Pernambuco Sertão, but also for the entire state of Pernambuco.

### I. INTRODUCTION

The municipality of Triunfo is located in the mesoregion of Sertão Pernambucano, at the top of the Serra da Baixa Verde. Distant approximately 405 km from the capital Recife, it is the highest city in the state of Pernambuco, situated more than a thousand meters above sea level. Due to its privileged geographical location, Triunfo has distinct climatological characteristics from other Sertaneja snow cities, often recording temperatures below 12 °C in winter, and having the historical record of the lowest temperature in the state of Pernambuco: 6.8 °C, measured on July 7, 1975.

Triunfo has a strong European influence, noted mainly in architecture and local gastronomy, a heritage left by the Dutch, German, Portuguese and Italian settlers, who arrived in the lands of the Cariris Indians in the mid-1800s. Currently, the city contains a set of historical buildings from the middle of the 19th and early 20th centuries.

Through a brief analysis of the churches and historical mansions that mark the scenario of Triumph, one can perceive the clear difference in the constructive methods used at the time, in contrast to those that are commonly used today.

Very thick masonry and facades with wealth of detail and symbologies are some of the differences that can be mentioned. The archaic construction techniques used and the lack of some primordial materials for civil construction today, such as cement and steel, have contributed to the occurrence of surface and/or structural damage in buildings over the years.

It is necessary, in this way, to intervene in the emergence of a greater number of pathological manifestations, as well as the control of existing ones, in order to preserve the historical heritage. The preservation of these historical monuments, as is the case of Guarany Theater Cinema, must ensure measures that keep both the

structure and cultural and artistic memory preserved - which needs to be passed on to future generations.

In addition, it is necessary to integrate the Federal, State and Municipal powers, in addition to the sectors of society responsible for issues related to the preservation of cultural heritage, in order to ensure more action in the physical, economic and social recovery of historical assets.

Taking into account the importance that Guarany Theater Cinema plays for the country scene, bringing artistic events and promoting culture to Triunfo and other cities of Pernambuco, it is necessary to value the construction and preserve its original characteristics. For this reason, this work aims to map the pathological manifestations in a damage map clearly enabling the analysis of the reasons that generated them.

The accomplishment of this research is also of fundamental importance in view of the scarcity of literature and available documents regarding restoration processes in historic buildings, thus contributing as material that can be used as a form of consultation and assistance in future research with themes related to pathological manifestations.

In a statement, the work addresses the importance of historical monuments, based on the Guarany Theater Cinema, also points out the concern to preserve the heritage, through its restoration, being made an analysis from the public policies and the responsible body, as well as the legislation of tipping in force.

## II. THEORETICAL FRAMEWORK

### 2.1 History of the Guarany Theater Cinema

In 1919, the construction of what would become triunfo's most iconic building began: The Guarany Theater Cinema, the city's main postcard, built in eclectic style, mainly with characteristics of neoclassical architecture. The building marks the Triunfense scenery, and enchants not only the locals, but also the tourists who visit Triunfo daily.

Conceived by Carolino Campos, Guarany Theater Cinema was built on top of a slab, on the site where previously it was a garage of cousin Manoel de Siqueira Campos. The project came from France, where Carolino traveled for a walk and glimpsed with French architecture, brought from there, the architectural plan. The work was completed and had its inauguration on February 17, 1922, with the show "Cenas Mudas", a success at the time. In this same period, the week of modern art took place in Brazil: a great artistic, cultural and political-social

movement that would bring great changes to the art scene in Brazil.

The Guarany Theater Cinema is a building that does not contain steel or cement in its structure, due to the time it was built, in this way were added to the mass, cocoa, sand, clay and whale oil – a technique in disuse, but that guaranteed the construction and structural stability of the buildings of the time. The Theater belonged to Carolino Campos until 1937, the year he lost it, the victim of a coup by the Sertão Improvement Company, a shell company.

In 1952, the theater was bought by friars who used the space as a place of training of men for theological activities.

Faced with many requests from the Triunfense population, in July 1988, the State Council of Culture overturned the building and in August of the same year the state bought it. From then on, taking into account the importance that the Theater already had, social movements emerged in the city that aimed to preserve the building.

The Guarany Theater Cinema, represented a milestone in the cultural life of Triunfo and the region. Imposing, the building is today the living testimony of the golden age through which the municipality passed in the early 20s. Few cities in the interior of the state have an architectural copy of the size of Guarany.

Currently, Guarany Theater Cinema is owned by FUNDARPE, and it has been held for 12 editions, the Triunfo Film Festival. Since its first edition in 2008, the Festival has exhibited more than 650 films, contributing to the formation of audiences and professionals in the film and theatrical market in the Sertão do Pajeú. In Fig. 1 and Fig. 2 we can see the reproduction of the structure of the Guarany Theater Cinema.



Fig. 1: Guarany Theater Cinema





Fig. 2: Guarany Theater Cinema

## 2.2 History of the Guarany Cinema Theater

The word "pathology" is derived from the Greek (pathos - disease, and logia - science, study) and means "study of the disease". In civil construction, it refers to the study of the damage present in buildings, exploring its causes and effects, as well as its viable means of solution and prevention. Pathological manifestations can be evidenced in various ways, the main ones being: infiltrations, cracks, efflorescence, displacement of plasters and floors, growth of vegetation, corrosion of hardware, deterioration of concrete, in addition to damage caused by human action, such as vandalism and graffiti.

According [1] and [2] the origin of pathological manifestations may result from poorly elaborated projects, the poor quality of the materials used in construction, the lack of technological control, mainly related to concrete, the failure in the construction stage, a team without preparation for the execution of more elaborate projects, lack of supervision by managers or those responsible for the execution of the enterprise, buildings being used for purposes other than the initial (project) or even by its improper use and lack of maintenance.

Damage to buildings can also occur due to chemical reactions, erosion, temperature fluctuations, vibrations and corrosion. For each type of pathological manifestation, one should seek the correct measure of treatment, first performing the correct diagnosis [3].

In order to prevent pathological manifestations from becoming common in constructions, the user must make the correct use of the building, obeying the requirements made by the designers and other responsible for the work and performing preventive and corrective maintenance in accordance with the manual of use, operation and maintenance formatted, written according to [4], in addition to making documented records of pathological maintenance.

## III. RESULTS AND DISCUSSIONS

### 3.1 Analysis of physical conditions at Guarany Theater Cinema

The pathological manifestations present in the two facades of the Guarany Theater Cinema building were identified. The identification of such pathological manifestations was made through a survey of the local where the theater is located by those involved in the work. Then there was the elaboration of the damage map.

It was possible to understand from the analysis of the physical situation of the facades of the historic building, which is a still preserved construction, evidencing the value that Cinema Teatro has for the Triunfense citizens. Despite containing pathological manifestations, which will be explored below, the Guarany Theater Cinema, maintained by FUNDARPE, is in a good condition, but it is of great importance to carry out the mapping of pathological problems, in order to make an intervention and repair of existing damages, thus preventing them from spreading over the years and compromising the structure of Guarany Theater Cinema.

### 3.2 Pathological manifestations present in the facades of Guarany Theater Cinema

#### 3.2.1 Surface stains

Surface stains are present on the two facades of the theater, all located at the same height. Such stains were caused by the constant passage of people through the sidewalks of the building, where they lay hands on the walls. The appearance of this type of pathological manifestation occurring over time, p and a repetitive and constant act. The result of the presence of this problem can be seen in Fig. 3.



Fig. 3: Surface stains on the facades of the building

This is a type of only aesthetic damage, which does not compromise in any way the functioning of the building, but it should be in addition to the fact of the visual

importance that the Theater has, in this way, simple maintenance, as paintings performed on a regular basis could solve this problem. Another suggestion for this problem is the use of super washable anti-stain paints, which can be applied both indoors and outdoors and that use special additives that allow the elimination of dirt without changing the paint.

The additive used in stain paints is a hydro repellent additive that prevents stains and dirt from attaching under paint, repelling them from the surface when it is washed with a damp cloth and neutral soap.

### 3.2.2 Plaster detachment

Some small areas with plaster detachment were identified Fig. 4, this pathological manifestation also called deplatement consists of the rupture of a part of the coating in relation to the whole, that is, a stretch of the mortar is parted from the surface (floor, ceiling, internal and external masonry), leaving exposed the area of occurrence of this pathological manifestation.



Fig. 4: Plaster detachment

Detachment can be caused due to sudden and continuous temperature changes, poorly executed labor, execution of very thin or very thick layers of plaster, among other factors. In the case of the external analysis of Guarany Theater Cinema, and observing that the plastering displacements are of low occurrence and in sizes considered small, one should first request the correct diagnosis with a professional in the area, to ensure that the "neighboring" regions are not compromised.

From this diagnosis, a new coating with mortar can be made at the site of pathological manifestation, and later apply a new painting, thus preventing these damages from spreading and causing major disorders. On the other hand, in the case of surfaces with a lot of occurrence of detachments, the most recommended is the complete

removal of the damaged mortar and the application of a new one.

### 3.2.3 Peeling of paint due to capillarity absorption

At the western end of the front façade at the bottom, there is the presence of peeling of the painting Fig. 5, in this particular case due to the absorption of water by a phenomenon known as capillarity – it is the ability that some substances have to climb or descend through capillary tubes or move through short spaces present in porous materials. This mechanism allows fluids to move against gravitational force.

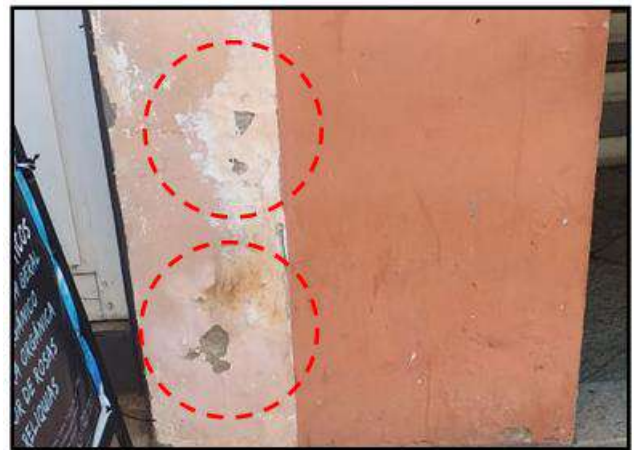


Fig. 5: Detachment of the painting

The peeling of the painting presents on the façade occurred, therefore, due to the porosity of the material that composes the pillar where this pathological manifestation was identified, which allowed the transport of water by capillarity. As a solution to this problem, it is recommended to scrape and sand the surface and then apply a layer of waterproofing.

It is necessary to eliminate the contact between the surface and moisture, to ensure that the problem does not appear again over time. According to Demetrius da Rocha Ramos, Civil Engineer and technical advisor at Weber Saint-Gobain, there are waterproofing mortars available in the market that can solve this problem. He states that it is important to perform all the removal of the wall cladding and then apply the product, both on the inner and outer side.

To carry out the prevention of this type of pathological manifestation during the construction process of the work, it costs cheaper than to perform methods of solving the problem, when it arises after the building is ready.

### 3.2.4 Surface stains

Moisture stains were noted on both theater facades, between the cornice components and especially in the upper regions of the building, as shown in Fig. 6. With the moisture present in the wall, it can trigger mold and the action of microorganisms. Moisture spots can appear in various situations and climates, such as in coastal regions and in cities such as Triunfo – with rainy winter and low temperatures.



Fig. 6: Surface spots characterized by moisture

The presence of moisture can affect the paint, flooring, ceramic coatings and even the structure of buildings. In the case of Guarany Theater Cinema, it is believed that the climate and frequency of precipitation (especially between May and July) have contributed to the emergence of this type of pathological manifestation. Unlike the peeling of the paint due to the absorption of water by capillarity, these types of moisture stains found on the facades, are derived from the contact that the surfaces have with the fluids, which are damaged by not having a correct waterproofing.

Even though the Guarany Theater was built with the use of whale oil, both as a binder and as a waterproofing agent, the age of the building may have made the oil's waterproofing capacity lost.

To treat this pathological manifestation, the procedures are to clean the region of occurrence to eliminate and prevent mold, perform proper waterproofing and then remake the finishes on the walls or any surfaces.

Expanded Polystyrene (EPS), for example, is being increasingly applied, mainly in external coatings, due to its thermal insulation capacity, prevention against molds and moisture, low water absorption, in addition to sustainability, economy, and the property of preventing the proliferation of microorganisms, among other factors.

### 3.2.5 Regions with loss of concrete used

It was located on the front façade, a broken capital as shown in Fig. 7. In architecture, capital refers to the top of the column, located above the steel. In the case of the damaged capital at Guarany Theater Cinema, the cause of the damage is unknown, but it is believed to have been caused simply by the use of a weak mass or the presence of fissures in the region of the collapse, which over time occurred the detachment of part of the structure.

As in the construction of the theater, no cement was used, this may also have contributed to this architectural component breaking down. For correction, the reconstruction of the workpiece must be performed, maintaining its characteristics.



Fig. 7: Areas with loss of concrete

Another component found broken was a piece of the cornice, located on the side façade seen in Fig. 8. In the same way as the capital, cracks may have caused the damage in the cornice region and consequently its detachment, therefore to reconstitution of the same, it must be carried out the reconstruction and reform of the piece.



Fig. 8: Areas with loss of concrete

In this context it can also be mentioned the wear of the frames that is related to the peeling of the painting, having been identified in almost all doors and windows, in addition to the wear noticed in the bodyguards, which are also wooden as seen in Fig. 9. To solve this problem, just sand the frames in order to remove the damaged paint and make a new one, which is proper for external environments, that is, with waterproofing properties.



Fig. 9: Wear of the frames

### 3.2.6 Cracks

The fissures were identified in the lateral façade as shown in Fig. 10. According to their physical characteristics, they were possibly caused by the vibration of cars that travel daily in the streets in front of the two facades, another possibility that should be taken into account is the vibration that was caused in the building when these highways were paved at the time of the use of compactor rollers, which are heavy machinery used to compact the asphalt mixture. Another point that may have generated the cracks is the temperature oscillation, which causes the materials to dilate and contract.

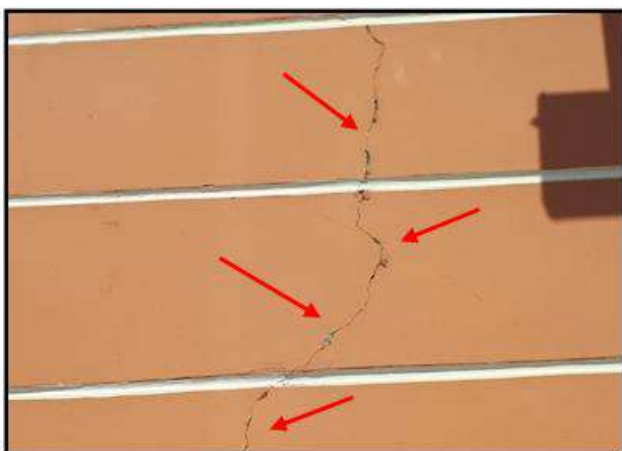


Fig. 10: Occurrence of fissures

Fissures are pathological manifestations that generally deserve special attention, because they are directly linked to the physical functioning of the building, and may worsen and become larger in larger cracks – cracks, which alert to structural problems.

A professional in the area needs to make the correct diagnosis about the fissures in order to point out what is the best method of treatment. For small cracks, you can retouch the plaster using acrylic mass or mortar, but they can reappear over time. Another option is to pass pure elastomeric paint at the crack site and then apply two or three coats of paint.

Another alternative to repair, is to open the crack using an equipment called "crack open", in addition to taking the paint present in the side bands, then you should remove the dust and clean the surface using a brush and a damp cloth, the next step is to fill the crack with dough, after full need to cover with a thin mesh canvas and cover the screen with the dough used previously, finally, sand and paint the surface that has been restored.

### 3.2.7 Vegetation

It was also noted the presence of vegetation at the eastern end of the side façade, at the limit where the Guarany Theater Cinema ends and begins the masonry of the neighboring building, possibly indicating a joint between the two buildings, which allowed the development of such pathological manifestation. The presence of this vegetation still exposes the lack of maintenance of the external area of the theater. This pathological manifestation can be seen as shown in Fig. 11.



Fig. 11: Presence of vegetation

### 3.3 Damage map

According [7] defines damage maps as the graphical-photographic, synoptic representation, where all manifestations of building deterioration are illustrated and

discriminated, rigorously and thoroughly, in order to synthesize the result of investigations on structural and functional changes in materials, techniques, systems and construction components.

The author warns that the term damage map should not be confused with damage mapping, since the former corresponds to the document or sets of documents that illustrate the state of conservation of the building on a specific date. The damage mapping, on the other hand, consists of a phase of the surveys where the surveys, investigations and production of the data for the elaboration of the damage map are done [5].

Thus, for the elaboration of the damage map, it is essential to collect information about the building studied in order to better understand the pathological problems that can be found in the damage survey phase. Thus, the constructive methods, the history of interventions and the understanding of the area where the building is located are primordial factors for the analysis of the pathological manifestations [5] and [6].

Thus, it was possible to identify the damages in the analyzed façade (with the identification of a symbology for each found damage). The Fig. 12 and Fig.13 below presents the damage maps produced for the Guarany theater facades.



Fig. 12: Damage map of the front façade

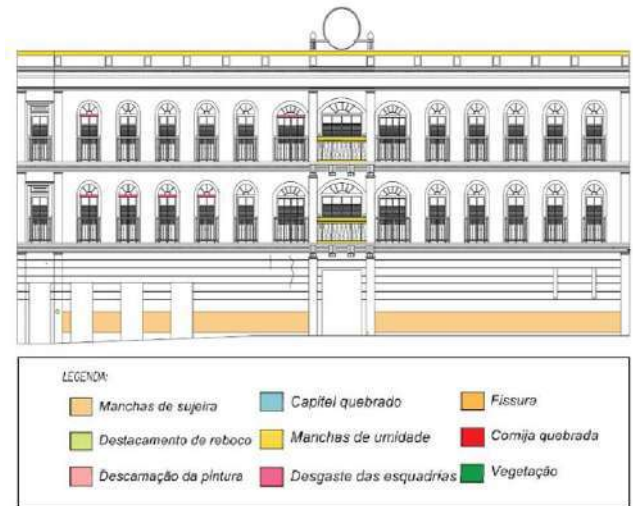


Fig. 13: Damage map of the side façade

#### IV. CONCLUSION

This work aimed to identify the pathological manifestations of Guarany Theater Cinema and to evidence them in a damage map, in this way managed to point out the damage present in the facades of the historic building and showed viable means of solution.

Taking into account the external analysis of the theater, it is of great relevance to explain that the building is in good condition of preservation, and that the pathological manifestations present in it are of simple eradication, but we see the need to repair the existing damages with the objective of prevention about the proliferation of construction problems already identified and the emergence of more pathological manifestations.

Considering that a simple maintenance would bring a better condition to the building, this work maps causes and solutions of pathological manifestations, proving that common processes related to restoration, can guarantee a better functioning and a better visual aspect, considering the cultural and historical value that theater plays.

This research is a document that seeks to show the importance regarding the valorization of Brazilian historical buildings, through the Guarany Theater Cinema.

#### ACKNOWLEDGEMENTS

We appreciate all those directly and indirectly involved, especially to Diana Rodrigues Lopes, for the willingness to receive us in their home and for providing us with materials and primary information for carrying out this work, an administrative team of Guarany Theater Cinema and, above all, the Faculty of Integration of the Sertão, for institutional support.

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# Palliative care Oncology Patient and Nursing Look in Integral Care Perspective and Death: Study Conducted in a public hospital in Porto Velho, Rondônia, Northern Brazil

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Received: 23 Nov 2020;

Received in revised form:

11 Jan 2021;

Accepted: 21 Jan 2021;

Available online: 30 Jan 2021

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**Keywords—** Palliative Care, Nursing,  
Patient, Oncology.

**Abstract** – The general objective of this research is to know the perception of the nursing team on palliative care in oncology in a State Public Hospital in the city of Porto Velho - Rondônia. In order to understand the perception and experience of nursing staff in palliative care to patients in a Unity Medical Clinic I, I was chosen by a descriptive research with bibliographical research and field methods with prospective approach, supported by qualitative approach and subsidized by the phenomenology of Maurice Merleau-Ponty perception. The study results show nurses that come in palliative care take care of one action based on the need to offer comfort and control the physical pain of patients in terminal stage of life, promoting humanized care that integrates not only this patient but also his family, offering support during the difficult time in which both are going through. These professionals reveal feelings of powerlessness due to the inevitable prognosis of patients in the terminal phase. However, when watching this population, these students take care to cover the practical assistance and the quest to meet basic human needs of the patient. Based on the analysis of evidence obtained in the present study, it was possible to demonstrate the relevance of the research topic and the need to expand the knowledge with respect to palliative care, so that nursing and the whole multidisciplinary team of health to enjoy this and transforming rich medium therapy.

## I. INTRODUCTION

At present, it is considered cancer as one of the most serious diseases that can affect humans and is related to the possibility of imminent death. Even technoscientific advances forward to provide prevention, early detection and therapy for many cancers, the stigma of the disease still remains strong, reinforced by the high mortality rates (Ribeiro et al., 2014).

The number of cancer diagnoses more than doubled in the last 30 years. Most patients seeking care in hospitals when home care is no longer effective to relieve symptoms of pain and discomfort. In this sense, nursing must be prepared to meet these patients at various stages of the disease, from diagnosis to the advanced stage of the disease and its physical and psychological needs (Silva et al., 2014).

Because of the large number of individuals with cancer processes without availability of curative treatment, "palliative care and knowledge about their purpose are very important for the management of these patients" (Daronco et al., 2014, p. 657). The concept of palliative care was designed by Cicely Saunders, the Hospice movement, as the philosophy of care to the dying person, aiming to ease the psychological, physical, social and spiritual suffering, for the sole purpose of caring (Vieira et al., 2017).

Dias et al (2014 p. 2047) report that many cancer patients are terminally ill. And in this context:

[...] palliative care are presented as a philosophy of care, which promote measures to improve the quality of life of patients and their families in coping process of end of life, through early identification, prevention and relief suffering, assessment and treatment of physical, psychosocial and spiritual problems.

Nursing as a science, has the care grounded in the scientific bases, where care becomes systematized, thus determining a real and continuous care to their patients. Therefore, the nursing care to cancer patients need to involve emotional, biological and social aspects of the pathology (Zucolo, and PAULINE WHITAKER, 2014). And this is considered a challenge for health professionals in the form of care and understanding illness and the impossibility of cure, to provide support and relief of suffering (Paula et al., 2013).

Knowing that is not easy to deal with terminally ill patients, this study has the objective to know the perception of the nursing team on palliative care in oncology in a State Public Hospital in the city of Porto Velho - Rondonia.

## II. MATERIALS AND METHODS

In order to understand the perception and experience of nursing staff in palliative care to patients in a Unity Medical Clinic I, I was chosen by a descriptive research with bibliographical research and field methods with prospective approach, supported by qualitative approach and subsidized by the phenomenology of Maurice Merleau-Ponty perception.

The survey was developed by adopting all ethical procedures set out in Resolution no. 466, of December 12, 2012 of the National Health Council (CNS) / Ministry of Health (MOH), which elucidates the research guidelines involving human subjects. The research project of the present study was submitted to the Research Ethics Committee (CEP), which issued a favorable opinion by the Integrated College Aparicio Carvalho, under the number 1959581, on March 10, 2017.

The participants were 17 nurses in the months from May to July of 2017, who worked at the Unit Medical Clinic I of HBAP. It ensures even the identity of the subjects, which were identified by the abbreviation of the nursing category and in order of receipt of the questionnaires, which were identified " *Enf.1*" to "*Enf.17*".

Data collection took place from May to July 2017. From the subjects' discourse, careful and attentive reading was held, seeking what was common between them for the construction of categories, since the technical analysis of data used in this research were directed to the perception and experience of the nursing team while acting in palliative care geared to cancer patients and with no chance of cure as the current perception of concepts based on the Existential Phenomenology of Maurice Merleau-Ponty.

## III. RESULTS AND DISCUSSION

The study included 17 nursing professionals who met the inclusion criteria. In the social characterization of the participants, it was identified that 11 of respondents were nursing technicians and 06 were nurses, among them, 12 were female and 05 male. The predominant age group was above 50 years. Regarding the length of service that varied from less than less than 1 year to more than 10 years.

After analyzing the speeches of the research subjects, it emerged-00 categories, namely: Nursing care dispensed to cancer patients out of therapeutic possibility; The concept of palliative care in view of nursing staff; Feeling of nursing staff to the sick patient at the terminally process; and nursing team perception about the terminally ill patients in their care



### 3.1 Nursing care to exempt cancer patients out possibility of therapeutic

Claiming that there is nothing to be done to cancer patients outside the therapeutic possibility is a mistake. Nursing care is required while there is life, since that helps the patient to have quality of life when it is no longer possible for him to add days (EGIDIO and GOMES, 2016).

When asked about the nursing care provided to customers out of therapeutic possibility, most of the study participants nurses related their care practices assists and seeks to meet basic human needs of the patient.

*"Physical mobility thereof, hygiene, nutrition, basic care and promoting health" (Nurse. 7).*

*"Providing hygiene, such as diaper changes, beware of the probes, administer medication on time, advise on the importance of decubitus change" (Nurse. 13).*

*"[...] administer medications as prescription, realize care with hygiene, nutrition and physical mobility in bed (Nurse. 10).*

*"I provide hygienic care, medication administration, decubitus and power changes" (Nurse. 17).*

Nursing is the professional category that is able to stay longer in contact with the customer, as their actions are not restricted to purely technical procedures (GARCIA, 2014). But they seek to combine and contemplate the various characteristics pertaining to human, comprising the biological, emotional and social aspects of illness (Araújo, and SILVA PEREIRA, 2013; Zucolo, and PAULINE WHITAKER, 2014).

The study by Garcia (2014) states that while there is life, there is a need of nursing care. In this sense, the work of the nursing staff is paramount and essential to offer the maximum comfort to the patient in the final stage of life, helping to experience the process of dying with dignity, so that they enjoy the best possible way, the time We left. Thereby ensuring quality of life to what you have.

However, the findings in this study reveals the promotion of nursing care grounded in patient care as a key issue for respondents, but in a somewhat shortsighted in its denotation, the meaning of which is related only to what is physical, disregarding their psychological, social and spiritual factors.

A study by Durante, Tonini and Armini (2014) with 30 nursing professionals who actively work with the palliative care setting in a Federal Hospital of Bonsucesso located in the city of Rio de Janeiro - RJ, revealed a physiological speech, in which the body the patient acts as a machine where its wheels require only one facility (catheter, monitor equipment, bed) or a hydrostatic fluid towards the

relationship between gas and liquid into the circulation, respiration or bodily analgesia.

Other similar studies have also brought results that corroborate the findings in this study, where the nursing care to cancer patients was related only to the question of relief from physical suffering through technical procedures (Daronco et al, 2014;. DURING 2014; FREITAS and Pereira, 2013; Silva et al, 2013)..

In addition to the care grounded in care, other care, as to drug therapy to relieve the pain of patients was cited by some respondents, as certifies the following reports:

*"Medication for pain [...]. (Nurse. 1).*

*"[...] prevent the patient has minimal pain [...]" (Nurse. 11).*

*"I administer medication for pain" (Nurse. 9).*

The pain is intense present in cancer patients, and is considered one of the most common symptoms and second Daronco et al (2014), the role of the nurse and the nursing staff is essential in the evaluation of pain, as these professionals will following the change of intensity of pain, and thus can intervene when necessary. Please note that the unrelieved physical pain is a constant threat factor to the feeling of fullness desired. Experience a peaceful death process without pain is, above all, the chance to live fully his last moment. You must realize that before the terminal patient to adjust to other needs, he must have his relieved and controlled physical discomforts. Provide pain relief, it is one of the primary goals of palliative care.

It is considered pain relief as a fundamental care of the nursing team and, at the stage where the patient is under hospice care, this care becomes a priority, which enables the pain and suffering of patients are avoided or mitigated, targeting the patient's well-being (Nascimento and FERREIRA, 2016; RODRIGUES, Bushatsky and VIARO, 2015).

Machado et al (2013) explain that it is necessary to pay attention to the dimensions of subjective pain, for example, its intensity, location, and duration of irradiation; the space that it occupies in the patient's life and meaning that the patient attaches the pain in your life. However, this care requires a different view on the part of the nursing team and not just the use of pain medications, as patients need to have their pain recognized, understood and respected.

Resort to spiritual care, was also recognized by two respondents as a viable alternative that can be implemented in the set of actions directed to cancer patients in terminal phase, as the following lines:

*"[...] word of God" (Nurse. 8).*

*"We have to provide trust in God [...]" (Nurse. 13).*

Despite being a small number of respondents who mention spirituality in nursing practice, it was realized that there is on the part of these professionals attempt to strengthen the patient's belief as a way to ease their pain.

Researchers emphasize the need for nursing staff in fact to recognize the importance of spirituality, faith and religion, and integrate these aspects in the treatment of cancer patients to improve quality of life in order to lead these patients to a dignified end of life with integral support and suffering little as possible (Daronco et al, 2014;. Dias et al, 2014;. Silva et al, 2016.).

For Bernardes et al (2014), this different perspective of the nursing team to cancer patients allows humanize care, that is, means giving quality to nursing-patient-family relationship, providing opportunities welcome the sufferings of human beings before the body weakness, mind and spirit.

### 3.2 Hospice care concept in vision of nursing team

When asked about their understanding of palliative care, most of the present study nursing professionals emphasized that action to care for the need to provide comfort to the patient in phase "terminal of life, as highlighted in the following lines:

*"Give maximum comfort [...]" (Nurse. 1).*

*"These are measures that bring comfort [...]" (Nurse. 9).*

*"And give maximum comfort" (Nurse. 11).*

*"My opinion is a care that we do not have drug that brings comfort to the patient" (Nurse. 17).*

According Daronco et al (2014), between the care offered to patients in palliative care, comfort stands out. The same etymologically originates from the Latin *Confortare*, denoting fortify, assist, comfort, ease, help and assist.

Previous studies aiming to understand the perception of the nursing team to palliative care in oncology, brought evidence to corroborate the findings in this study, where the results pointed to the importance of comprehensive measures of comfort (FREITAS and PEREIRA, 2013; DURING 2014 ; Silva et al, 2014)..

Fernandes et al (2013) and Garcia (2014) argue that this understanding is consistent with the philosophy of palliative care which proposes to provide comfort and relief required to make minimum the suffering and pain of the patient, and consequently promoting the quality of life, which is essential part of maintaining dignity in human finitude.

It is important to note that knowledge of care needs and comfort on the part of health professionals, especially in the nursing field, directs the professional to reflect on the care environment and changes within the hospital setting,

assisting in perceptions about the care needed for the well-being and better quality of life for patients in palliative care (Daronco et al., 2014).

However, despite the majority of professional nursing staff describe the comfort, as essential parameter for the quality of life of patients in palliative care, some unveil lines that the care provided to patients in palliative phase are restricted to the control of physical pain .

*"Ease the pain" (Nurse. 12).*

*"They care seeking relief and / or ameliorate the pain" (Nurse. 14).*

*"Mitigating pains" (Nurse. 15).*

Corroborating these findings can cite the studies of Lopes et al (2013) in Singapore - PB and study Daronco et al (2014) in Rio Grande do Sul - RS, which were developed with nursing professionals who work directly with cancer patients. In both the research study participants defined palliative care as the control of physical pain.

Considered as the fifth vital sign, Egidio and Gomes (2016) state that "Physical Pain" brings influence to the quality of life of cancer patients requiring attention and proper care for the patients who need this therapy.

According to Lopes et al. (2013), pain control is an individual right and a duty of professionals who need to develop strategies to mitigate the suffering caused by this situation. Such strategies will lead, in a milder and smooth the process of death. Therefore, physical pain should not be addressed in isolation and should not be ignored either.

Moreover, it is important to point out that control of pain is considered one of the main goals of palliative care, since the pain significantly affects the quality of life and recovery of patients, and about 95% of patients require analgesia for relief pain (Freitas and Pereira, 2013).

Due to the large number of individuals with cancer processes outside of curability, palliative care and knowledge of its purposes is very important for management of these patients (Daronco et al., 2014).

As the importance of palliative care to this population, the studied nursing team has the following vision:

*"Relieve the suffering before death, favoring a more peaceful passage to the patient and family" (Nurse. 9).*

*"Ease the suffering both the patient and his family, even if it is in the terminal phase" (Nurse. 12).*

*"Comfort for family and patient, providing support and easing the concerns in the last moments of life" (Nurse. 15).*

Given these statements, it is evident that respondents have these care one way to promote a humanized care that

integrates not only the patient but also his family, offering support during the difficult time in which both are going through.

These results coincide with the findings of qualitative studies conducted with nursing professionals who treat cancer patients in palliative care regimen, where the survey participants reported the importance of grounded palliative care to promote a comprehensive care, humanized and multidisciplinary, aiming minimize the desires of the patient and his family, giving support during the therapeutic process bereavement (Fernandes et al, 2013; ZucoloPaulino and Whitaker, 2014).

The humanized care should meet the patient and their family of integral way. Importantly, completeness, is one of the principles of the SUS. The same is defined by Zucolo, Paulino and Whitaker (2014) as a way to take care with comprehensive and holistic approach, through the use of health technologies available in order to prolong patient survival.

For Silva et al (2014), care, palliative care, is an art, where human relations have adopted a leading role, allowing the preservation of a person's quality of life even in a complex situation, providing a peaceful death and promoting a grieving process. Thus, the meaning and understanding of palliative care has a magnitude that pierces the word itself. The unveiling of the dimensions of the phenomenon "palliative care" is founded to promote comfort, dignity, protection, open communication with the patient, an interdisciplinary action, family support, humanized care and an individualized treatment plan, in addition to pain relief and physical, spiritual and psychological distress.

The World Health Organization (WHO) focuses on the importance of palliative care to this population, since these care establishing an approach to care through prevention, assessment and treatment of pain and psychological, social and spiritual support in order to improve the quality of life of patients and families facing a medical condition that threatens the continued existence (WHO, 2017).

### **3.3 Feeling of professional nursing patient front of the sick in the process of terminality**

In the face of technological advances and the progressive increase in life expectancy, disease without curing prospects and risk of death has increased in similar proportion. On the other hand, health professionals have difficulties in following the growing demand of patients in terminal patients in need, in general, strengthen its instrumentalization for care in the dying process and how to work with this theme, especially for its association with the feeling that nothing more can be done to these patients (VASQUES et al., 2016).

Given the above, we asked the which nurses the feelings they describe to care for a terminally ill patient, the speeches of all surveyed denote feeling that express sensitivity to the situation, since in some these professionals times not They can provide the patient with all that it needs, as can be seen in the following lines:

*"Powerlessness, you feel that there's nothing more to be done before the disease" (Nurse. 1).*

*"Powerlessness, we see the patient in the situation and can do nothing" (Nurse. 5).*

*"Impotence to see that every second may be the last and you can not do anything to improve the situation" (Nurse. 9).*

*"Failure to do something, I feel helpless" (Nurse. 16).*

Facing the situation of death experienced by cancer patients with no chance of cure, all the nurses of this study demonstrated feelings of frustration and suffering, because they feel powerless to care in terminal illness. It is believed that such a feeling arises due to the inevitable outcome of the terminally ill patient and also the difficulty of planning a nursing care in these cases.

Pink and Couto (2015) state that the patient contact the terminally process induces the nursing professional to an emotional wear, where feelings are expressed in a confused manner. This professional has difficulties in dealing with the patient's death, due to consider it as a new and distant event, causing feeling of helplessness.

Results found in the study Vasquez et al (2016) conducted with 23 professionals active nursing in a Medical Clinic Unit of a University Hospital Public Federal, located in the extreme south of Brazil, are similar to the findings in this study, where the majority of nurses had difficulties in acting front of the terminal illness, since they found themselves strongly mobilized by feelings of powerlessness due to the imminent process of death of patients.

It is important to emphasize that this negative sentiment was also evident in other studies with nursing professionals attending patients in end-of-process (ALMEIDA, SALES and MARCON, 2014; BERNARDES et al, 2014; Garcia, 2014; Garcia and Santos, 2014; PINK and Couto, 2015; Silveira, Ciampone and Gutierrez, 2014; ZucoloPaulino and Whitaker, 2014).

### **3.4 Perception of nursing team on the terminal phase of patients under your care**

When a patient is labeled a 'terminal', ie without any possibility of healing, there is the idea that there is nothing to be done. However, this patient is alive and needs to be

carefully (and GARCIA SANTOS, 2014; Zucolo, and PAULINE WHITAKER, 2014).

About the understanding of professionals about the final phase of life of patients who are under nursing care, if questioned as it should be this phase, many said it should be painless and next to family, which can be noted in the following lines:

*"Close relatives and without pain [...]" (Nurse. 6).*

*"With less suffering and their families around" (Nurse. 9).*

*"Preferably painlessly and with the family" (Enf.10).*

*"No pain and most likely to be close to their families and loved ones [...]" (Nurse. 14).*

It is worth noting that the survey participants emphasize the promotion of comfort and enhancement of quality of life, and for this the patients finitude should remain with the family, getting adequate treatment without the least pain.

Confirming these findings, a study developed with nurses that are inserted directly in the process of care in oncology sector at a university hospital, located in Uberlândia - Minas Gerais, revealed a great concern on the part of these professionals to provide a peaceful death no pain and humanized form, in the presence of family and loved ones for the close time (WEDGE, Araujo and Peres, 2016).

Strengthening further such findings, Garcia (2014) conducted a survey in the Regional Hospital of Luziânia - Goiás with 08 nursing professionals, which showed through the speeches of these professionals the encouragement of family members with patients as a way to care for terminally life situations since the family's presence provides greater safety and comfort, helping to face the difficult times of less arduous and hostile manner.

Other national studies of nursing professionals, even brought evidence to corroborate the findings in this study, where they recognize the importance of a differentiated care by the nursing staff, through which is prioritized the reduction of pain and the interaction with the family in the search for an effective patient care that no longer responds to curative therapy (Fernandes et al, 2013;. GARCIA AND SAINTS, 2014).

Even on the final stage of life of terminal patients in their care process, some nursing professionals study participants reported care involving biological, psychological and spiritual aspects, which can be evidenced in the following highlighted excerpts:

*"Taking care of these patients in the most varied needs, providing physical, spiritual and emotional support, providing greater comfort" (Nurse. 3).*

*"Really the patient needs physical, emotional and spiritual care every day, until the last breath of his life" (Nurse. 7).*

*"Providing care grounded in bio-socio-spiritual, so that it has a dignified death" (Nurse. 15).*

Before the speech showed that these professionals relate the care that the patient should receive terminals at the time of farewell to life support problems of physical, psychosocial and spiritual order, ie a care for palliative surgery.

Vieira et al (2017) point out that the phase of human terminally makes the process of care more difficult, since the patient needs to be careful in full considering both the disease and the degenerative process of his own age. The care to the terminal patient should be offered in a holistic way, ie recognizing the guy who is terminally ill as a whole being that lacks assistance in their bio-psycho-socio-spiritual sphere.

Some researchers say that both the nurse as his team should assist and support the terminal patient involving aspects of physical order, emotional, social and spiritual. And even identify their real needs, providing greater comfort (DURING 2014, DURING, and TONINI ARMINI, 2014).

It is known palliative approach aims to add quality of life to days and not days to life through the pain relief and its biological, psychological and spiritual suffering, where healing gives way to the care skills related to suffering support and dignity (Garcia and Santos, 2014; Ribeiro et al, 2014;. ZucoloPaulino and Whitaker, 2014).

It is known to take care of a cancer patient in the final stage of life, it is no easy task, as this should be seen in all their needs, whether physical, psycho affective and / or spiritual (VENTURE, 2013).

Thus, he questioned the study participants whether they feel prepared to care for a terminally ill patient, the response was unanimous, which said they feel prepared, and still support the families of these patients. Below are highlighted a few lines expressing this statement:

*"I am prepared to take care of cancer patients, as well as support their families" (Nurse. 1).*

*"I'm prepared psychologically to support patient safety spend the family [...]" (Nurse. 13).*

*I feel I am prepared to work with oncology clients, can still support your family "(Nurse. 15).*

The work of the nursing staff is paramount and essential to offer maximum comfort to this patient, helping him in the dying process in a dignified manner, so that enjoy the best possible way, the time you have left (RODRIGUES, Bushatsky and VIARO, 2015).

According to the study by Garcia (2014), the nursing staff must act to support the patient and his family, allowing minimum make the fears and anxieties, besides contributing to the appropriate participation of both in the process. For this it is important that these professionals are prepared technically and emotionally to watch both the patient and his family, who needs support and is nursing the bond of trust to provide them comfort at this moment that is so difficult.

Almeida, Sales and Marcon (2014) also advocate the need for professional nurses to be prepared to deal with terminal illness and death and not deny it in the care, given that this professional as caregiver, it may assist the patient in their dying employing the ethical principles of palliative care as a common thread in care. And may also preserve the dignity of that person and help in coping and in recognition of his death.

#### IV. FINALY

It is known that death is always a challenge, even for the professional who is trained to maintain life. This study allowed us to describe how nursing professionals perceive palliative care, as well as demonstrate their feelings and emotions on this care. And yet, for researchers, it was a unique moment, which was given the opportunity to expand their concerns and reflections on the care of nursing professionals to clients in palliative care and care at the end of life.

As the survey was conducted only with nurses that cater to adults terminally ill patients in the medical clinic I, not expanding the professionals caring for other age groups, as is the case in pediatric oncology of the hospital and with a small sample of these professionals, it is important that further studies be conducted to better identify the perception of these professionals working in palliative care and pain management, as well as the entire multidisciplinary team.

Based on the analysis of evidence obtained in the present study, it was possible to demonstrate the relevance of the research topic and the need to expand the knowledge with respect to palliative care, so that nursing and the whole multidisciplinary team of health to enjoy this rich and transformative form of therapy, building a humanized care to patients in finitude process and their families.

It is believed that the evidenced results contribute reflections and teachings so that more and more health professionals, especially those in the nursing field, are empowered and motivated to provide care that is reflected in the quality of life of customers, leading into account all the bio-psycho-social-spiritual aspects.

It can conclude that this study aggregated positive values to our personal life, but especially for our professional life. As future nurses, we will observe the terminal patient in its totality, as a being that requires not only the devices and drugs to stay alive, more essential care that offer comfort for body and soul, for actions They must be geared to quality care and humane, during and after the patient's death.

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# Calibration of the SLEUTH urban simulation model using NOMAD and Genetic Algorithms

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Received: 21 Nov 2020;

Received in revised form:

14 Jan 2021;

Accepted: 20 Jan 2021;

Available online: 30 Jan 2021

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**Keywords—** Optimization, NOMAD, Genetic Algorithms, Sleuth, Urban Simulation.

**Abstract—** Computer simulations often entail an optimization problem, corresponding to the calibration of model parameters to ensure a precise representation of a given scenario. Many complex phenomena such as urban growth have characteristics that make optimization harder; this can be exemplified by the lack of an analytical formulation, presence of nonlinearity, discontinuities, and nondeterminism. SLEUTH is a long-established urban simulator, used to compute forecasts of city evolution. The tool is controlled by five parameters that span a search space of the order of 10 billion combinations, with a calibration procedure that is CPU-intensive and not compatible with gradient-descent methods. In this work we compare the efficiency of a genetic-algorithm version of the simulator with the use of the optimization library NOMAD. Different alternatives for the integration of the library are suggested. The experiments are analyzed using data profiles, a technique designed to handle cases with a limited number of function evaluations. The results confirm interest in NOMAD, and reveal more information than traditional comparisons of number of iterations or final optimization results. The methodology of the study can be applied to similar situations and is not restricted to simulators implementing urban models.

## I. INTRODUCTION

Simulation is a fundamental tool in science and technology, in fields as different as medicine, astronomy, economics, and engineering. The execution of simulation models makes it possible to compare alternative explanations to a phenomenon, make projections, and refine designs in contexts as research and development of new technological products, or administration of complex systems. Urban simulation is a comparatively recent field, and it encompasses several aspects of the study of cities, such as mobility, waste management, microclimate and urban growth.

A critical point of simulation studies is to guarantee a match between computed results and actual data [1-3]. In other terms, given a physical system, a model should be capable of reproducing its behavior within a tolerance. This can be assessed by monitoring variables of the model

and comparing them against reference values, examining qualitative or behavioral characteristics of the simulator, or possibly, conducting the analysis of both types of information [4,5]. In a broad context, finding the correct values for physical parameters that match a phenomenon is generally known as an inverse problem [6]. Computer software may also require calibration of variables that do not directly represent physical properties, but control simulation behavior; this is often the case with complex systems [5].

Models of urban growth, or more generally, models of land use and cover change, require Geographical Information Systems data, which are generally represented as tables of values or 2D images [5]. A common technique to implement urban simulation is Cellular Automata [7,8], where each cell represents a square area of land. Calibration of such models is based on global statistics



(e.g., urbanized area) and local information (e.g., morphology of the urban footprint) [7].

The SLEUTH simulator is a long-established model of urban growth [9,10]. The calibration procedure adjusts the values of five parameters that control the simulation. The parameters take integer values between 0 and 100, meaning that the search space has  $101^5$  combinations. Calibrating SLEUTH corresponds to finding the extreme of a metric. The original method is based on a brute-force strategy, conducted manually; processing times of the order of six months were reported ten years ago [10]. The software has support for parallel execution via MPI (Message Passing Interface), but this translates to pushing further to the hardware the inefficiency of the search. One attempt to address the problem was the implementation of a genetic algorithm, tailored to this software [10,11]. Studies of model calibration can be found in many fields; cellular automata models of urban growth constitutes part of the literature of the problem, and some references are [12-16].

It has been documented that the SLEUTH model exhibits high sensitivity to temporal locality of data [17]; in our experience, the opposite happens with its control parameters. By inspecting the output of metrics it can be observed the presence of a pattern of plateaus. Other characteristics of the model, as strong nonlinearity, and discontinuity, prompt the use of zero-order optimization methods [18].

In this work, we modify the SLEUTH simulator by coupling it with the optimization toolkit NOMAD [19], capable of handling characteristics as non-convexity and noise. The software connection was implemented using named sockets. The technique of data profiles was used to analyze the results. The performance of NOMAD was compared with the original method of the simulator and also with another version of the tool, GA-SLEUTH, which implements a genetic algorithm for calibration.

## II. MATERIALS AND METHODS

### 2.1 THE SLEUTH MODEL

The software SLEUTH implements a model of urban growth based on the technique of Cellular Automata [8-10]. Each cell obeys a set of rules that determines whether a location becomes urbanized or not, depending on the state of neighbor cells and on five layers of data that give the software its name: Slope, Land Use, Excluded Areas, Urbanization, and Hillshade. The model implements heuristic and stochastic rules that are controlled by five parameters that vary in the range  $0 \leq p \leq 100$ ; they are:

- diffusion: controls the generation of new cells scattered on the matrix;
- bread: controls the expansion of new city fragments;
- spread: controls the generation of new cells around areas that are already urbanized;
- slope: controls to which extent the city can advance over steep terrains; and
- road gravity: controls the generation of new urban cells along of roads.

These five parameters are dubbed ‘SLEUTH DNA’; they are proposed as a means to characterize the dynamics of a city according to the model [20].

Before calculating a forecast, SLEUTH must be calibrated to replicate the historical evolution of a city. This task employs images depicting the past of the area, and a comparison metric. The original procedure is based on an exhaustive search, following the logic on Fig. 1. The simulator is executed with images of increasing finer resolution and smaller parameter grids, producing logs of statistics that are manually inspected [9].

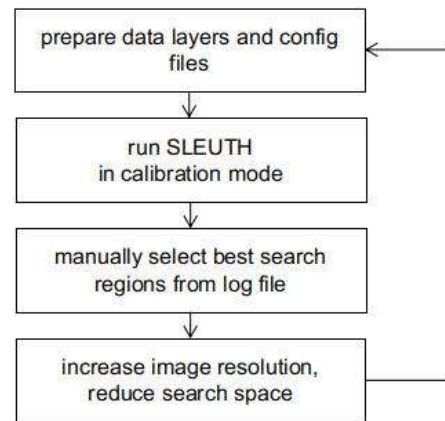


Fig. 1: Original SLEUTH calibration process.

The brute force method scans the search space using five nested loops, with ranges configured by the user. The documentation suggests three calibration rounds, each time doubling image resolution. Each simulation run iterates an internal Monte-Carlo process to average random effects implemented in the model [9,10,21].

The algorithm in Fig. 1 explores contiguous regions and, in principle, does not handle disjoint subsets of parameters. This incurs the risk of losing an extreme point, possibly a global one. To the best of our knowledge, this aspect seems to be overlooked by the literature.

Fig. 2 shows a typical output of one of SLEUTH statistics, obtained in our experiments.

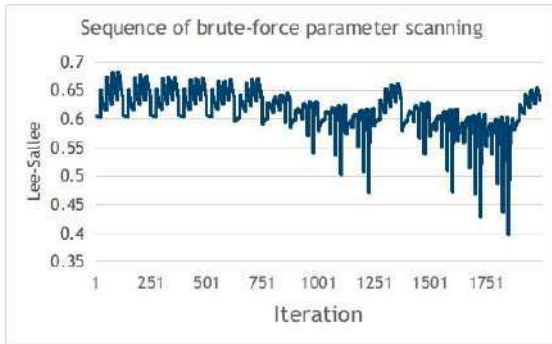


Fig. 2: Output pattern of SLEUTH calibration.

Fig. 2 shows a plot of the metric Lee-Sallee [22], which measures the match between a reference map of urban/non-urban pixels, and the simulator output. Another metric consists of a product of several statistics and is known as OSM (Optimal SLEUTH Metric) [23]. It exhibits much more noise but also has a pattern-like structure. This metric is hardcoded in the genetic version, GA-SLEUTH [10,11]. Both metrics have values between 0 (worst) and 1 (best).

2.2 OPTIMIZATION TOOLS

Direct search methods stand out for their capability to perform optimization without requiring derivatives, and handling nonconvexity and discontinuities [18]. Since such methods make little or no assumptions regarding the behavior of functions, they are also known as black-box optimization algorithms [24,25].

Possibly one of the most famous direct search methods is the one proposed by Nelder and Mead in 1965, which scans the search space using a simplex [26]. A simplex is a polytope with  $n+1$  vertices, where  $n$  is the dimension of the search space. Since its introduction, this algorithm has been studied and recast in different forms, including methods to handle constraints and discrete grids [25,27].

NOMAD is a library written in C++ that implements black-box optimization algorithms. It is capable of handling discontinuities, constrained optimization, and functions of discrete variables [28-30]. The algorithm it implements can be divided into two parts [29]:

- search: evaluates  $f$  for a set of points that radiate to directions  $D$ ;
- poll: if the search step fails to improve the function, the grid size is adjusted and a different set of directions  $D'$  is used to generate candidates.

The implementation allows to modify the default values of parameters and even to change aspects of execution; for instance, the Nelder-Mead algorithm can be chosen as the search step [29]. There are two basic ways to use the NOMAD toolkit, illustrated in Fig. 3.

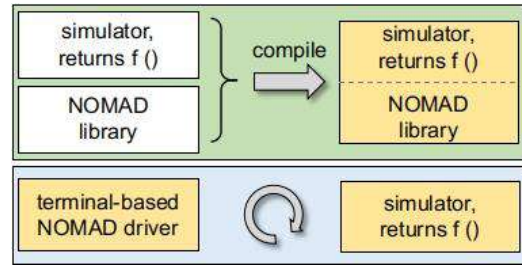


Fig. 3: Two methods to use the NOMAD tool.

The code, in the form of a library, can be linked with an objective function provided by the user; the result is a stand-alone executable that calculates the objective function and runs the optimization. This form can be exploited using compiled languages, but there are interfaces for Matlab and Python. Another alternative is to have the objective function implemented in a separate application, that will be called by a sort of NOMAD driver that sends command line parameters and collects output from stdout [29].

In the case of SLEUTH, the first method requires incorporating the library into the simulator, and the second is not compatible with the high latency of its start-up code. In this study, a third alternative was devised. We modified the simulator to receive parameters using Unix domain sockets [30]. A small application embedding the NOMAD library was implemented, replacing the terminal-based driver, as shown in Fig. 4.

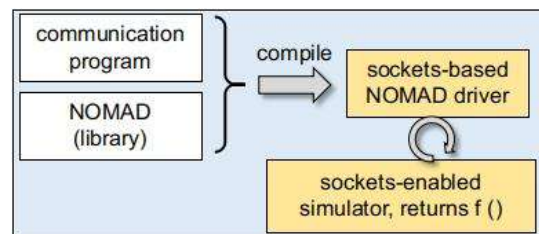


Fig. 4: Our implementation of NOMAD with SLEUTH.

Other alternatives to the architecture shown in Fig. 4. include the use of file and memory sharing, and named pipes. In the case of file and memory sharing it would be necessary to implement a synchronization scheme [31], signaling the moment when each of the endpoints - SLEUTH and NOMAD - would have finished computing metrics and parameters, respectively. Named pipes implement synchronization in a transparent way, and could be used in place of Unix domain sockets.

2.3 ANALYSIS CRITERIA

Calibration of SLEUTH and of many other cellular automata models of urban growth is a difficult process [10,12-16]. The key issue is to extract a maximum of

information from a minimum number of simulation runs. Optimization must aim at reducing the number of tested configurations, but at the same time, it must also guarantee a certain level of quality of results.

The performance of optimization algorithms is evaluated in terms of convergence rates, which, in the case of non-gradient methods, relates to decreasing lengths of the search step [18,32]. Usually, the results are represented on graphs showing target values as a function of the number of iterations, a concept similar to the technique of time-to-target plot [33].

Generally, it is preferable to use a large set of points to perform this type of comparison. In the present case, however, the simulation of different regions requires geographical data, and obtaining that information and preparing the files is a lengthy task *per se* [34]. In addition to that, long processing times limit the number of data points available for analysis [24,25].

Performance profiles are an instrument to compare the relative efficiency of optimization algorithms [35]. The method takes the best value found by the algorithms as a reference, and then computes a distribution function of the results. Plots of distributions are a means to depict the relative performance of optimizers. When the evaluation of the cost function is too expensive, a technique developed later, data profiles, is a better alternative [36]. The main difference between the two is that performance profiles compute a ratio based on the number of problems solved within a given threshold, while data profiles are calculated with respect to the number of function evaluations.

In this paper data profiles were used, with an adjustment that corresponds to selecting the full range of values to compute a distribution [36]. We begin by recording the whole set of trial points  $X^k = \{x^k_1 \dots x^k_{n(k)}\}$  and respective function values for each optimization algorithm  $k=1, \dots$  and also recording the best result  $r^* = \min \{ f(x) \}$ , among all tests. Then we calculate:

$$d^k(\alpha) = |\mathbf{x}^k : \frac{f(\mathbf{x}^k)}{r^*} < \alpha| \quad (1)$$

, where the symbol  $|$  stands for cardinality of a set and  $\alpha$  varies between 0 and 1. The curve  $d^k$  indicates the number of times a method  $k$  produces results which are at least  $\alpha$  percent as good as  $r^*$ . By plotting  $d^k$  we get a visual description of the relative efficiency of an optimization method to explore the search space.

Here, the objective function  $f$  was the same metric implemented in the genetic version of SLEUTH: OSM. This choice does not mean an endorsement of this metric for calibration of the model, but analyzing this matter is not part of the scope of this study.

## 2.4 SIMULATION SETUP AND DATA COLLECTION

Preparing layers of geographical data for SLEUTH is a demanding task, and this kind of data is not readily publicly available. In this work, two datasets, D1 and D2, were employed with the three optimization methods: brute force; genetic algorithm; and NOMAD.

The first set of data layers, D1, were the same used in [20]. All images had 1242 x 1339 pixels, corresponding to a scale of 30 meters. The data layers included:

- a slope layer, representing in gray scale the steepness of terrain as a percentage;
- an exclusion layer, black and white, identifying areas where urbanization is not allowed;
- a set of urban footprints, black and white, in intervals of 3 years, between 1984 and 2017.
- road maps, in gray scale, for the years 1984, 1996 and 2017;

Sample images are shown in Fig. 4. At the left, an urban footprint; white pixels represent urban areas. At the right of Fig. 4, a road map; the brighter the pixel, the greater the importance of the road.

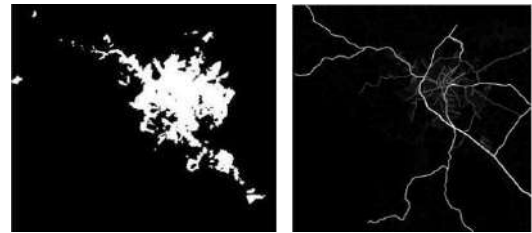


Fig. 4: Example of SLEUTH input layers.

The second dataset, D2, was composed of the images used in [37]. It includes layers for slope, exclusion, and hillshade; and images in 5-years intervals, from 2000 to 2015, depicting roads and urban footprints. Images were square, with 1116 pixels of edge and corresponding to approximately 71.5 meters per pixel.

SLEUTH supports two types of simulation: a binary-mode where the state of each cell is either urban or not; and a category-mode with different classes of land use. We chose the binary-mode simulation.

In the brute-force approach, we opted for not following the long procedure suggested in the documentation of SLEUTH, and shown in Fig 1. It was decided to make a single pass using images of full resolution; the configuration file was set to scan the search space through all the range 0 to 100 in increments of 25. This produced a total of  $5^5 = 3125$  iterations, each of which was internally repeated 2 times by the Monte-Carlo process. In a classic application of Monte-Carlo this would be a small value,

but the regularity of the simulator output, depicted in Fig. 2, indicated that noise levels were not pronounced.

For the genetic version of SLEUTH, the default parameters of the tool were used; following the instructions found in the documentation, the population was set to 55 individuals, the mutation rate was 13%, and the number of generations was set to 100.

Finally, for the optimization using NOMAD, the programming interface exposes several parameters that can be adjusted by means of special function calls. However, the user guide makes recommendations only in response to difficulties with the optimization process. This way, the various parameters of the library were also left with their default values.

### III. RESULTS

The simulation scenarios presented contrasting characteristics. Calibration of dataset D1 was harder to achieve, with lower values for OSM and also for Lee-Sallee. A possible cause might be the fine temporal resolution of 3 years between images [17,20]. The second dataset required less cycles and had higher values for the metrics. Table 1 summarizes the main results.

Table.1: Summary of optimization results.

Set	Method	Cycles	Best	Point @ cycle
D1	B.F.	3165	0.00455	[1 50 1 100 1] @ 270
	G.A.	8024	<b>0.00472</b>	[8 99 95 100 91]@7544
	NOMA D	7999	0.00465	[8 96 73 99 41] @ 2818
D2	B.F.	3165	<b>0.68370</b>	[100 75 50 1 1] @ 2925
	G.A.	929	0.66965	[66 66 57 1 48] @ 914
	NOMA D	780	0.64048	[21 100 90 1 1] @ 150

The worst value for both datasets was 0. The best result  $r^*$  for dataset D1 was found at iteration 7544 by the GA optimization. The Brute-Force method found its best value at iteration 270, but this is not a fast result since, by design, the algorithm blindly scans the whole search space. NOMAD came in second place with less than half the effort of GA to reach 98.5% of  $r^*$ .

For the second dataset, NOMAD was by far the fastest

algorithm; the best value for OSM was found after 150 iterations only, although the method executed additional cycles to ascertain that no further improvement was possible. On the other hand, NOMAD also had the lowest global result, behind G.A. in second place and Brute-Force in the first position.

The G.A. implemented in SLEUTH selects initial points along of a diagonal that traverses the search grid, with coordinates  $(0+\Delta, 0+\Delta, 0+\Delta, 0+\Delta, 0+\Delta)$  for increasing values of  $\Delta$ . NOMAD utilises a variation of a simplex-based algorithm, and is likely to be more sensitive to the choice of the starting point. NOMAD was tested with points  $(0, 0, 0, 0, 0)$  and  $(50, 50, 50, 50, 50)$ , but the second choice caused the algorithm to obtain worst results. A plot of the optimization trajectories provides an intuitive comparison of G.A. and NOMAD. This is shown in Fig. 5, for the dataset D1 (with similar characteristics found for D2).

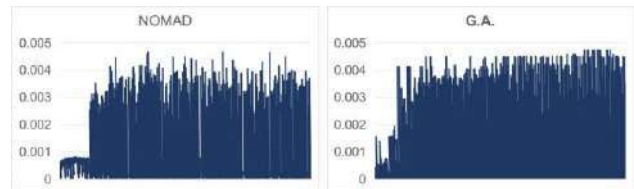


Fig. 5: Optimization history of NOMAD and G.A.

Fig. 5 shows that NOMAD succeeds in escaping a region of low values and, subsequently, it searches for areas with high values. However, sporadically it touches points of bad quality. The algorithm G.A. implemented in SLEUTH, by comparison, seems to be more elitist and avoids low points altogether.

It is interesting to note that the graphs on Fig. 5 were created from simulator logs and show all the points evaluated. This way, they offer a general view of the heuristics followed by each algorithm.

The concept of data profiles allows us to draw a more detailed comparison. The question to address is the relative efficiency of the algorithms to yield results, instead of comparing only peak values, or number of function evaluations. This is more relevant in the present context, because of low parameter sensitivity (which leads to slow progression), and the difficulty to find a global maximum.

The Fig. 6 shows a data profile graph for dataset D1. We use the same perspective as [31] and plot  $d^{-1}(\alpha)$ ; this way the data profiles illustrate the relative computation effort to attain a minimum  $\alpha r^*$ .

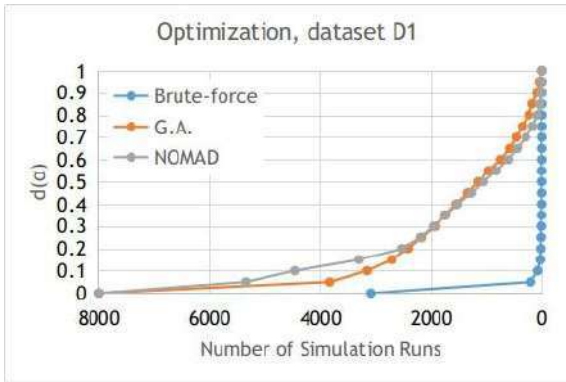


Fig. 6: Plot of  $d^1(\alpha)$  for dataset D1.

To exemplify how to interpret the plot in Fig 6, let's chose  $\alpha=0.3$ . The graph shows that approximately 2000 function evaluations of NOMAD (1964 to be exact) produced values equal or better to 30% of the best result  $r^*= 0.00472$ . The genetic algorithm version of SLEUTH comes close, with 1927 evaluations. By comparison, in the Brute-Force approach, only 11 function evaluations attained the same mark. Moreover, along the interval  $0.2 < \alpha < 0.8$ , the exhaustive search shows a low probability of finding an adequate set of parameters. Fig. 6 also shows that, for values of  $\alpha$  above 0.5, G.A. obtained slightly better results than NOMAD.

The results for dataset D2 are shown in Fig 7.

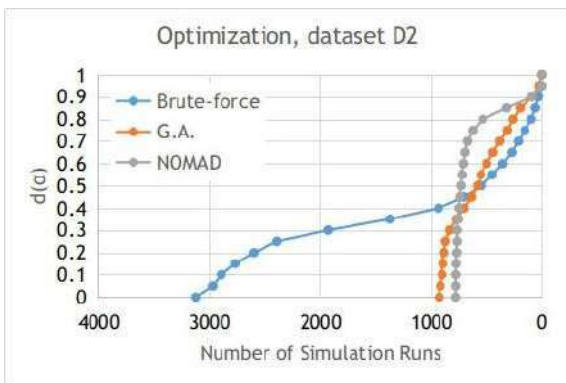


Fig. 7: Plot of  $d(\alpha)$  for dataset D2.

Once again, NOMAD and G.A. obtained significant savings in the number of function evaluations, orienting the search towards regions of good potential. In this test NOMAD jumped ahead of G.A. for values  $\alpha \geq 40\%$ . A main difference between NOMAD and G.A. comes from the fact that the first follows a trajectory while exploring the space, whereas the latter is more flexible and can take random jumps. In theory, G.A. has a greater chance of finding a global extreme, while NOMAD has the potential to converge faster; this was the case with dataset D2.

As a last verification, it was evaluated the relative distance between solutions found by each optimization algorithm. As it was mentioned, the five parameters control the results of the simulation and are utilised to characterize and compare trends of city growth [20]. If the calibration returns points that are too far from each other, this might be a sign that local solutions were found.

Table.2: Distance between the 20 best solutions.

Dataset	radius of hyperball	
	NOMAD	G.A.
D1	20.3004	45.8189
D2	2.9580	45.3927

The values in Table 2 correspond to the radius of a hyperball containing the 20 best 5-dimensional points produced by each optimization algorithm. The radius was determined using the algorithm described in [38]. It can be seen that NOMAD tested more points around the same neighborhood, in comparison to G.A. This is another indication that, comparatively, if NOMAD might converge faster, G.A. might cover a more extensive area.

#### IV. CONCLUSION

The outputs of a computer simulation can be treated in certain contexts as functions of input parameters. An example of this is the calibration of models of urban growth, where a function indicates the quality of the simulated results. In the case of SLEUTH, characteristics as nondeterminism, discontinuities, and nonlinearity make it harder to optimize parameters. In addition to these aspects, the execution of the model has a high computational cost. This negatively impacts studies that aim to contrast scenarios and perform what-if analysis, and justifies the interest in accelerating the calibration process.

This study used named sockets to couple SLEUTH to the NOMAD optimization library. This choice ensures fast communication, and required minimal changes in the simulator code.

The number of function evaluations in the experiments was limited in the brute force approach, if compared with the standard calibration procedure described in SLEUTH documentation. Nevertheless, the volume of data generated was sufficient to provide a baseline.

In the first dataset, genetic-algorithms and NOMAD presented close results. The two methods showed a near-linear relation between the number of function evaluations and the improvement of results in 50% of the points tested ( $0.2 < \alpha < 0.7$ ). It must be emphasized that the analysis

refers to the relative computational effort spent to optimize the calibration, and not the convergence speed. As indicated on Fig 2., both the GA version of SLEUTH and NOMAD spend some effort trying to escape from local minima during the search.

For the second dataset, the optimization was a lot faster, and NOMAD was more efficient than GA. For instance, the library provided 675 parameter configurations within 70% of  $r^*$ , the double of points found by the genetic algorithm. The G.A. version obtained the best result, but the corresponding  $f$  was only 4.5% better than NOMAD.

The SLEUTH parameters in Table 1 show a certain disagreement between methods. This is in accordance with the fact that the cost function has several minima. However, large deviations of values would conflict with the idea of using the five parameters to characterize the growth of a city. We estimated the coherence of results by computing the smallest hyper-ball holding the 20 best points found by each optimization algorithm. The results in Table 2 indicate that, while NOMAD tries to find global optima, it also refines the search around points of greater potential. The genetic version of SLEUTH exhibited a less pronounced tendency in this sense.

Overall, NOMAD has proven to be a good solution for SLEUTH calibration, and potentially better than the genetic version of that simulator. The library can handle characteristics as non-linearity, noisy and discontinuous functions of real and integer parameters, present in many simulation models. As a consequence, this study with NOMAD and the technique of data profiles can be applied in similar situations, involving calibration of urban models but also other computer simulations that include an optimization task.

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# The Link between Electronic Transactions and Stock Market Performance in the Nigerian Financial Ecosystem

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Received: 15 Nov 2020;

Received in revised form:

10 Jan 2021;

Accepted: 18 Jan 2021;

Available online: 30 Jan 2021

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**Keywords—** *Electronic transactions, Stock market performance, financial ecosystem, Vector error correction model, financial inclusion, Nigeria.*

**Abstract—** *The electronic payment system involves transactions carried out via the aid of technology. The Nigerian economy have seen it as a welcome development and among other objectives to promote cashless economy. In a process to achieve rapid transformation, the Central Bank of Nigeria (CBN) launched the financial inclusion strategies for all sundries through the help of the Financial Technology (FIN Tech). This study assessed the linkages of electronic transactions and stock market performance in the Nigerian financial ecosystem. The study employed WEB, Automated Teller Machine (ATM), Nibss Instant Payment (NIP), and Point of Sale (POS) as the electronic transactions' channels and its link to stock market capitalization in Nigeria. The study adopted quarterly data between 2012 and 2019. The Vector Error Correction Model was applied for the evaluations, including the Johansen Co-integration. The short-run error correction shows that, the ATM and WEB were negatively and insignificantly linked to stock market performance. The findings also showed that, POS is positively but not significantly linked to stock market performance. The findings further revealed that NIP is positively and significantly linked to stock market capitalization. In essence among the study variables, NIP was the only constituted and significant variable that influenced the stock market performance in the Nigerian financial ecosystem. The study recommended the Central Bank of Nigeria (CBN) to monitor, control and report the movement of all money via NIP, as well as re-double the awareness campaign with regards to use of ATM, WEB and POS.*

## I. INTRODUCTION

The introduction of electronic means of transactions in Nigeria is now on the increase and has received a rapid growth. These ideas of financial inclusion have assisted to revamp the financial system. The target for embracing the financial inclusion has raised the bar and strengthens the financial system across board. Digitalizing the financial ecosystem makes it possible for transaction even at large

scale business without physical contact of the parties. Many nations have welcomed the idea and have set the trend growing.

In Nigeria, the electronic payment has come to stay. As many Nigerians that yearns for a reserved and efficient transactions has accepted the innovation. The study of Slozko and Pelo (2014) mentioned that the current movement of the world financial environment is now



featured by the application of information and communication technology in business transactions. In virtually all financial transactions it is now driven by the aid of information and communication technology (ICT). This observation is well acknowledged and practicable if the desired infrastructures are available and also accessible by users.

The large-scale use of financial technology (Fintech) platforms such as automated teller machines (ATM), WEB, NIP, and POS for financial transactions and the rise in internet access have created an innovative and new method for the use of financial resources and services. Financial technology is gradually phasing out the conventional brick and mortar financial services offered by banks which restricts customer access to financial services to banking offices and expensive telephone banking services.

Without limiting access to financial services to a particular time and place financial technology enables customers access to digitized means to transact business electronically (Kim, Shin and Lee, 2009, Pandiya and Gupta 2015, Shaikh and Karjaluo 2014). This has changed the pattern of financial intermediation in the financial system, as the use of financial technology ensures financial transactions becomes more efficient, consumer friendly and open. Deposit money banks, financial technology firms, insurance companies, asset management firms and the stock market have been at the forefront in the deployment of ATM, WEB, NIP, and POS for financial transactions.

Despite the improved financial technology network and customer friendly, it appears the performance of the Nigerian stock market still remain low. The 'Fintech revolution' is quite new and it is an emerging trend in Nigeria's financial ecosystem. Questions perhaps may emanate to the reasons why the digital environment has not performed favorably, especial within the financial ecosystem. However, there is a dearth of studies about Financial Technology on its contribution to the Nigerian stock market. This study stands to cover the gap in the literature regarding this sub-sector.

The purpose of this study is to assess the link between electronic transactions and the stock market performance in the Nigerian financial ecosystem. The study is posed by asking the extent of link between the electronic transactions of ATM, WEB, NIP, and POS, and stock market capitalization in the Nigerian financial ecosystem. Hypothetically, electronic transactions of ATM, WEB, NIP, POS, did not positively and significant linked stock market

capitalization in the Nigerian financial ecosystem. The study covers the period of 2012 and 2019. The variables were extracted from the Central Bank of Nigeria (CBN) statistical bulletin, and its website of 2019 publications. The stock market capitalization data was extracted from the Central Bank of Nigeria (CBN) statistical bulletin, while electronic transactions such as the ATM, WEB, NIP, and POS data were sourced from the CBN website. The obvious limitation of this work was the short period covered. All data were prorated on quarterly basis to achieved a longer period as well as to enhanced the analysis. In that circumstance, the results of this work would have improved if the data were available earlier than the covered periods. Notwithstanding, the findings of this study stands to benefit the Scholars/Academics, Policy-makers, Industrial practitioners, and the general public.

The remainder of this paper is arranged as follows: in section II, a review of the literature is discussed, while section III presents the methodology employed in the present study. The results of the empirical analysis are presented in section IV. In Section V, a discussion of the results outlined in section 4 are articulated. The conclusion and recommendations of the paper are laid out in section VI.

## II. LITERATURE REVIEW

The efficient market hypothesis states that asset prices reflect all available information. According to Fama (1970) that stocks are always trading at their current fair market value. This hypothesis holds that it is virtually impossible to either buy undervalued stocks at a bargain or sell overvalued stocks for extra profits. A recent study conducted by Ozili (2020) revealed to investors to be aware of financial inclusion assumptions, which the theory in itself suggested the ease of access and the availability digital infrastructures. Besides, the term, financial inclusion is concerned by individuals and business having access to useful and affordable financial products and services that meet their needs in a responsible and sustainable way.

The theory of financial inclusion (FI) and the efficient market hypothesis (EMH) are combination that tries to expand our knowledge horizon concerning modern transactions in the world. These theories further explained the influence of electronic transactions on stock market performance. For the fact all investors are abreast with all market information and modern technologies to expand the business frontiers. In this case, the study is focused only on the stock market performance as influenced by the modern

technologies. So, the study explicitly evaluates the relationships between electronic transactions and stock market performance within the Nigerian financial ecosystem in connection to EMH and FI theories empirically.

Similar studies have emanated towards the development of stock market through the uses of technology. However, Brynjolfson (2000) noted that the benefits of IT investment are difficult to measure since they are intangible by nature. Meliciani (2002) opined that countries that specialized in fast growing technologies experience above average rates and also, innovation affect countries performance in the international markets. Furthermore, a study by Benner (2007) explained that an incumbent firm's stock price will decrease to the extent that it is forced (it) to depart from its stock market identity. This inability to respond to technological change which may arise from institutional pressures from financial market during the uncertain period of technology change.

The use of technology in financial transactions has impacted businesses variety of ways. For instance, Bett and Bogonko (2017) study in Kenya found out that the adaptation of digital finance technologies has minimized operational cost and have impacted huge turnover in the financial system despite the initial high cost of capital. Also, Gomber, Kauffman, Parker and Webber (2018) argued that many fintech starts-ups are looking for new pathways to successful business models and the creation has enhanced customer experience and results in services transformation.

Consequently, this study provides an empirical-based insight into the link between electronic transactions and stock market performance in Nigeria Financial ecosystem.

### III. METHODOLOGY

The study adopted the *ex-post facto* analytical research design. Such analytical research design plan is fit for a work concerning quasi-experimental. Justly, it is an attempt to established the linkages of Electronic Transactions and Stock Market Performance in the Nigerian Financial Ecosystem. This can be explained by the relationship of Automated Teller Machine (ATM), Internet (WEB), Nibss Instant Payment (NIP), and Point of Sale(POS), and stock market capitalization in Nigeria. This study adds in its design, the econometric/analytical design to the approval of the *ex-post facto* design.

The data sets for empirical estimation in this study have two major properties. The data is secondary and is

quarterly time-series. Time series are data sets that follow regular time-frequency of market performance was measured by market capitalization, while the electronic transactions of ATM, WEB, NIP and POS were prorated to put all variables at the same level. In a view of assessing the influence of Fintech environment on stock market performance in Nigeria, in this case, quarterly data are used for both the dependent and explanatory variables. In terms of sources, data was extracted from the Central Bank of Nigeria fact books. The study accounted for quarterly information between 2012 and 2019. This is for the fact that, the data commence 2012, and the study intended to make it as current as possible by extending to 2019. The obvious limitation of this work was the short period covered. In that circumstance, the results of this work would have improved if the data were available earlier than the covered periods.

The theoretical outline of this study was the theory of financial inclusion (FI) and the efficient market hypothesis (EMH). These theories take into explanation the digital environmental factors on the stock market performance relationships within the financial ecosystem. The theory in itself provides applicable evidence concerning the stock market activities so it needs to empirically determine the linkages with electronic transactions. The study adopted the Vector Error Correction Model (VECM) to diagnosed and empirically test the FI and the EMH functional approach. The attempt is to validate or invalidate these concepts via the VECM. Sims (1980) stated that VECM is a prevalent method of time-series modeling. According to Sims, VECM is analytical tool used by macroeconomists to characterize the jointed dynamic behavior of collection of variables without requiring strong restrictions. Therefore, the Vector Error Correction model becomes more appropriate for modeling the joint dynamics and the linkages concerning the electronic environment and the stock market performance within the Nigerian financial ecosystem.

Expressing the FI/EMH functionally appears thus:

$$MCAP = f(\text{electronic transactions}) \text{-----}$$

--eq. 1

Taking MCAP to be market capitalization being performance index of stock market and the electronic transactions as an indicator of Automated Teller Machine (ATM), WEB, Nibss Instant Payment (NIP), and Point of Sale, (POS). Thus, the study empirically estimates the functional linkages as follows:

$$MCAP_r = f(ATM_r, WEB_r, NIP_r, POS_r) \text{ --- eq. 2}$$

Standing from the theoretical perspective, this study was designed to prove the reality or otherwise of the FI/EMH applying Nigerian information. The above equation can be written in a mathematical form, thus

$$MCAP_t = Y_t = \alpha + \beta_0 Y_t + \beta_1 AMT_{t-1} + \beta_2 WEB_{t-1} + \beta_3 NIP_{t-1} + \beta_4 POS_{t-1} + \mu_t \text{ --- eq. 3}$$

By and large, the regression forms, eqs. 1, 2, and 3 can be rewritten in econometric form, thus:

$$MCAP_t = Y_t + \beta_0 MCAP_t + \beta_1 ATM_{t-1} + \beta_2 WEB_{t-1} + \beta_3 NIP_{t-1} + \beta_4 POS_{t-1} + \mu_t \text{ --- eq. 4}$$

Where  $\beta_0$  = the constant (the value of the dependent variable when all the regressor are at zero);  $\beta_1, \beta_2, \beta_3, \beta_4$  were the coefficient of the independent variables and  $\mu_t$  was the noise or error term.

The model's variable of this study was the electronic transactions as a broad dependent variable that was influenced by the ATM, WEB, NIP, POS as the independent variables.

The estimation process for this study followed the Diagnostic tests, long-run and short-run Test of Hypothesis using the Vector Error Correction Model estimations. These sets of tests are designed to validate the goodness of the data sets for Unit Root stationary of the variables. The Philips Perron was adopted to show the data stationery of the unit root properties. The series following equation being specified below.

$$\Delta y_t = \beta_1 + \delta y_{t-1} + \alpha_i \sum_{i=1}^m \Delta y_{t-1} + \mu_t \text{ --- eq. 5}$$

Where the test is for  $H_0 = \delta = 0$  and  $H_1 = \delta < 0$ .

Lag selection was based on the Bayesian Criterion generated automatically by the estimation software following the form of equation 6 below:

$$BIC = \ln(n)K - 2\ln(\hat{L}) \text{ --- eq. 6}$$

Where:

n represents either the sample size, the number of observations, or the number of data points in x.

k represents free parameters to be estimated.

$\hat{L}$  represents the maximized value of the likelihood function for the estimated model M given as  $\hat{L} = p(\frac{x}{\theta}, M)$

### Vector Error Correction Model Representation

The Vector error correction model was seen possible to test the estimations linkage effect through the speed of adjustment between stock market performance and shocks emanating from the electronic environment. This followed the form specified below:

From the Model, MCAP as the dependent variable:

$$\begin{aligned} \Delta MCAP_t = & \beta_0 + \sum_{i=1}^n y_i \Delta MCAP_{t-i} - \sum_{i=1}^{n1} \beta_1 \delta_i \Delta ATM \\ & + \sum_{i=1}^{n2} \beta_1 \delta_i \Delta WEB + \sum_{i=1}^{n3} \beta_1 \delta_i \Delta NIP \\ & + \sum_{i=1}^{n4} \beta_1 \delta_i \Delta POS + \Phi z_{t-1} \\ & + \omega_{1p} ATM_{t-1} \\ & + \omega_{1p} WEB_{t-1} \omega_{1p} NIP_{t-1} \\ & + \omega_{1p} POS_{t-1} + \mu_t \text{ --- eq. 7} \end{aligned}$$

All the variables are discussed above with the Vector Error Correction modeling coefficients framework.

### A-Priori expectorations:

The priori expectations are derived from underlying theoretical relationships between the dependent and each of the employed explanatory variables. These were presented in a summary from the model's tests of the hypotheses as follows:

$$MCAP_t = \beta_0 + \beta_1 ATM_t + \beta_2 WEB_{t-1} + \beta_3 NIP_{t-1} + \beta_4 POS_{t-1} + \epsilon_t \text{ --- eq. 8}$$

All the variables are discussed above with combined modeling of the short-run coefficient in the error correction framework. Thus, the priori expectation with regards to this is  $\beta_1 > 0, \beta_2 > 0, \beta_3 > 0, \beta_4 > 0$ . To ensure that estimates are valid, efficient, and unbiased inferences in this study, the diagnostic test contained in table 1 below shall be adopted.

Table 1: Summary of Adopted Diagnostic Tests

S/No	Test Name	Test Function	Decision Rule
1.	Coefficient of Correlation (R <sup>2</sup> )	To measure the goodness of fit of the model	It is between 0 and 1. The higher the R <sup>2</sup> the better the fit.
2.	Probability	To test the significance of the regression	The p-value of less than 0.05 suggests it is good enough inferences acceptance.
3.	t- Statistics	To confirm the significance level	t- Statistics higher than 1.96 shows evidence of significant.
4.	Durbin Watson Statistics	To measure the first-order autocorrelation	DW approximately 2 shows evidence against the first-order autocorrelation.

Source: Author's Compilation.

Inferences in this study are based on the outcome of the estimation approaches as well as conclusions drawn based on the tested hypotheses. The choice level of significance for all tests is 0.05 or 5% level. All estimations are done by the use of E-views estimation software version 10.

Table 2: Data and results presentation

The table 2 below presented quarterly data of MCAP, ATM, NIP, POS, and WEB from 2012 to 2019. The MCAP represents market capitalization, ATM is Automated Teller Machine, NIP is Nibss Instant Payment, POS is Point of Sale, and WEB is the internet WEB in volumes.

YEAR	MCAP	ATM	NIP	POS	WEB
2012-Q1	6549.84	93878288.5	1112413.5	646898.75	569116
2012-Q2	6895.29	93878288.5	1112413.5	646898.75	569116
2012-Q3	8282.28	93878288.5	1112413.5	646898.75	569116
2012-Q4	8974.45	93878288.5	1112413.5	646898.75	569116
2013-Q1	10733.29	73854181	4278039.5	2354606.75	725118.25
2013-Q2	11426.25	73854181	4278039.5	2354606.75	725118.25
2013-Q3	11652.87	73854181	4278039.5	2354606.75	725118.25
2013-Q4	13226	73854181	4278039.5	2354606.75	725118.25
2014-Q1	12445.69	100067285	10207463.5	5204355.75	1391859
2014-Q2	14027.71	100067285	10207463.5	5204355.75	1391859
2014-Q3	13607.4	100067285	10207463.5	5204355.75	1391859
2014-Q4	11477.66	100067285	10207463.5	5204355.75	1391859
2015-Q1	10717.53	108423937	17805886.25	8430233.25	1995340.25
2015-Q2	11421.02	108423937	17805886.25	8430233.25	1995340.25
2015-Q3	10728.9	108423937	17805886.25	8430233.25	1995340.25
2015-Q4	9850.61	108423937	17805886.25	8430233.25	1995340.25
2016-Q1	8704.87	147559731	38404112.5	1592880.75	3522061.75

2016-Q2	10165.34	147559731	38404112.5	1592880.75	3522061.75
2016-Q3	9733.37	147559731	38404112.5	1592880.75	3522061.75
2016-Q4	9246.92	147559731	38404112.5	1592880.75	3522061.75
2017-Q1	8828.96	200137274.8	92717668	36566789	7247774.25
2017-Q2	11452.12	200137274.8	92717668	36566789	7247774.25
2017-Q3	12216.93	200137274.8	92717668	36566789	7247774.25
2017-Q4	13609.47	200137274.8	92717668	36566789	7247774.25
2018-Q1	14992.96	218879826.8	165781034.8	73972541.75	12703975.25
2018-Q2	13802.61	218879826.8	165781034.8	73972541.75	12703975.25
2018-Q3	11962.26	218879826.8	165781034.8	73972541.75	12703975.25
2018-Q4	11720.72	218879826.8	165781034.8	73972541.75	12703975.25
2019-Q1	64725.55	20995480.5	2864430307	109653545.5	25873501.75
2019-Q2	64725.55	20995480.5	2864430307	109653545.5	25873501.75
2019-Q3	64725.55	20995480.5	2864430307	109653545.5	25873501.75
2019-Q4	64722.55	20995480.5	2864430307	109653545.5	25873501.75

Source: Central Bank of Nigeria (CBN) Statistical bulletin and website.

**IV. RESULTS**

*Results analysis and discussion*

**Table 3: Unit root test results**

The table 3 below presented the Philips-Perron Unit root test results.

Table 3: Unit Root Test Results

Differenced variable	ADF-Test Statistic	Test of Critical Level			Order of integration	Probability Value
		1%	5%	10%		
D(MCAP)	-5.537550	-3.670170	-2.963972	-2.621007	1(1)	0.0001
D(ATM)	-5.312464	-3.670170	-2.963972	-2.621007	1(1)	0.0001
D(WEB)	-5.899892	-3.670170	-2.963972	-2.621007	1(1)	0.0000
D(NIP)	-5.503036	-3.670170	-2.963972	-2.621007	1(1)	0.0001
D(POS)	-5.902452	-3.670170	-2.963972	-2.621007	1(1)	0.0000

Source: Extracted from E-views 10

*Unit root test results analysis*

In the above table, the results of Philips-Perron test statistics indicate that all variables became stationary at first difference. The Test Statistic -5.537550, -5.312464, -5.899892, -5.503036, and -5.902452, were greater than the respective critical level values of -2.963972, -2.963972, -2.963972, -2.963972 and -2.963972 at 0.05 significance level. Moreover, the respective probability values of 0.0001, 0.0001, 0.0000, 0.0001, and 0.0000 were all less than 0.05 significance level conducted with the trend and intercept, therefore the study refuses to accept the alternate hypothesis that there are unit-roots. So, the data was can be used for analysis since the data were spurious free.

Table 4: Johansen Co-integration results

The table 4 below presented Johansen Co-integration results

**Johansen co integration results**

Date: 11/26/20 Time: 12:20  
 Sample (adjusted): 4 32  
 Included observations: 29 after adjustments  
 Trend assumption: Linear deterministic trend  
 Series: LOG(MCAP) LOG(ATM) LOG(NIP) LOG(POS)  
 LOG(WEB)  
 Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized	Trace	0.05		
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.697856	72.83735	69.81889	0.0281
At most 1	0.503423	38.12867	47.85613	0.2964
At most 2	0.299477	17.82819	29.79707	0.5788
At most 3	0.171272	7.506263	15.49471	0.5196
At most 4	0.068513	2.058231	3.841466	0.1514

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

Source: Extracted from E-views 10 version

**Johansen Co-integration results analysis**

In the above table, the results of Johnsen co-integration indicated 1 cointegrating variable. For the fact that, the trace statistic of 72.83735 is greater than critical value of 69.81889. Also, judging from the probability value, only one variable was significant (0.0281) as it is less than 0.05.

Table 5: Vector Error Correction Results

The Table 5 below presented the Vector Error Correction Results

Dependent Variable: MCAP  
 Method: Least Squares  
 Date: 11/26/20 Time: 12:22  
 Sample (adjusted): 2 32  
 Included observations: 31 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	12125.27	1248.312	9.713333	0.0000
ATM	-1.10E-05	1.61E-05	-0.680074	0.5027
NIP	1.98E-05	2.96E-06	6.692998	0.0000
POS	7.78E-05	4.56E-05	1.705708	0.1005
WEB	-0.000471	0.000467	-1.007256	0.3235
ECM(-1)	0.723588	0.115276	6.277029	0.0000
R-squared	0.997266	Mean dependent var		18090.41
Adjusted R-squared	0.996719	S.D. dependent var		18339.33
S.E. of regression	1050.463	Akaike info criterion		16.92384
Sum squared resid	27586813	Schwarz criterion		17.20138
Log likelihood	-256.3194	Hannan-Quinn criter.		17.01431
F-statistic	1823.759	Durbin-Watson stat		1.825827
Prob(F-statistic)	0.000000			

Source: Extracted from E-views 10 version

#### Vector error correction results analysis

In the table the ( $R^2$ ) of 0.9972 indicated that the model is good and fit for the analysis and such less than 0.01 was accounted for noise/errors or other variables not captured in the study. Since the fitness of the model is said to have been concluded. The study reports the Durbin Watson test statistic.

According to the rule of the thumb by Field (2009) stated that test statistics value in the range of 1.5 to 2.5 is relatively normal for time series data. Therefore, the results of the test for autocorrelation shown in table 5 take into account the value of 1.825827 is within the range of 1.5 to 2.5. Thus, the null hypothesis that there is no autocorrelation is refused to be rejected. The study found no evidence of autocorrelation following the statistical value of 1.825827 which is within the range. In essence, it can be concluded that the model is free from serial correlation.

#### Test of Hypothesis

$H_{01}$  What is the extent of link between electronic transactions of ATM, WEB, NIP, POS, and stock market capitalization in the Nigerian financial ecosystem.

$H_{A1}$  Electronic transactions of ATM, WEB, NIP, POS did not positively and significant linked stock market capitalization in the Nigerian financial ecosystem.

#### V. DISCUSSION

The table above 5 showed the short run vector error correction results. Recalling from table 1 decision rule 3 that there exists evidence of significance if t- Statistics [1.96] is higher than 2. It can either be positive or negative as results suggested and control the decision rules. In table5, ATM, WEB, and MCAP indicated a negative link, but insignificant since the t-Statistics of -0.680074, -1.007256 are less than the criterion value of 2, and the probability values of 0.5027 and 0.3235 respectively are higher than 0.05. Again, POS and MCAP showed a positive and insignificant link, based on the value of the t-Statistics of 1.705708 is less than 2, and the probability value of 0.1005 is higher than 0.05. The results however, revealed a positive and significant link between NIP and stock market capitalization in the Nigerian financial ecosystem, for the fact that the t-Statistics of 6.692998 is higher than 2, and the probability value of 0.0000 is less than 0.05. Concerning these results, only NIP electronic transactions significantly and positively influenced stock market performance in the Nigerian financial ecosystem.

The implications to these findings in the real economic situation prevailed that, for every unit change in

ATM would have caused a 1.10 decrease in the performance of the Nigerian stock market, but insignificant. The findings also revealed in the real economic activities that, for every unit change in NIP causes a 1.98 increase in the performance of the Nigerian stock. More so, for every unit change in POS would have caused 7.7 increase in the stock market performance, although not significant. On the side of WEB, for every unit change of WEB would not have caused any decrease or increase (-0.00) in the stock market performance, but insignificant. The findings in NIP could be for the reasons that more of the electronic transactions are carried out by the use of instant transfer. Whereas, ATM and WEB tends to influenced the Nigerian stock market negatively. These results can be for the fact of unavailability and ignorance of the digital environment. However, POS operated positively and independent. The independent relationship among POS and MCAP could be that most customers' transactions are not gearing towards stock purchase. Most of the customers' transactions using POS are more of domestic items and not for investment purposes.

## VI. CONCLUSION

From the findings of this study, it can be concluded that there is gradual awareness of the digital environment. The electronic transactions are topping the stage in doing business easily. The study has shown that there is little literature in the field of financial inclusion. The study in the cause of reviewing literature archives identified that no work has considered the linkage of electronic transactions and stock market performance in Nigeria. Considering this gap and how the subject is valuable in the area of financial economics, the study assessed the link between the electronic transactions and the stock market performance in the Nigerian financial ecosystem. Knowing that, the findings emanated from the study has contributed to the existing body of knowledge in banking and finance, and as such helpful to the academic, policymakers and the general public. Consequently, the selection of MCAPs dependent variable for stock market performance, and the adoption of ATM, WEB, NIP, and POS as the explanatory variables for electronic transactions makes the study valuable to the Financial Economists.

Aftermath, the VECM analytical test results showed that ATM, WEB, and MCAP negatively and but insignificant linkage. The findings of POS and MCAP indicated a positive, and insignificant relationships. However, NIP electronic transactions significantly and positively influenced stock market performance in the

Nigerian financial ecosystem. The findings revealed an economic implication indicating that for every unit change in ATM, would have caused a -1.10 decrease, and no causation by WEB since the value is -0.00 in the performance of the Nigerian stock market, although both were insignificant. The implication in the real economic activities also revealed that, for every unit change in NIP causes a 1.98 increase in the performance of the Nigerian stock. Meanwhile, for every unit change in POS would have caused 7.7 increase in the stock market performance, though POS operated independently. Although, FI and EMH assumptions did not explicitly publicises the degree of magnitude and the direction of links between electronic transactions and the stock market performance within the financial ecosystem, the findings support and validated the FI and EMH. Thus, the economic implications arise from this study constituted valuable information to the policymakers, participants, and other beneficiaries of the Nigerian stock market.

## VII. RECOMMENDATION

In the light of the above findings, the study therefore recommended the following:

1. The Central Bank of Nigeria (CBN) should re-double the awareness campaign with regards to use of ATM and WEB for transactions. The awareness will increase the chances of these platforms to be more effective and thereby increase the performance of the stock market.
2. Investors should be enlightened the use of POS for stock market bills payment possibility. The knowledge of paying bills in the stock market via POS will rapidly increase the successes of the stock market operations.
3. The Central Bank of Nigeria (CBN) should monitor, control and report the movement of money via NIP. The control is remained necessary to make sure that all money transfer has a genuine source and destination.
4. The Central Bank of Nigeria (CBN) should collaborate with the Federal government, network providers and the Financial Technology unit to increase the availability of digital infrastructures. The limited number of ATM, and other digital infrastructures outlet can impede the successes of financial inclusion targets.



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# Population aging and Hospitalization for Sensitive Causes to Primary Care

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Received: 03 Nov 2020;

Received in revised form:

09 Jan 2021;

Accepted: 19 Jan 2021;

Available online: 31 Jan 2021

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**Keywords**— *Access to Health Information,  
Primary Health Care, Health Promotion.*

**Abstract**— *The study aimed to analyze the main Hospitalizations for Causes Sensitive to Primary Care in elderly people in a small city in the state of Santa Catarina. The data were obtained by consulting a secondary database in the Information System of the Ministry of Health - Department of Informatics of the Unified Health System (DATASUS). For the research, the age group from 60 to 74 years old was considered, the frequency of hospitalizations by sex and main causes of Hospitalization Sensitive to Primary Care, in the period from 2012 to 2018. Population aging is a reality in Brazil and in the world and studies are fundamental for understanding the health needs of the elderly population. The results showed that, of the total number of hospitalizations in the studied period, 39% were for Causes Sensitive to Primary Care (ICSAP), and more frequently in males. There was a decrease in the number of hospitalizations for these causes in 2018 compared to previous years. Among the most frequent causes of hospitalizations, bacterial pneumonia stood out, followed by lung diseases, heart failure, cerebrovascular diseases, diabetes mellitus and kidney and urinary tract infections. It is concluded that there is a need to strengthen Primary Health Care, concentrating greater efforts on health promotion and education and prevention of diseases through strategies to encourage active aging, avoiding the need for hospitalization for causes that can be managed in Primary Care.*

## I. INTRODUCTION

The scenario of an aging population in large extent in Brazil implies challenges to the public health system, in view of the greater susceptibility of the elderly population

to diseases. Thus, if access is not efficient at the first levels of health care, hospitalizations will be more frequent, which in addition to representing a burden on the State, represents a loss of quality of life for the elderly (Rodrigues, Alvarez, & Rauch, 2019).

Hospital indicators have been analyzed in the international scenario to assess the effectiveness of Primary Health Care actions, considering that primary care is the level of service that represents the entry into the system, based on a set of actions that is characteristic of it. That is, it receives new health situations and problems while offering longitudinal attention to the person's health, coordinating care, providing care in all conditions, except rare or complex ones, and even in these, it integrates the care network (Starfield, 2004).

Among the indicators of public health effectiveness are Hospitalizations for Causes Sensitive to Primary Care (ICSAP), initially proposed as ambulatory care sensitive conditions, by Billings in the 1990s, in the United States of America (USA) and later disseminated worldwide, this indicator represents a list of diagnoses of diseases that, when there is primary resolution care, should not be the cause of hospital admissions (Billings *et al.*, 1993).

In Brazil, in order to regulate the diagnoses to be used to assess the effectiveness of Primary Care and the performance of the health system, Ordinance № 221/2008 was enacted by the Ministry of Health. The list consists of 125 diagnoses, divided into 19 categories, classified according to the Tenth Revision of the International Classification of Disease ICD-10 (Ministério da Saúde [MS], 2008).

With a view to strengthening Primary Health Care, from 1994 onwards, the first Family Health Strategy (ESF) teams emerged, initially as the Family Health Program (PSF) and later as ESF (Santana & Carmagnani, 2001). The FHS emerged to redefine the model of care, which is now focused on knowledge and mastery over the needs of the territory, no longer the pre-existing biomedical model. In view of the role of the ESF in primary care, what is sought is that, with greater population coverage by these teams, the lower the rates of ICSAP are. According to the Primary Care Indicators of Santa Catarina, in 2018 the population coverage of São Miguel do Oeste by EFS was 86.7%, while in the State of Santa Catarina the coverage was 79.88% in the same year (Departamento de Informática do Sistema Único de Saúde [DATASUS], 2019).

The population aging estimate for Brazil is exponential<sup>1</sup>. In 2020, we will approach 13 million elderly people (12.4%) and, in the year 2060, the estimate is that more than a third of the population will be made up of people aged 60 or over (33.7%). The expectation with this scenario is that the Unified Health System (SUS) will be overburdened, an expected condition since the elderly are, proportionally, the greatest demand for services. Thus, it is essential to analyze the causes of Hospitalization for

Conditions Sensitive to Primary Care (ICSAP) in the elderly population.

## II. METHODS

This research is characterized by a descriptive, exploratory and ecological study. Information was collected on hospitalizations in the Hospital Information System of the Unified Health System (SIH/SUS), available on the public domain website of the State of Santa Catarina <http://200.19.222.8/cgi/@GEABS/tabcgi.exe?@GEABS\DEF\03-ICSAP.def>.

The TABNET application was used, which is a generic public domain tab, which allows you to organize data quickly according to the query you want to tabulate. This application was developed by DATASUS to generate information from the databases of the Unified Health System.

For the main diagnosis of hospitalizations registered at SIH/SUS, related causes were considered according to the International Disease Code (ICD-10) in the item "List of Morbidity". Data on the Diagnostic Groups with the greatest representativeness were analyzed.

Hospitalizations were classified as Causes Sensitive to Primary Care (CSAP), based on the List of Conditions Sensitive to Primary Care contained in Ordinance № 221, of April 17, 2008.

The classification of ages by age group (60 to 74 years), gender (Male and Female), municipality of residence in São Miguel do Oeste, Santa Catarina, registered in the Information System by municipality of residence, was observed as indicators. The analyzed data were limited to the period from 2012 to 2018.

The analyzes of the collected data were carried out with the aid of the "LibreOffice Calc" Program and the data were presented using tables and graphs. The analysis of the results was supported by national and international literature on the researched subject.

As it is a study in secondary and public domain databases, the project did not involve human beings in the research. Thus, it was not necessary to send it for approval by the Research Ethics Committee. However, the guidelines of the CNS Resolution № 266/2012 were observed.

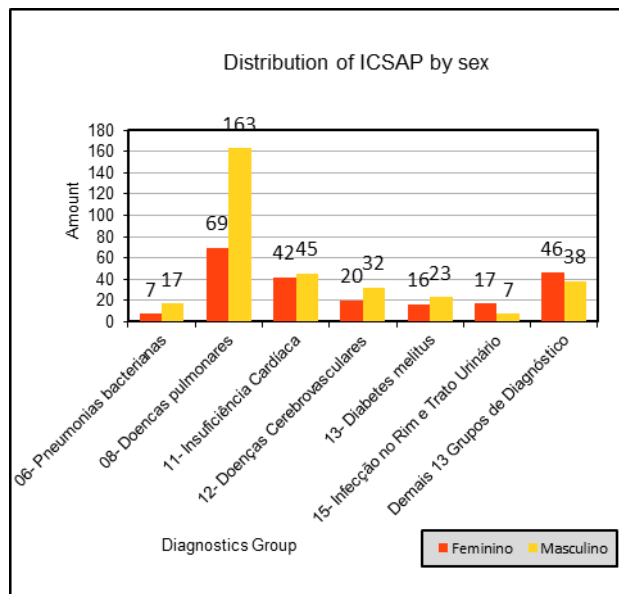
## III. RESULTS AND DISCUSSION

According to data, the population estimate for São Miguel do Oeste in 2018 was 40,090 people. In 2010 the population of the municipality was 36,306 people, and the elderly population aged 60 - 74 years was 3,230 people

(8.9%), of these, 1501 (46.5%) men and 1729 (53.5%) women (Instituto Brasileiro de Geografia e Estatística [IBGE], 2013).

Graph 01 shows the proportion of ICSAP by sex, between 60 and 74 years old, between 2012 and 2018. Of the total number of female hospitalizations in this age group in the period (583), ICSAP totaled 218 (37 , 39%), while there were 807 male hospitalizations', and of these, 325 (40.27%) were due to ICSAP.

Among the Causes Sensitive to Primary Care (CSAP) that represented the most hospitalizations in the period, women had more frequent hospitalizations in relation to the male sex only by the Diagnostics Group 15 - Kidney and Urinary Tract Infection, where of the 24 hospitalizations 17 were of the sex female and 7 male. For all other most frequent causes, the proportion of hospitalizations in males exceeded those in females. In the Diagnostics Group 06 - Bacterial Pneumonias, of the 24 hospitalizations, 17 were male and 7 female, in the Diagnostics Group 08 - Lung Diseases, of the 232 hospitalizations in the period, 163 were male while 69 were female . Regarding the Diagnostics Group 11 - Heart Failure, the number of male hospitalizations was 45 and female was 20, totaling 87 hospitalizations. Of the 52 admissions by the Diagnostics Group 12 - Cerebrovascular Diseases, 32 were male and 20 female. Still, of the 39 hospitalizations by the Diagnostics Group 13 - Diabetes Mellitus, 23 were male, while 16 were female (Graph 1).



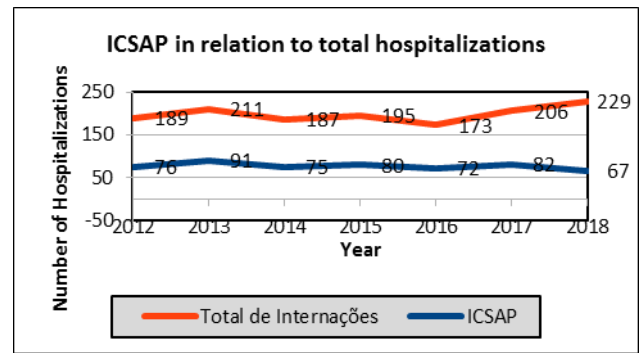
Graph 1: Distribution of ICSAP in the municipality of São Miguel do Oeste, SC, by Sex, in the period from 2012 to 2018

Source: Datasus (2019).

Regarding the proportion of ICSAP in relation to the total number of hospitalizations (Graph 02), there is little

variation between the years 2012 and 2017, with a greater drop in ICSAP in hospitalizations in 2018, from more than 39% of hospitalizations (in 2017 ) for about 29% of hospitalizations of elderly people for these causes in 2018.

In 2012, the municipality registered 189 hospitalizations, of these 76 (40.21%) were due to CSAP. In 2013, of the 211 admissions, the ICSAP represented 43.13% (91). In 2014, there were 187 hospitalizations, of which 75 (40.11%) were due to ICSAP. In 2015, 195 hospitalizations were registered and of these 80 (41.03%) were due to CSAP. Of the total hospitalizations in 2016 (173), 72 (41.62%) were CSAP. In 2017, 82 (39.81%) of 206 admissions were due to CSAP. In 2018, of the 229 hospitalizations registered in the 60 - 74 age group, 67 (29.26%) had CSAP as the cause of hospitalization (Graph 2).



Graph 2: ICSAP in the municipality of São Miguel do Oeste, SC, in relation to the total number of hospitalizations, in the period from 2012 to 2018

Source: Datasus (2019).

Data provided by the Health Department of the Government of the State of Santa Catarina, between the years 2008 to 2014, indicate an increase in the proportion of ICSAP according to the age group, strengthening the influence of functional decline on health impairment. In this time interval, the ICSAPs in the age group from 60 to 74 years old were, on average, 30% of the total hospital admissions. In a general picture, it is observed that both the proportion of ICSAP and the expenses with these hospitalizations had a gradual decline over the years, although although they are decreasing, one in 3 hospitalizations of the elderly in Santa Catarina in this age range are due to CSAP (DATASUS, 2019).

The number of ICSAP between the years 2012 and 2018 in the municipality of São Miguel do Oeste was 542 (Table 1), which corresponds to 39% of the total hospitalizations in the period, which was 1388. Of the ICSAP, 458 (84 , 5%) were for 06 groups of diagnoses, while the remaining 13 groups represent 15.5% (84) of

ICSAP. Of the 06 main diagnostic groups, 232 (42.8%) of hospitalizations were in Group 08 - Lung Diseases, among which 226 for Chronic Obstructive Pulmonary Diseases. Among the most frequent reasons are, still, the diagnoses of Group 11 - Heart Failure, which represent 16% of hospitalizations. Cerebrovascular diseases (Group 12) are the third cause (9.6%), followed by Diabetes Mellitus (Group 13 - 7.2%), Bacterial Pneumonias (Group 06 - 4.4%) and Kidney and Urinary Tract Infections ( Group 15 - 4.4%).

Table 1: Distribution of ICSAP by Diagnostic Group, in the municipality of São Miguel do Oeste, SC, from 2012 to 2018

Diagnosics Group	ICSAP number	Percentage (%) in relation to ICSAP	Percentage (%) in relation to the total number of hospitalizations in the period
06 - Bacterial Pneumonia	24	4,4%	1,7%
08 - Lung Diseases	232	42,9%	16,7%
11 - Cardiac insufficiency	87	16%	6,3%
12 - Cerebrovascular Diseases	52	9,6%	3,7%
13 - Diabetes Mellitus	39	7,2%	2,8%
15 - Kidney and Urinary Tract Infection	24	4,4%	1,7%
Other 13 Groups of Diagnostics	84	15,5%	6,1%
TOTAL	542	100%	39%

Source: Datasus (2019).

A study carried out in the city of Florianópolis analyzed 50 individuals (66% of them elderly) hospitalized for chronic obstructive pulmonary disease (DPOC) and concluded that most of them had a severe condition, that 33% were smokers and only 28% received the pneumococcal vaccine. Inadequate treatment led to hospitalization, coupled with factors such as lack of support for oxygen therapy, low income and decreased rate

of immunization against influenza (Giacomelli *et al.*, 2014).

They carried out a study where they analyzed the ICSAP in elderly people in the state of Santa Catarina in the years 2008 to 2015 and identified a significant decrease in the rates of hospitalizations of the elderly between 60 and 79 years old until the year 2012, decreasing at a lower speed since then (Rodrigues *et al.*, 2019). The most significant health problems were: heart failure, chronic obstructive pulmonary diseases (DPOCs) and cerebrovascular diseases.

A study in 13 European countries showed that patients with chronic obstructive pulmonary disease (DPOC) had an increase in hospitalization time due to the worsening of the condition at hospitalization, which could be avoided with adequate and effective assistance at primary levels (Ruparel *et al.*, 2016).

A study conducted in the United States, Canada and the United Kingdom associated the geographical impact with the increase in hospitalizations, reinforcing that the ease of access to secondary care and the inadequacy of primary care influences the increase in hospitalizations (Vitolo, 2015).

Population aging is a reality in the world and also in Brazil. The Brazilian Institute of Geography and Statistics (IBGE) predicts that in the year 2025 Brazil will be the country with the sixth oldest population in the world. Population aging requires adjustments to the care needed by the elderly (Ministério da Saúde [MS], 2007).

Public health policies must contribute so that longevity is accompanied by quality of life and good health, providing healthy and active aging. For this to be possible, it is necessary to offer a social and cultural environment with a focus on population aging, and the work of the Family Health Teams is fundamental in this process, through collective actions in the community, group activities and attention to the social support of women old people (Ministério da Saúde [MS], 2007).

The absence of an easy access gateway compromises the quality of care offered, due to the individual's lack of clarity as to the degree of care that his condition requires. Quality primary access should provide the user with the necessary medical guidance to understand whether they need to seek another source of care (Starfield, 2004).

#### IV. FINAL CONSIDERATIONS

Hospitalizations for Causes Sensitive to Primary Care reflect the quality of Primary Health Care in the territory. The high percentage of ICSAP compared to the total number of hospitalizations, it is necessary to make Primary

Care more resolute. In the context under study, health promotion and disease prevention actions are paramount and must be geared to the needs of the territory. The integration between existing health services in Primary Care must focus on the matrix support of the elderly population. For this, it is important to highlight the use of SUS databases available for consultation. They are sources of information that are easily accessible, free of charge, and that enable the planning of activities to be developed based on the existing context. Observation of the data allows the educational activities developed to be focused on the real needs of the population. It is important to invest in Permanent Education in Health, aimed at professionals who serve the elderly population. The elderly public deserves special attention from the health area and other public policies due to the specific needs they have. The results found in the study should attract the attention of public managers and the need to rethink actions aimed at improving the health of the elderly through the services offered in Primary Care.

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# What African State are you referring to? Different ontologies different States

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Received: 23 Oct 2020;

Received in revised form:

05 Jan 2021;

Accepted: 17 Jan 2021;

Available online: 31 Jan 2021

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**Keywords**— African states, objectivist,  
subjectivist and intersubjectivist  
ontology.

**Abstract** — African states have been analysed under the label of “failed states”, “collapsed states” and “predatory states”. In this sense, without the intention of analysing the scope of transformations resulting from changes of political regimes, this qualitative essay based on literature review, analyses how the use of ontologies has produced different “images” of African States. It is argued that the images produced are anchored to the dominant objectivist and subjectivist ontologies of the 70s and 80s, which applied in the analysis of African States are very limited. Accordingly, it is suggested the adoption of intersubjectivist ontology, which, favouring the joint construction of meanings and knowledge, is more apt to capture the organizational dynamics that have been influenced by ubuntu (“I am because we are; I can only be one person through others”) considered the African philosophy of life, management, and leadership.

## I. INTRODUCTION

In the late 1980s, Peter Evans published an article in which he addressed different types of states in the so-called Third World which are: the developmental states, the predators and “other devices”. While looking at three countries on three continents, categorization does not prevent hasty scholars from using it as representative of other states on the same continent. Thus, analysed in a continuum, according to Evans (1989), Japan appeared, at the top, as a developmental state, Brazil, in the middle, as “another apparatus” and, then Zaire, at the end, as a predatory state.

Years later, Call (2008) criticized the proliferation of labels such as “failed states” and “collapsed states”; the presentation of Liberia as a predatory state and Somalia as a collapsed state. Similar cases are multiplying, Bellucci (2010, p. 10) states that when considering that they were constituted by colonial law, African states are seen under the label of “external”, “quasi-states”, “artificial” or “pseudo-states””. However, as if an outlier, Botswana appears in contemporary literature as the “African case of

success” echoing the observation made seminally by (Acemoglu; Johnson & Robinson, 2003).

In contrast, Call (2008) points out, as possible reasons, among several, cultural values and Western paternalism as aspects underlying the categorization of failed states, almost all, in the so-called Third World. In the same vein, seeking to re-conceptualize the notion of a failed state in Western knowledge, Jakwa (2016) argues that Zimbabwe is not a weak, fragile or bankrupt state, but also a strongly unstable state that highlights the need to re-conceptualize democracy in Africa.

Analyzing the political changes that have occurred in the continent, Cardoso et al. (2002) question if we are facing the same Africa. If so, what is the real scope of these changes? In this sense, without intending to analyze the scope of the transformations resulting from the change in the political regime, we question how the use of different ontologies has produced a different Africa and how intersubjective ontology can contribute to transcend the limitations of objectivist and subjectivist ontology.

Thus, it is argued that the disparity of points of view, which tend to be contradictory, is due to the use of

different ontologies that vary between the objectivist and the subjectivist. In other words, the use of different ontologies results in the construction of different objects of analysis. It is shown that the use of objectivist ontology is compatible with the essentialist view of African State as a state that once was, but that tends to not be, the “Africa invented” in the observation of (Mudimbe, 2013).

In turn, the subjectivist refers to the unfinished state-building characteristic marked by advances and setbacks, which Bierschenk & De Sardan (2014) call *Statehood*. As a way to overcome this dichotomy, even because there are dilemmas with the “African forms of self-registration” (Mbembe, 2001), it is proposed the use of an intersubjective ontology (Cunliffe, 2010) that transcends the limitations presented by the objectivist and subjectivist ontologies.

According to Quijano (2002), the hegemonic rationality imposed by Eurocentrism from the 17th century onwards based on the radical dualism between “reason” and “body” and between “subject” and “object” in the production of knowledge that is characterized by being a-historical, reductionist and homogenizing, is in crisis.

One of the evidence is observed when the Cameroonian philosopher Mbembe (2015) says “from the point of view of knowledge production, it turned out that we know very advantageously what African societies are not (or should be), and less what they really are” (p.376). And Quijano (2002) observes that the state as a universal central form of control over collective authority and the modern nation-state as its hegemonic variant is one of the structural elements of the coloniality of power today.

Mignolo (2002, p.59) explains that the expansion of Western capitalism implied the expansion of Western epistemology in all its ramifications, from the instrumental reason that accompanied capitalism and the industrial revolution, to the theories of the State, to the criticism of capitalism and State.

This work is structured in six parts. After this introduction, we present the approaches of the African State analyzed under the objectivist ontology and its implications, in the third part, the African State under the lens of subjectivist ontology and its developments, following that, the analysis under the intersubjectivity ontology and, finally, the conclusion.

## II. THE AFRICAN STATE UNDER THE OBJECTIVIST ONTOLOGY

Cunliffe (2010) enlightens that the objectivist assumptions maintain that reality is concrete data, something that is external. However, through the use of scientific methods, “real” knowledge is built based on observable and measurable regularities, laws, and

standards. In turn, according to the author, intersubjective researchers are based on hermeneutic phenomenology, relationally responsive social constructionism, and the notion of dialogism.

The difference between constructivist and social constructionist researchers draws attention. According to Cunliffe (2014), the interest of the constructivists is the generation of theoretical explanations from practice and their work is not reflective because they do not see themselves as part of the construction process. Social constructionists, in turn, focus on how meaning or practical theories are created among people in their embodied and relationally responsive dialogue and see themselves as part of the meaning-building process (Ibid, p.483).

Aware of these possibilities and of the various labels attributed to the State of Africa, in *The danger of a single story*, the Nigerian writer Chimamanda Adichie draws attention to the starting point of the narratives about the African States. He observes that starting the story with the failure of the African States and not with the colonial creation of the African State, the story told will be totally different (Adichie, 2009).

This view of the author can be seen in divergence of ideas between authors. According to Njoku and Bondarenko (2018), the construction of the modern state of Africa is the product of the centuries-old process of colonization. Post-colonial societies, according to the authors, are a unique event in world history. However, the legacy of this experience is not consensual among scholars.

While Adamolekun (2005) argues that, with independence, most countries in sub-Saharan Africa inherited systems of public administration that satisfactorily performed two key functions of a modern state: guaranteeing the continuity of the state and maintaining law and order within territorial areas of each country. For Mkandawire (2010), very early in the post-independence period in Africa, it was clear that the inherited state was inadequate for the development task since the inherited colonial state was, in many parts of Africa, nothing more than a stationary garrison used to protect the trading posts and routes that the imperial order had established.

Despite the divergence in the vision of state capabilities, the authors converge on the idea of the existence of a State. As Adichie (2009) warned, the adoption of any of the points of view, conditions the course of the narrative. For example, for scholars who corroborate Adamolekun (2005), the post-colonial African state will be seen as a “perennial essence”, an organ that was, but tends not to be. Cardoso et al. (2002, p. 17)



explain that the essentialist model of analysis makes useful empirical findings. He describes the political phenomenon in Africa. But this description is synchronous, therefore, the dominant approaches that do not go beyond a description.

Seen as a “perennial essence”, most theoretically created in the image and likeness of the colonizing countries, the description of African states tends to be made in history by analogy (Mamdani, 1996). According to the author, the experiences summarized by analogy were considered historical laggards and were attributed to predestination, and in the case that real-life performance did not correspond to the prescribed trajectory, it was understood as a deviation.

This explains, in part, the proliferation of labels such as “failed states”, “collapsed states” (Call, 2008), “predatory states” (Evans, 1989) among others. For Njoku and Bondarenko (2018, p.4) “contemporary international law is based on the recognition of the nation-state as the basic unit of international relations and world politics. Thus, post-colonial countries simply had no alternative to declaring themselves sovereign nation-states”.

In agreement Mamdani, Bellucci (2010, p. 11) affirms that based on concrete data, the Western State model is used as a reference, to conclude that Africans are unable to manage their State, and, therefore, should be the westerners. Bierschenk and De Sardan, (2014) explain that the representations of the state proposed by philosophers, researchers and social scientists are always rooted to a greater or lesser degree in a particular context that constitutes a kind of latent reference point.

Looking at scholars and the geographic space of the literature production on “failed states”, “collapsed states”, “predator states”, according to Call (2008) these labels flourished at the end of September 11 associated with needs security of the American empire and western states. Mkandawire and Soludo (1998, p.vii) note that great irony in the history of Africa's development is that the theories and models employed come largely from outside the continent. And they point out that no other region in the world has been so dominated by external ideas and models.

However, Mbembe (2001) points out limitations resulting from what he called “African forms of self-registration”. According to the author, the effort to determine the conditions under which the African subject could fully acquire its own subjectivity found two forms of historicism that limited him: first, the “economicism” that resorted to Marxist and nationalist categories and the second, that developed from the emphasis on the “native condition” (Mbembe, 2001).

According to Mbembe (2001), the first current of ideas (Marxist and nationalist) is permeated by the tension between voluntarism and victimization and has four main characteristics: (i) Lack of reflexivity and instrumental conception of knowledge and science, in the sense that none of them are recognized as autonomous. (ii) Mechanical and reified view of history. (iii) The desire to destroy tradition and the belief that true identity is conferred by the division of labor that gives rise to social classes, in which the proletariat (rural or urban) has the role of universal class par excellence, and (iv) This body of thoughts rests in an essentially controversial relationship with the world based on rhetorical rituals.

It concludes that, over time, attempts to define African identity simply and clearly have failed because African identity does not exist as an essence, it is constituted, in varying forms, through a series of practices, notably the practices of the self (Mbembe, 2001).

It is highlighted from above that the limitations of the use of objectivist ontology are reflected in the research of scholars on both sides of the border, those from outside who analyze the African State from a latent reference point (Bierschenk & De Sardan, 2014) and the insiders who confront the tensions presented by Mbembe (2001). The following is an analysis of the State from the subjectivist ontology.

### III. THE AFRICAN STATE IN THE LENS OF SUBJECTIVIST ONTOLOGY

Subjectivist ontology according to Cunliffe (2010) sees reality as imagined and as a product of the human mind. The scholars who base on subjectivist ontology, according to the author, assume that humans are autonomous, give meaning to their surroundings, and are creative; that knowledge is personal and experiential. Therefore, research methods need to explore individual understandings and subjective world experiences.

The works *Discourse on colonialism* by Aimé Césaire (1978) and *Invention of Africa* by Valetim Mudimbe (1988) are emblematic in criticizing the colonial narrative about Africa. Mudimbe (1988) explains that concepts widely used in anthropology such as “savages” and “primitives” were created, by prominent social scientists, during the Enlightenment period. And, from that moment on, “several schools of anthropology developed models and techniques to describe the ‘primitive’ according to changing trends in the context of the Western experience” (p.34).

The use of the term “invention” indicates that the object of analysis in Africa rests on individual cognitions and does not have an independent existence. It is, therefore, a

creation. This term was later used by Said (1990) in his book *Orientalism* where the author explains that the Orient is an idea that has a history and tradition of thought, imagery, and vocabulary that gave it reality and presence in and for the West (p. 17).

This invention of subjects as objects of transformation and spaces of intervention may have as one of the main references, the speech of President Harry Truman. According to Banerjee (2003), “the invention of development and the creation of underdevelopment” had its genesis in President Harry Truman's inaugural speech on January 20, 1949, in which he outlined a global program for development. In the spirit of this discourse, in addition to the narcissistic recognition of itself as the prototype, US imperialism was entrusted with the mission of bringing development to the underdeveloped areas of the world.

According to Apata (2019) in the discourse of the invention, Africans are seen as passive heirs of all Western cultural imports, which are assimilated without resistance, however, according to the author, Africans are active agents frequently involved in negotiating their destiny with Western powers.

This view is in line with the subjectivist ontology which, according to (Cardoso et al., 2002), focuses on the analysis of the processes of daily construction of the State, not presenting it as an essence in itself, but a permanent construction subject to attempts at errors, correction, and progress.

In the same line of reasoning, Bierschenk and De Sardan, (2014) state that incompleteness, fragility, and reversibility are universal characteristics of state-building processes. The authors introduce the concept of Statehood, which refers to this unfinished state-building feature.

Under the lens of a subjectivist ontology, the emphasis is placed on the process of knowledge construction that involves the interaction between the subject and object that divides researchers into social constructivists and constructionists. As Cunliffe (2014) explains, the interest of constructivists is the generation of theoretical explanations from practice, and their work is not reflective while social constructionists focus on how meaning or practical theories are created among people in their embodied dialogue and relationally responsive and see themselves as part of the meaning-building process (Ibid, p.483).

Correspondingly, Cardoso et al. (2002) say that constructivism starts from two assumptions: the first consists of the idea that social reality is constituted through the action of individuals, and the second sees in politics a

process that is always in formation, and therefore cannot be an essence perennial (Cardoso et al., 2002, p. 11).

The study carried out by Evans (1989) on models of States and the fruit of which, years later, he defended the thesis of “embedded autonomy” as one of the factors leading to the economic development of East Asian countries, was based on the analysis of the functioning of the bureaucracy that in his view, in East Asian countries, he was already approaching the ideal Weberian model (Evans, 2010).

Consequently, the deficiencies of the bureaucracy in Zaire have led it to be considered a “predatory state”, a term close to the concepts of “failed state”, “fragile state” and “collapsed state”. Ferreira (2014) states that the concept of a fragile state is centered on a concept of state as a normative ideal, not based on the empirical reality of state formation processes in different parts of the world.

According to the author, the dominant conception of a fragile state is a-historical, because it does not consider the different processes of state formation in various regions. It is also presented as static and is not based on the empirical reality that presents various political dynamics, legitimacy, and authorities that unfold at levels other than the central power of the state.

Regarding the approach advocated by Evans (1989, 2010), Bierschenk and De Sardan, (2014) argue that the ideal type of bureaucracy only connotes the “chance of its own existence”. Referring to studies such as that of (Evans, 1989; 2010), they explain that the empirical argument is that there are different degrees of the existence of bureaucracies and states, ranging from the hypothetical extremes of complete absence to complete existence. They conclude that claiming that a particular bureaucracy, say an African bureaucracy, is not in line with Weber's ideal type of bureaucracy, is a sociological banality and would certainly not come as a surprise to Weber himself.

Bierschenk and De Sardan, (2014) suggest that the state should be seen not as an entity, but as a set of practices and processes in a field of complex powers. And these processes can be executed in different directions, with different effects (p.14-15). The authors highlight the always incomplete nature of state formation processes and the “patched” (*bricolé* or *gebastelt*) nature of the “state”, which is its heterogeneity (Ibid, p. 5).

Despite privileging a process of knowledge that is sensitive to the process and gives priority to the autonomy of individuals in the attribution of meanings, in the subjectivist ontology as the objectivist the subject and object are separate entities where “hierarchically” in the research, the subject occupies a superior position about the “objects”. The intersubjectivist ontology, as we shall see

below, levels this inequality between the subject and the object.

#### IV. THE AFRICAN STATE FROM THE PERSPECTIVE OF INTERSUBJECTIVIST ONTOLOGY

According to Cunliffe (2010), intersubjectivity emphasizes “we”, interrelated experiences incorporated, and meanings *in situ*. According to the author, the emphasis of intersubjectivism is on “us”, intersubjectivist researchers work in a reflexive hermeneutics, with research participants in conversations to explore how they both interpret, understand, and relate continuously with each other and with what fence. The following shows a possible application in the study of the African State.

With the historical distance of the independence period, the 1960s, current studies (Ayee, 2015; Adamolekun, 2005; Karyeija, 2012) seek to assess the impact of public sector reforms in several African countries, implemented since the 1980s. Despite the difference in arguments, scholars agree that although there is variation in results between and within countries, across areas and sectors, there is still much to be done.

However, two arguments call attention, the first is by Botlhale (2019) who looks at the case of success in Africa. The author questions the Public Sector Reforms in Botswana; *Good Seed but Bad Soil?* And, he argues that the results of public sector reform in the country were modest because when introducing reforms it is necessary to prepare the soil (foundation conditions) before planting the seed (reform).

The same finding was made earlier by Karyeija (2012) when answering about *Public sector reforms in Africa: What lessons have we learned?* According to the author, ten lessons can be extracted from the implemented processes, two of which are: the need to recognize the importance of culture and context, because sometimes local values contradict the content of reform efforts and do things in their order that is, first things first, therefore, a reliable public sector must be created before reforming it.

According to Botlhale (2019, p. 541), before the government launched public sector reforms in the 1990s, it was very necessary to introduce national work ethic and mentality change programs. Based on this statement, made by a scholar from and residing in the country most praised in international literature, one can ask: how does the mentality change? Can you change the mindset of someone who does not feel and does not see the need to change? Who can change the other's mentality?

The author points out that the expression ‘*go lekanya tiro le madi*’ (equating work effort with remuneration) and the cattle post mentality compromise productivity in the

public sector (Botlhale, 2019). Also interesting are the findings that Karyeija (2012) had in his doctoral research, where he observed that performance based on the New Public Management (NPM). The performance evaluation system was less applicable to the civil service of Uganda because the culture seemed incompatible with a system that sought to evaluate individual performance without taking into account the unequal distribution of power, strong collective norms, and fear of innovation or new ways of doing things (p.113).

The “*go lekanya Tiro le madi*” in Botswana makes a proportion of the effort with the salary questioning the conception and value of the work and the salary level. How can you “adjust” this habit? The study carried out on performance evaluation carried out in Uganda by Karyeija (2012) also revealed that there was a difficulty in evaluating an older person by the younger ones. The evaluation is confused with disrespect, lack of consideration, or lack of education even with instruction.

Ncube (2010), Pillay et al. (2013) and Nussbaum, (2003) invite us to look at the core of the African tradition called ubuntu and analyze its influence on African management and leadership styles. Ncube (2010) states that ubuntu forms the nucleus of the most traditional African culture and constitutes an alternative to the western leadership philosophy. In turn, Pillay et al. (2013) explain that, while the West is based on an individualistic and self-service paradigm, ubuntu is rooted in a collectivist perspective expressed in “I am because we are; I can only be a person through others”. Therefore, ubuntu is the ability of African culture to express compassion, reciprocity, dignity, harmony, and humanity in the interest of building and maintaining a community with justice and mutual care (Nussbaum, 2003).

The intersubjectivist ontology overcomes the limitations of the objectivist and subjectivist ontologies because it has more advantages and can capture the essence of the functioning of formal organizations based on the philosophy of life of the respective societies. At one time, Frederickson (2002) comparatively analyzing the bureaucratic morality of Weberianism (West) and Confucianism (East Asia) stated that there are few foundations in Western thought on which the moral justification of bureaucracy can rest and concluded that “Confucius stands for the ethics of bureaucracy, like Weber, is for the structure and behavior of bureaucracy”(p.610).

These conclusions justify the effort that Blunt and Jones (1997) made in their article Exploring the limits of Western leadership theory in East Asia and Africa. The authors’ objective was to critically examine the Western functionalist paradigm (Burrell and Morgan, 1979) of

human resource management-transformational leadership - comparing it with the leadership patterns observed in East Asia and Africa. They concluded that current Western notions of leadership are not widely applicable in Africa and East Asia.

“The main reasons have to do with significant differences in values regarding authority, group loyalty and interpersonal harmony. Leadership in the West depends on the follower and the performance and therefore tends to be more participatory. Concern for the well-being of employees masks a primary interest in the performance of the individual and the organization, while in the East the maintenance of harmony and face has deep philosophical and cultural roots, which may override short-term commercial considerations, but (paradoxically, perhaps) still being in the long-term interest (performance) of the organization” (Blunt & Jones 1997, p. 18).

The study by Mailey (2015) affiliated to the Strategic Center for the Study of Africa based in the United States entitled Anatomy of the resource curse: predatory investment in the extractive industry in Africa, follows a similar line of reasoning revealing the emergence of a new model of business between Asians (in the study the Queensway group) and several African state leaders whose “secret” is “first make friends and then do business”. This business approach differs from the idea of the market as a neutral space in which unknown actors with no previous connection offer or buy goods and services, the so-called “free market”. Therefore, this case shows that objectively there is no free market for human relations at least, inspired by trust and perspectives of reciprocity.

As we mentioned above, under the lens of objectivist ontology, the post-colonial African State tends to be seen as a perennial essence, “an organ that was, but that tends not to be”. In a different sense, the subjectivist ontology defended by Bierschenk and De Sardan, (2014) looks at a state as a reality under construction. In other words, while objectivist ontology anchored to a normative approach to the State based on national and international legal norms, it conceives the State as a fully realized object that, in certain regions, tends to show pathologies or even die (example from Somalia), ontology subjectivist is more sensitive to the process and considers the incompleteness of the formation of the State characterized by advances and setbacks, trials and errors.

However, the common denominator of these ontologies (objectivist and subjectivist) lies in the separation of the subject and object. The first being the one that best understands the phenomenon in question and the second, an instrument of analysis, passive and manipulable.

## V. IMPLICATIONS OF USING INTERSUBJECTIVE ONTOLOGY IN THE STUDY OF THE STATE IN AFRICA

a) It can be recognized, as (Frederickson, 2002; Blunt & Jones, 1997) observe that there is a cultural tradition, management style and leadership based on *ubuntu* philosophy;

b) Although *ubuntu* is not widely disseminated, and is studied even in african academies, it is nevertheless constitutive of the way of being of communities and reflected in individual behavior. The case of “*go lekanya Tiro le madi*” in Botswana and NPM, the challenges of the performance evaluation system in the civil service of Uganda due to collective norms or the perception of seniority as an official post in Mozambique, are examples of the influence of social norms in the functioning of bureaucracy;

c) Africans, like other people, are not subjects who passively appropriate innovations and “solutions” coming from outside their context (Apata, 2019). The solutions are subject to evaluations and contextualization and can be modified, interrupted or simply rejected. In this light, one might, for example, question whether it is the state that has failed, or collapsed, or are the programs for structural readjustment and public sector reform preached by donors and creditors;

d) The intersubjectivity, although aiming at the construction of scientific knowledge, is more sensitive to other types of knowledge subordinated to colonization, which is positive for post-colonial societies with low levels of formal education, but centered on norms and social values;

e) Intersubjectivism allows the subjects involved in the research to learn from each other, that is, learning between equals which minimizes the risk of creating a greater collection of systematized knowledge about the studied communities outside their context, a situation visible before and in the early years of political independence;

f) Finally, intersubjective ontology is more apt to counter the tendency to narrate Africa from the point of view of what it is not (Mbembe, 2015) for what it effectively is.

## VI. CONCLUSION

In this qualitative essay, it was shown that the adoption of an ontology influences our view of the reality under study. In this case, different ontologies led to the construction of different images about African State, whether as “something that was but tends not to be” And for that reason, failed or collapsed or, on the other hand, a state under construction subject to advances and setbacks, trial and error. It was argued that the images produced are

anchored to the dominant objectivist and subjectivist ontologies in the 70s and 80s, which applied in the analysis of African State have been shown to be very limited. It is suggested, therefore, the adoption of intersubjectivist ontology that, privileging the joint construction of meanings and knowledge, is more apt to capture the organizational dynamics that have been influenced by *ubuntu* (“I am because we are; I can only be one person through others”) considered the African philosophy of life, management, and leadership. In short, can the Bantu people speak (too)?

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# Performance Analysis of High Early-Strength Concrete for Accelerated Bridge Construction Closure Pour Connections

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Received: 29 Oct 2020;

Received in revised form:

07 Jan 2021;

Accepted: 21 Jan 2021;

Available online: 31 Jan 2021

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**Keywords**— Accelerated Bridge  
Construction, Closure joints, durability  
and high-early strength.

**Abstract**— Accelerated bridge construction (ABC) are becoming a popular alternative for new bridge construction as well as in existing bridge deck replacement because of its reduced time spent in situ activities. A main function of these bridges is the use of prefabricated components. Prefabricated structural components are joined in the field with closure pours using high performance materials such as steel and concrete to ensure proper transfer of forces between components. The purpose of this research was to create a method to develop concrete mixtures that are designed using some general constituents and that satisfy performance requirements of accelerated bridge construction closure pours primarily high early strength and long-term durability. Two concrete mixtures were developed with a primary goal of reaching high-early strength while maintaining constructability. The secondary goal of the concrete mixtures was to be durable; therefore, measures were taken during the development of the concrete mixture to generate a mixture that also had durable properties.

## I. INTRODUCTION

Accelerated bridge construction (ABC) is a construction technique that has become popular with existing bridge deck replacement and even with some new bridge construction projects because of the reduction in on-site activities. By reducing the on-site activities, ABC techniques reduce the overall construction time, which results in economic savings. ABC techniques also create safer roadway conditions and reduce traffic delays when compared to traditional construction techniques.

One common technology used with ABC is prefabricated bridge elements and systems.

The prefabricated structural members are the components of ABC technology which allows for a reduction in construction time and cost (Beerman 2016). Prefabricated components are joined on site with small volume closure pours using high performance materials, commonly comprised of steel and concrete. Concrete

closure pours must ensure adequate load transfer between structural components before the bridge is in use by developing high strengths in a short period of time.

Generally, most materials used for closure pours contain proprietary components, such as ultra-high performance concrete (UHPC) that contains steel fibers, or rapid setting concrete that contains proprietary cements. These materials currently used for ABC closure pours utilize properties of proprietary components, making it expensive for extensive use and hindering the widespread application of these materials. It is also difficult to source proprietary materials in state bridge projects, which often makes it impractical to specify these materials for ABC.

Consequently, a need for the development of concrete mixtures comprised of generic components has emerged. These concrete mixtures must still satisfy some of the performance requirements of ABC closure pours,

including a high strength gain rate and long-term durability.

The main objective of this research project was to develop and validate concrete mixtures that develop high-early strength without detrimentally affecting their long-term performance.

### Closure joints for accelerated bridge construction

Closure joints, normally, refer to joints for connecting the bridge deck elements to each other and to the substructure. Application of the ABC using prefabricated elements and assemblies necessitates the use of joints for connecting and integrating the bridge structure. Different types of ABC connections and evaluation of the available connections have been experimentally and analytically studied.



Fig. 1: Closure joints for accelerated bridge construction

## II. LITERATURE REVIEWS

A bridge database stored with several parameters extracted from bridges part of the National Highway Inventory was studied to identify the key parameters. Using mean values from the database, a hypothetical bridge was created for each bridge type. Finite-element or grillage analysis was carried out to assist in the development of the LLDF formulas. Important parameters considered in the analyses included different bridge types, span lengths, edge-to-edge widths, skew angles, number of girders, girder depths, slab thickness, overhangs, curb to curb widths, year of construction, girder eccentricity, girder moment of inertia, and girder area. A sensitivity study was performed to identify the key parameters for live-load distribution (Zokaie 2000).

Barr et al. (2001) evaluated the accuracy of finite-element modeling techniques and code equations for determining flexural live load distribution factors for prestressed concrete girder bridges. The study also investigated the effects of lifts, IDs, EDs, continuity, skew

angle, and load type. The evaluation was based on the response of a live-load test on a bridge as per earlier studies. The experiment was used to ensure that moment obtained from finite element model corresponded to the observed behaviour of the prototype bridge.

Cai et al. (2002) examined the effect of diaphragms on live load distribution factors and maximum strain through numerical predictions and comparisons with load testing for six prestressed concrete bridges. The bridges included different AASHTO girder types, skew angles, span lengths, diaphragm layouts, and number of lanes. These bridges were analyzed using slab-on-grid finite element technique with four different cases. In each case, the bridges were analyzed differently to consider effects of end and intermediate diaphragms. In all the cases, EDs were modeled integral with the beam ends and assuming stiffness based on uncracked sections. For IDs, full composite action with the beam was not assumed since reinforcing bars are discontinuous at the interface of the two members. Different stiffness levels were used in modeling the IDs as a result of cracking assumed to develop in the concrete. Composite behavior between IDs and the slab was also assumed in some of the models.

Sengupta and Breen (1973) investigated the influence of IDs in prestressed concrete bridges using four 1/5.5 scale microconcrete simply supported models. Physical models of the bridges were tested under static and dynamic loads. Variables included in the tests were span lengths, skew angles, stiffness, number and location of diaphragms. Experimental results were used to validate a computer program for analysis of the bridge which was then used to study, the general effect of diaphragms in load distribution of a variety of bridge models.

Air pollution has reduced by 20% to 30% during the covid period because of lockdown in several countries and in India air pollution has reduced by 30%. This will improve the health of people who got health issues from air pollution there by reducing mortality (Ravi Manne et. al. 2020).

Wong and Gamble (1973) carried out an investigation to study the effects of diaphragms on load distribution characteristics of continuous, straight slab and girder highway bridges. The study focused on the influence of change in diaphragm stiffness and location on the variation of maximum positive and negative moments. The results of load distribution from continuous bridges were compared to those from simply supported bridges. It was found that when diaphragm stiffness exceeded the optimum stiffness, exterior beams experienced a higher maximum moment than the absolute maximum moments



in the beams of the bridge without IDs. Increasing diaphragm stiffness reduced the moments in the interior girders and increased the moments in the edge girders.

### III. EXPERIMENTAL SETUP

An experimental program consisting of ponding and strength tests was designed and implemented. For comparison purposes, three specimens with and three specimens without the UHPC longitudinal connection (named jointed and joint less specimens, respectively) were fabricated, instrumented, and tested.



Fig. 2: Experimental setup for connection testing

Strength tests were conducted to check whether the jointed specimens had the same strength as did the joint less specimens. All specimens were tested under the loading and boundary conditions. Two-line loads were applied to the jointed specimen 10 cm. away from the outermost interface surface. The loads were continuously applied on the specimens by two hydraulic actuators each fitted with load cells to record the applied loading. The loading continued until it was seen that each specimen has failed. Each specimen was visually observed multiple times throughout the experiment.

### IV. RESULTS

Before failure of each specimen, cracks occurred above the two center supports, between the two loading lines, and in the first and third spans, as shown in Figure. For the jointed specimens, cracks also formed at the connection interface because of the separation of the normal concrete and UHPC,

A flexural-shear failure occurred at the center span of the joint less and jointed specimens. The concrete crushed

near a loading line, and large diagonal cracks formed and were extended from a center support to the loading line. No concrete crushing or cracks were found in the UHPC.

### V. CONCLUSION

Strength tests were conducted to evaluate the behavior of the longitudinal closure pour connection planned to be used in the precast constructed Bridge. For comparison purposes, specimens with and without a UHPC longitudinal connection were fabricated, instrumented, and tested. The following conclusions were drawn:

- The UHPC connections show no cracks or leakage in the joint due to early-age drying shrinkage and temperature changes.
- Under strength loading conditions, the jointed specimens had slightly lower cracking loads than the joint less specimens.
- Cracks formed at the connection interface, and no concrete crushing or cracks were found in the UHPC pour.

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# Analysis of Economic Viability of the Repowering of Hydroelectric Plant

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Received: 21 Oct 2020;

Received in revised form:

09 Jan 2021;

Accepted: 19 Jan 2021;

Available online: 31 Jan 2021

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**Keywords**— *Small Hydroelectric  
Plants. Economic viability.  
Repowering.*

**Abstract**— *The present study aimed to carry out an economic feasibility study for the repowering of Small Hydroelectric Plants - SHPs. Through the application of economic parameters, it was possible to evaluate the potential gains obtained through repowering. The case study was carried out at Martinuv SHP, located in the city of Vilhena / RO.*

## I. INTRODUCTION

For Maldonado et al. (2006), with repowering, it is possible to maximize the energy efficiency of the plant without generating major socio-environmental impacts, considering that the impacts have already been consolidated and there is no need for compulsory removal of riverside populations. In addition, when there is no change in the level of the reservoir, any chances of erosion along the river are discarded.

The economic viability of the repowering project will be confirmed when the price of the cost of the energy produced (R\$/kWh) reaches values lower than the

commercialization, that is, this relationship is considered as a sensitivity index (attractiveness) in the selection of the best projects repowering in which the investment should be made (VEIGA, 2001).

The choice of the best repowering alternative for a given project is made, from an economic point of view, through the joint analysis of specific methods, commonly used for the analysis of investments in projects. The main methods used and which contribute to decision making will be discussed below.

## II. METHODOLOGY

The investment analysis methods that will be applied in this study are: NPV, IRR and payback. These methods also take into account the minimum rate of attractiveness - TMA.

### 2.1 Net Present Value Method - NPV

According to Rebelatto (2004) the NPV consists of bringing the capital inflows and outflows to the zero investment date, discounting the interest rate, it is a method generally used in the evaluation of alternatives and selection of projects. When the NPV is positive ( $NPV > 0$ ), it means that the project has an income rate higher than the interest rate considered, thus being economically viable. Otherwise ( $NPV < 0$ ), the project must be rejected, as the return would be lower than the interest rate. The NPV can be obtained through equation 1:

$$NPV = \sum_{t=0}^n \frac{FC_t}{(1+i)^t} - FC_0 \quad (1)$$

Where,

$NPV$  = Net Present Value;

$FC_0$  = Cash flow verified at time zero (initial);

$FC_t$  = Cash flow in period  $t$  (expected).

$i$  = Interest rate;

$n$  = number of periods considered.

### 2.2 Internal Rate of Return - IRR

It is defined as the discount rate that equals the net present value (NPV) to zero, making the present value of the inputs equal to the initial investment. In other words, it is the annual rate of return that the company would obtain if it completed the project and received the cash inflows as planned (GITMAN, 2007). From equation 1, the IRR equation is obtained:

$$FC_0 = \sum_{t=0}^n \frac{FC_t}{(1+IRR)^t} \quad (2)$$

For evaluation criteria, if the obtained IRR is greater than the cost of capital invested (minimum attractiveness rate) the project is viable and can be accepted, otherwise ( $IRR < \text{minimum attractiveness rate}$ ) it must be rejected.

### 2.3 Simple Payback

According to Schaicoski (2002), the simple payback can be defined as the period in which the investment values (negative flows) cancel each other out with the cash values (positive flows). In other words, it is the time that a given investment takes to be repaid.

As an analysis criterion, the project must be accepted if it presents a payback below the minimum defined and expected by the company, defined according to its business strategies (MOTA; CALÔBA, 2002). The simple payback can be obtained through Equation 3:

$$PB_s = \frac{I}{BA} \quad (3)$$

Where:

PBs - Simple payback;

I - Total investment;

BA - Net annual benefit.

### 2.4 Discounted Payback

The concept of discounted payback is similar to that of simple payback, but it takes into account the time factor in the value of money, bringing future values of cash flow to present value (ASSAF NETO; LIMA, 2011). That is, this method intends to measure the time necessary for the sum of the discounted installments to be, at least, equal to the initial investment. When considering the value of money over time (discounted cash flow), it is noticed that the period for return on investment increases.

### 2.5 Benefit / Cost Ratio

It is an indicator used to compare the present value of net benefits with the investment value of the project (OLIVEIRA, 2012). It can be expressed as:

$$R_{B/C} = \frac{BA}{I}$$

For a project to be viable, the  $R_{B/C}$  must be greater than 1.

## III. RESULTS AND DISCUSSION

The plant selected for the application of the methodological proposal for technical and economic feasibility analysis will be the Martinuv Small Hydroelectric Plant. In the search for repowering alternatives for the plant, all elements of the plant were analyzed, from the dam to the generation itself, in the powerhouse.

Martinuv SHP underwent a repowering process, in the extension modality, in 2017. Until then, the plant had only Generator Unit 1, with a power of 950 kW. The generating units are in excellent generation conditions, with levels of income above average. However, despite the installed capacity being 1.84 MW, the average monthly generation, considering the range from 2017 to 2019, is 1069.52 MW.

Considering that, from the plant's maintenance history, the generating units do not present operational problems, such as, for example, excessive vibration and the occurrence of cavitation, added to the fact that the plant operates with approximately 60% of the total power, the hypotheses were dispensed with extension of the powerhouse. Following with the field analysis, the possibility of obtaining energy gains through works on the CGH adduction channel was verified.

### 3.1 Investment cost

A survey of the costs involved in covering the plant's adduction channel through High Density Polyethylene - HDPE geomembranes was carried out. In order to determine the best alternative, the main suppliers were consulted and, then, three geomembrane alternatives were compared, as shown in Table 1.

Table 1 - Costs of coating with HDPE geomembrane

ADDITION CHANNEL COATING			
Costs	ALTERNATIVE I HDPE Geomembrane 0.65 mm (Aquamat)	ALTERNATIVE II HDPE Geomembrane 0.8 mm	ALTERNATIVE III HDPE geomembrane 1.0 mm
Geomembrane	R\$ 175.770,00	R\$ 130.720,15	R\$ 153.130,82
Geotextile	R\$ 64.000,00	R\$ 64.000,00	R\$ 64.000,00
HDPE profile	R\$ 1.410,00	R\$ 1.410,00	R\$ 1.410,00
Support	R\$ 1.500,00	R\$ 1.371,06	R\$ 1.371,06
Installation	R\$ 37.654,00	R\$ 37.654,00	R\$ 37.654,00
Civil / Earthworks	R\$ 24.000,00	R\$ 24.000,00	R\$ 24.000,00
Taxes	R\$ 26.365,50	R\$ 19.608,02	R\$ 22.969,62
Freight	R\$ 9.700,00	R\$ 9.566,00	R\$ 10.350,00
Investment cost	R\$ 340.399,50	R\$ 288.329,23	R\$ 314.885,50

Source: The author (2020).

During the period of execution of the work (preparation and installation of the geomembrane), the plant interrupts the electrical generation, therefore this period must be considered in the feasibility study.

The downtime, obtained by applying the PERT/CPM network diagram, is 15 days. As the average monthly generation is 1069.52 MWh, there is a generation of 35.64 MWh / day. Therefore, the cost of unavailability ( $C_{un}$ ) is given by:

$$C_{un} = \text{Daily generation} \times TME \times \text{days without operation} \tag{5}$$

$$C_{un} = 35,64 \times 209,8 \times 15$$

$$C_{un} = R\$ 112.192,65$$

The total cost ( $C_{TOTAL}$ ) is given by the sum of investment costs and unavailability, therefore:

$$C_{TOTAL} = C_{INVEST} + C_{un}$$

The total cost associated with each alternative is shown in Table 2.

Table 2 - Total cost

Alternative	Total Cost
I	R\$ 452.592,15
II	R\$ 400.521,88
III	R\$ 427.078,15

Source: The author (2020).

### 3.2 Economic analysis

The economic return obtained directly through the repowering work under study, with respect to the reduction of head loss and flow gain, can be measured, as shown in Table 3.

Table 3 - Annual gain due to repowering

ANNUAL GAIN DUE TO INCREASED FLOW	
Qi [m <sup>3</sup> /s]	0,00888
Flow Gain [%]	0,404%
Generation Gain [R\$/ano]	R\$ 10.867,43
ANNUAL GAIN DUE TO REDUCED FRICTION	
Generation Gain [R\$/ano]	R\$ 63.435,23

Source: The author (2020).

Therefore, the annual return due to increased flow and reduced friction consists of an amount of R \$ 74,302.66, considering the current average tariff. In order to estimate future revenue, the trend of increasing the price of TME from ANEEL's auctions (Figure 35) was used, which in the last 10 years has presented an average annual increase of 6.44%.

The discount rate adopted was 3%, taking into account the current basic interest rate (SELIC), which is 2% (value in effect in August 2020). The economic parameters VP, VPL, TIR, TL and discounted Paypack, for each alternative, are shown below. The economic parameters of Alternative I are shown in Table 4.

Table 4 - Economic analysis - CGH Martinuv (Alternative I)

ECONOMIC ANALYSIS - CGH MARTINUV			
<b>Total Cost</b>		R\$ 452.592,15	
<b>Discount rate</b>		3,00%	
Period (Year)	Cash flow	Present value	Accumulated PV
0	-R\$ 452.592,15	-R\$ 452.592,15	-R\$ 452.592,15
1	R\$ 74.302,66	R\$ 72.138,51	-R\$ 380.453,64
2	R\$ 79.087,75	R\$ 74.547,79	-R\$ 305.905,85
3	R\$ 84.181,00	R\$ 77.037,54	-R\$ 228.868,31
4	R\$ 89.602,26	R\$ 79.610,45	-R\$ 149.257,86
5	R\$ 95.372,65	R\$ 82.269,28	-R\$ 66.988,58
6	R\$ 101.514,64	R\$ 85.016,92	R\$ 18.028,34
7	R\$ 108.052,19	R\$ 87.856,32	R\$ 105.884,66
8	R\$ 115.010,75	R\$ 90.790,55	R\$ 196.675,20
<b>Sum PVs (Year 1 to 8)</b>		<b>R\$ 649.267,35</b>	
<b>Project NPV</b>		<b>R\$ 196.675,20</b>	
<b>Internal Rate of Return (IRR)</b>		<b>11,68%</b>	
<b>Profit Rate (TL)</b>		<b>1,43</b>	
<b>Payback Time (Discounted)</b>		<b>5,79</b>	

Source: The author (2020).

Figure 1 shows a projection of the project's accumulated present value over the plant's useful life, considering alternative I.

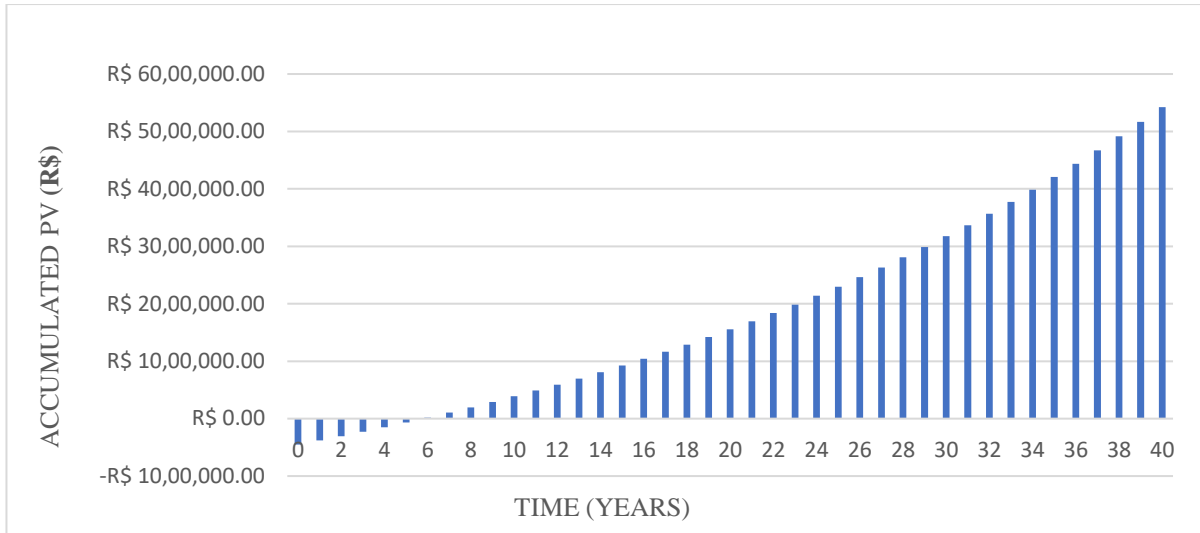


Fig.1: Accumulated Present Value x Lifetime Curve (Alternative I)

Source: The author (2020).

The economic parameters of Alternative II are shown in Table 5.

Table 5 - Economic analysis - CGH Martinuv (Alternative II)

ECONOMIC ANALYSIS - CGH MARTINUV			
<b>Total Cost</b>	R\$ 400.521,88		
<b>Discount rate</b>	3,00%		
Period (Year)	Cash flow	Present value	Accumulated PV
0	-R\$ 400.521,88	-R\$ 400.521,88	-R\$ 400.521,88
1	R\$ 74.302,66	R\$ 72.138,51	-R\$ 328.383,37
2	R\$ 79.087,75	R\$ 74.547,79	-R\$ 253.835,58
3	R\$ 84.181,00	R\$ 77.037,54	-R\$ 176.798,04
4	R\$ 89.602,26	R\$ 79.610,45	-R\$ 97.187,59
5	R\$ 95.372,65	R\$ 82.269,28	-R\$ 14.918,31
6	R\$ 101.514,64	R\$ 85.016,92	R\$ 70.098,61
7	R\$ 108.052,19	R\$ 87.856,32	R\$ 157.954,93
8	R\$ 115.010,75	R\$ 90.790,55	R\$ 248.745,47
<b>Sum PVs (Year 1 to 8)</b>	<b>R\$ 649.267,35</b>		
<b>Project NPV</b>	<b>R\$ 248.745,47</b>		
<b>Internal Rate of Return (IRR)</b>	<b>15,00%</b>		
<b>Profit Rate (TL)</b>	<b>1,62</b>		
<b>Payback Time (Discounted)</b>	<b>5,18</b>		

Source: The author (2020).

Figure 2 shows a projection of the project's accumulated present value over the plant's useful life, considering alternative II.

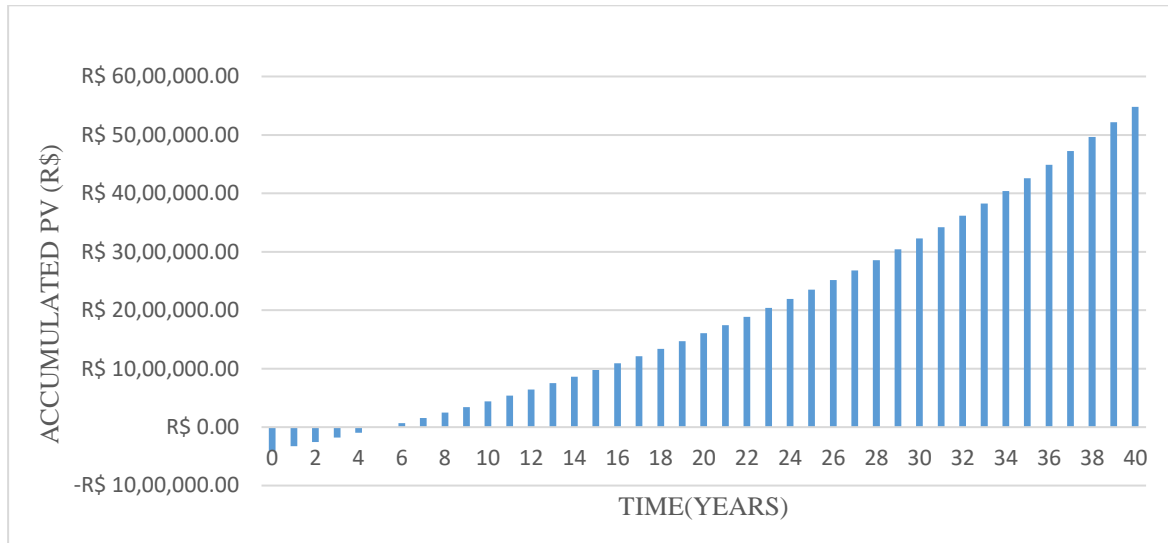


Fig.2: Accumulated Present Value x Lifetime Curve (Alternative II)

Source: The author (2020).

The economic parameters of Alternative III are shown in Table 6.

Table 6 - Economic analysis - CGH Martinuv (Alternative III)

ECONOMIC ANALYSIS - CGH MARTINUV			
<b>Total Cost</b>	R\$ 427.078,15		
<b>Discount rate</b>	3,00%		
Period (Year)	Cash flow	Present value	Accumulated PV
0	-R\$ 427.078,15	-R\$ 427.078,15	-R\$ 427.078,15
1	R\$ 74.302,66	R\$ 72.138,51	-R\$ 354.939,64
2	R\$ 79.087,75	R\$ 74.547,79	-R\$ 280.391,85
3	R\$ 84.181,00	R\$ 77.037,54	-R\$ 203.354,31
4	R\$ 89.602,26	R\$ 79.610,45	-R\$ 123.743,86
5	R\$ 95.372,65	R\$ 82.269,28	-R\$ 41.474,58
6	R\$ 101.514,64	R\$ 85.016,92	R\$ 43.542,34
7	R\$ 108.052,19	R\$ 87.856,32	R\$ 131.398,66
8	R\$ 115.010,75	R\$ 90.790,55	R\$ 222.189,20
<b>Sum VPs (Year 1 to 8)</b>	<b>R\$ 649.267,35</b>		
<b>Project NPV</b>	<b>R\$ 222.189,20</b>		
<b>Internal Rate of Return (IRR)</b>	<b>13,23%</b>		
<b>Profit Rate (TL)</b>	<b>1,52</b>		
<b>Payback Time (Discounted)</b>	<b>5,49</b>		

Source: The author (2020).



Figure 3 shows a projection of the project's accumulated present value over the plant's useful life, considering alternative III.

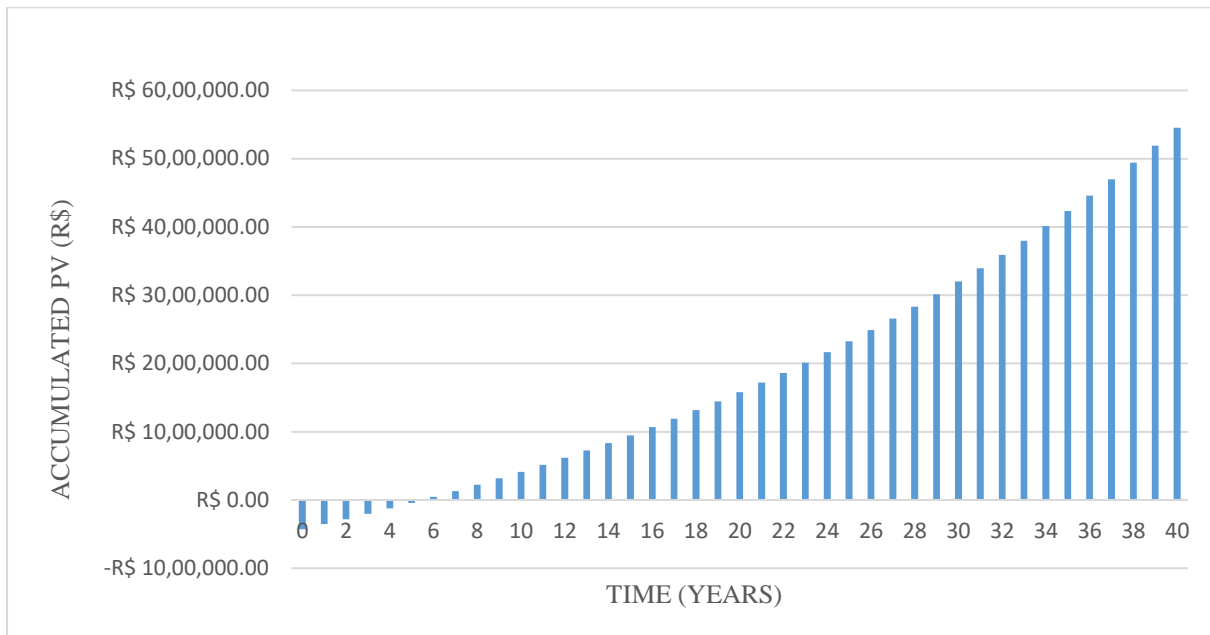


Fig.3: Accumulated Present Value x Lifetime Curve (Alternative III)

Source: The author (2020).

Through the graphical analysis it is verified that throughout the useful life of the enterprise the NPV accumulated for each alternative presented similar results. The NPV over 40 years for alternatives I, II and III is R \$ 5,425,512.86, R \$ 5,477,583.13 and R \$ 5,451,026.86, respectively.

**3.3 Summary of economic evaluation**

Through the economic viability analysis carried out, the repowering project under study proved to be highly viable for the project. The summary of the economic study is shown in Table 7.

Table 7 - Summary of the economic evaluation

Parameter	Alternative I	Alternative II	Alternative III
Total Cost	R\$ 452.592,15	R\$ 400.521,88	R\$ 427.078,15
Sum PVs (Year 1 to 8)	R\$ 649.267,35	R\$ 649.267,35	R\$ 649.267,35
Project NPV	R\$ 196.675,20	R\$ 248.745,47	R\$ 222.189,20
Internal Rate of Return (IRR)	11,68%	15,00%	13,23%
Profit Rate	1,43	1,62	1,52
Payback Time (Discounted)	5,79	5,18	5,49

Source: The author (2020).

It should be noted that in addition to the revenues used in economic calculations, there is an indirect economic return due to the reduction in the cost of maintaining the adduction channel and the plant's equipment.

**IV. CONCLUSION**

The repowering process proved to be very advantageous and comprehensive. Martinuv SHP (Vilhena/RO) is a power plant that, after ten years of operation, underwent a repowering process in the

expansion modality, in which it doubled its generation capacity (installed power) and even so presents possibilities for increment, as demonstrated in the present study, involving the lining of the adduction canal. The economic evaluation showed that the return on investment

is easily achieved, as demonstrated through the discounted payback of 5.79 years.

As for the lining of the adduction channel, the use of the Aquamat Flex HDPE geomembrane proved to be the most technically and economically feasible choice, enabling sustainable energy gains, without causing new environmental impacts.

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# Outrigger Connection of Multistoried Building at Plinth level to Increase Lateral Load Handling Capacity under Seismic Loading: A Review

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Received: 03 Nov 2020;

Received in revised form:

15 Jan 2021;

Accepted: 21 Jan 2021;

Available online: 31 Jan 2021

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**Keywords**— *Lateral loads, Multistoried  
building, Outrigger system, Plinth Level.*

**Abstract**— *Individually the building needs a table to withstand the system of combating large forces caused by earthquakes, wind etc. One of the premium arrangements is the outrigger system. The explosives of the building blocks hold the order of the earthquake loads. When the height of a building's height is greater than before, it becomes larger and the addition of tempting additions to counter programs such as runners is important. The use of a building directive can increase construction power by linking the main building to a remote colony and building whole-body operations as a single unit against such lateral effects.*

*The current review study deals with the fugitive and the investigation is based on the Outrigger Wall System by various investigators. These words are based on experiments in those elements including the Outrigger Wall which raises structural strength in terms of stability, durability, strength and level.*

## I. INTRODUCTION

With the increasing demand for high-quality buildings that encourage construction, as well as customization in the area, the various themes and daily expansions at high altitudes present the novel challenges and the need for new security systems. In order to survive earthquakes and strong winds due to structural improvements, such as unstable building developments and high altitudes, we need to break down some defenses. Small examples spaces, shortcuts, escape systems, and more. Outrigger structure always since the competition continues in the nation. The underlying reason under this is that when a load is taken from a building, in a system of vertical and vertical pillars, there are a number of similar loads made of the structure, and this load must be supported by the building itself. Since seismic activity causes vibrations from the ground, it is connected to the structure, and the most effective way to use this resistance to the structure is to use this joint system to use stabilizing materials, system

support belts, reinforcement and system support belt. Outriggers are objects that contain poles or contact plates from the center to the outside of both sides, preventing the formation and operation of connecting links. The base is made in the form of an available beam, which held tightly to the entire structure to withstand the loads and transport the same loads to the foundations. This type of construction provides high durability of the standard frame. The outrigger combines two elements to attach a strong body to withstand the force of an emergency. If an external reinforcement is inclined to deviate from wind loads or earthquakes, the outrigger connects a large wall to and from the top; the side load block replaces the complete layout of the structure. The best method used in multi-storey buildings is body support, be it a basic belt or a rafter strap system. These are real estate agents and communicators. They are called belt support systems because the belt usually consists of roads or bolts that connect a building line. The load is removed from each

object, still distributed evenly throughout the body. External straps and straps are used to absorb wave energy and maintain structural stability.

**Outriggers and Wallpaper Belts** As you can see this competition is happening in the country. The basic reason is that in carrying out the load of a building, with a straight and vertical support system, a large amount of the combined load produced by the building is available and that the load must be supported by the building itself. As the earthquake produces ground movement, it is connected to the building, and the most effective way to use it to resist the building using these integrated systems for the use of stabilizers, system support belts, and system reinforcement includes belt support.

Construction of buildings at the expense of engineering and construction of buildings as residences. A simple structure can be defined as a closed space with a roof, food, fabric, and basic human needs. In ancient times, people lived in caves, above trees or under trees, to protect themselves from wild animals, rain, sun, etc.,. As time went on, people began to live in houses built of tree branches. The whole process of construction and design requires not only thinking and calculation but also the scientific knowledge of architectural engineering to gain knowledge of particles, bidding rules and design codes, depending on experience and judgment. The builder must know his work and be able to follow the instructions of the engineer and be able to draw the necessary sketch of the building, auxiliary plans and building plans, etc., according to the requirements. Refugees are built these days in beautiful homes. Wealthy people live in luxurious houses. The buildings are an important indicator of social progress in the region. Everyone wants to have a comfortable home on average and usually spends a second of his or her home life, a sense of social security of responsibility. New strategies are developed daily for economic housing development, meeting the needs of community engineers and architects, planning and planning, etc. An artist is responsible for making construction drawings as instructed by the engineers and builders.

**Outriggers**

An outrigger is a rigid beam that attaches the shear walls to external columns. When the construction is subjected to seismic forces, the outrigger and the pillars resist the revolution of the core and thus expressively decrease the lateral deflection and base moment, which would have risen in a free core.

The outer outrigger system is a lateral load-resistant system in which the outer to outer columns are fastened in the middle and outward and with a belt loop at the levels or above. Belt trusses are fastened to the columns at the

edges of the building while the exterior attaches to the large or middle shear wall. This building system is often used as one of the building systems to effectively control excessive erosion due to lateral load, so that when light or medium load due to wind or earthquakes, the risk of damage to the structure and non-building is reduced. The outrigger system design response is based on the couple of tension conflicts placed in the outer columns. The outrigger acts as a strong arm that encloses the outer columns and the middle spine. The lateral load when inserted in the middle part is transferred to the pepper columns by outriggers and the rolling moment is reduced.

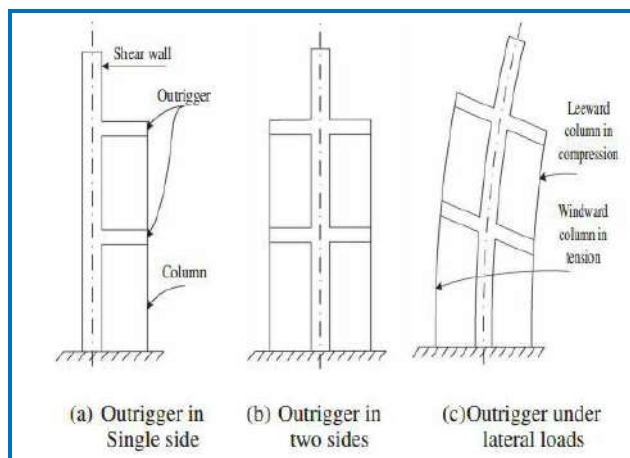


Fig. 1: Impression of Outrigger (a, b) & its consequence in Seismic Loads (c)

**II. LITERATURE REVIEW SUMMARY**

As a review paper discuss getting the current state of the story and seeing the current state claim. The review paper also looks at a shorter way to represent previously published work that focuses on reading, rather than writing new facts or analysis. They are written as investigative articles or, in a press release, a work-study framework. With the current project the test of the article is based on the Outrigger Wall and Outrigger title of the headline to be a grapevine of the topic information and the work and future tilt work done with the test support.

**1) Nadh VS, Sumanth BH (2020)**

The current study is based on the construction of timber and wood systems for High-rise buildings. The main emphasis is on providing appropriate topology and the construction of an outrigger system. The facilitator will provide a definition and explanation of the philosophies, expectations, ideas, and approaches used in the articles studied in good theory and structure. The findings help to understand how different parameters affect the appropriate topology and size of the design of a tall structure with a

truss and truss system. The code method is also accepted for standard or special constructions for tall buildings.

### 2) Patel N. & Jamle S.(Aug.-2019)

High-rise buildings and skyscrapers are the need of today's modern world. The safety and security of these types of structures are on priority. This paper is based on the new preventing structural system like bracing system. As the structure height increases it is important to adapt some preventing systems and bracing system is one of them. By reviewing and analyzing we found that the bracing system is one of the best systems for high-rised structures/buildings.

### 3) Dangi A. & Jamle S. (Sept.-2018)

Investigators are examining the Ground with a 10 Storey, 3-D made under the inspiration of an earthquake. Exit the site from the Taranath route. Response methods have been used with special care in the presentation of the seventh phase form by conformists, core welds, outriggers, and wall belts and outrigger belt and truss support systems. The base speed, axial column strength, and axial velocity members were studied. Excellent chapters of all the topics discussed in this article. Base Shear results show that feedback is more important than standard design which seems to be very helpful under the general wave of standard structure and key isolation. Shear Core outrigger and wall systems show good communication between all time-resistant cases. Underneath the power house shows a great deal where only Shear Core systems will be used. both of these concepts help to separate the forces of both Y and Z forces into agents. The agents of the agents had seen the beauty and elegance of the construction in the lower part and the fence. Summary parameter management issues in both Shear Core outrigger systems and bar support systems. The latter one, like the Wall Strap Wall, works much better than spears.

### 4) Das U., Pal A. et. al. (Oct.-2020)

All Buildings need a table to withstand the system of resistance to other wind-generated forces or strong earthquakes. One of the best programs is the outrigger. The structural explosives support the formation of the rear loads together. When the height of the structures rises to a great extent and the addition of tempting additions to resist systems such as a belt containing belts and exits is required. The use of a building code can increase the strength of a building by connecting a large building with a distant colony and making the whole body work as a single unit to withstand the load. Current review articles deal with research based on Outrigger Wall and Wall Belt Supported System by various investigators. This assumption is based on a review of Outrigger Wall and Wall Belt inputs that increase building performance with

durability, durability, strength and cost. It also concluded that these works vary in size and size of heights, depths and structures. The research also influences the system and is carried out according to the guidelines provided.

### 5) Das U., Pal A., et. al.(Oct.-2020)

The demands of multi-story building with architectural impact are increases day by say in all over the world. The multistory building improvement has spread rapidly around the world because now, people try to live in multi-storey structures. A Structure is said to acceptable if it satisfies the design criteria in it to resist the lateral forces, loads mainly from severe earthquakes. The shear wall was implemented to resist lateral loads. To fulfill these aspects the Outrigger & wall belt system should be used in the structure. In this project a G+20 Storey structure is analyzed using six different cases named as HP1 (Horizontal plan1) to HP6 (horizontal plan 6). 1 to 6 indicates ground level to 20 storeys. In this study a multi storey building consist of structure made up of G+ 20 storey's building in Zone III. The plinth area is taken as 900 m<sup>2</sup>. The 5 bay & 6 bay with grid spacing is taken 5 m. & 6 m in x and y direction respectively. For determination of Performance of structure under efficient location of single outrigger wall connection and wall belt supported system over horizontal plane in CSI-ETABS different levels of building is major objective of project. The project concluded that Optimum height for placing shear wall belt to increase lateral load handling capacity from above objective parameters will be at 11.50 m i.e. structure with shear strip at 3rd floor. Two more location also predominate in it i.e. 3rd & 6th floor. Analytically If N no. of storey is taken than optimum location lies under  $((N/2)-1)$  to  $((N/2) +1)$ , most preferably at  $(N/2)$  Storey.

### 6) Abrar Ahamad, Ankit Pal & et. al. (2020)

In the new era of high-rise building for current works and analysis, the construction of a multi-storey building is directed at the background loading with various porch areas. In addition to the dead load and the set load, seismic loads are used in the structure and in the structural analysis that is performed. Software design software is used for design and analysis. In the current or current situation, the G + 12 structure in position III is considered for Analysis. Analysis for earthquake zone III. The building model is analyzed and compared with the open area of the terrace zone zone III according to IS 1893-2016 spectrum analysis. Test results for Reset, Storey Shear, and Base Shear etc. Results are obtained and represented by the types of graphs and tables of the earthquake zone.

### 7) Abrar Ahamad, Ankit Pal & et. al. (2020)

This paper summarizes the determination of the beautiful balcony area with the help of the analysis method

using staad-pro software. It also describes the effects of earthquake and earthquake damage on multi-room buildings. The earth is full of buildings with many buildings and buildings so it is very important to make it safer for people and reduce its overall cost so land analysis can be important and mandatory in today's world. The analysis is also geographical. The software used for analysis is staad-pro.

#### 8) Mahendra Kumawat, Ankit Pal et. al. (2020)

In this age of multi-line architecture and architectural ideas, a new concept is needed. The various competitors around them create the design of their choice, as well as the market demand and multi-media structure, performing a very important role in new and innovative sectors. There are 5 complete SHAPES of the five-storey building in the middle ground area under the seismic zone zone III present This should explain the complexity of the region's production, as well as the concept of construction and construction. Following this, the storey drift is calculated in both X and Z ISHAPE directions and the most efficient Z ISHAPE will be analyzed after all the parameters. These types of buildings are the Twin Tower structure used in the modern world. In this study, the parameters of the test results such as migration and drift are found in the pillars of the multi-storey building of the Zone III earthquake tower. in a long and changing sense. Ground and integrated layouts on the same substrates require reliability in a constructive manner

#### 9) Aasif Khan, Ankit Pal (2020)

The building today is designed for many civilizations such as high-rise construction, etc., and where the need is met with new modernity and latest ideas. In Zone III, the effects of the earthquake affect the structure below 7 different level columns to reduce the basic migration. To reduce shear base, use the best column size for columns with the same concrete section in a multi-storey building under an earthquake load to study shear reduction and ensure E-Tabs software integration. The world is growing rapidly and the need for the world is for new ideas and technologies in the construction industry. High-rise buildings and high-rise buildings are the modern needs of the world. To make them safe, secure, durable and easy to use it is necessary to add new construction ideas to it. Reducing shear base under earthquake load is a new approach. In this way the column size of the upper floors is reduced which helps to reduce the basic shear of the building under earthquake load. It also makes the building more economical and reduces the dead load of the building. Many related founders have used them to build the structure in their own way and market needs. Parameters are estimated for effects such as migration and

drift based on the foundations of any multi-storey building located in an earthquake zone.

#### 10) Apoorva Joshi, Ankit Pal (2020)

The research article is based on the study of various research articles by various researchers using different soil categories. In the field of diversified, intermediate and flexible investigators are used in a variety of constructions to find the answer as opposed to shortcuts. The basis of the study determined that the superior investigator operates in the middle ground which is considered a reference. The vast majority of investigations are the basis of earthquake activity in it and a few are also wind limits. Under the construction of the building is somehow focused on the level of the concrete. Fertility is high in hard soils and in medium to medium soils and foundation adoption is much needed in soft soils.

#### 11) Apoorva Joshi, Ankit Pal (2020)

To make sure that the structure bear, all types of loads affect the structure, such as the structure's self-weight, dead loads, live load and seismic loads and its crash action on the structure such as seismic and wind force. The Grade of concrete used in the structure is one of the major parameters to guarantee strength & stability of the structure. The primary step in construction is the sub structure that rest on the subsoil beneath. The soil has diverse properties and phases in it. According to the Indian earthquake code, the soil can be soft, medium and hard soils. It can also be classified by zones. Therefore, structural requirement is to analyze the structure of the four diverse soil types, as the geography and layers of the soil surface differ according to the site conditions.

In this research the impact of Grade of concrete can be advantage to guarantee the stability of multi storey building. A G+16 Storey building having a plane area 576 m<sup>2</sup>. The two types of grade of concrete i.e. M25 & M40 is used in the structure. A concrete up gradation or concrete belt is used in the structure on the 6th, 7th, 8th 9th & 10th floor of the building. The collision of Concrete belt is analysed in soft soil. The outcome is based on the maximum Displacement, base shear, bending moments, Torsional moments & Stresses. The project concluded that The Structure Models case PP2 (6th floor beam M- 40 Grade of Beam) Show the most favorable Structure with All 6th floor beam M- 40 Grade of Beam. The importance of basis structure construction is used as M-40 grade concrete belt with 6 th floor, at plinth, all structure with M25 grade of concrete and then at the top floor(18 th floor) in decrement order.

**12) Shubham Patel, Ankit Pal (2020)**

India is a country where infrastructure is moving very fast and our country is the fastest economy in the world and infrastructure plays a very important role in it. The construction of the tallest building in India is growing day by day. As a result new ideas and engagements are needed to make the design safer, more financial and resilient. The basic shear reduction by using Beam's most favorable Size on Top Floors in the Multistoried Building at a different level is one of. It reduces the size of the pillar at the bottom of the building to reduce its weight.

**13) Shubham Patel, Ankit Pal (2020)**

Nowadays the building has been renovated in many modern ways and there is a need for it to be filled with new ideas and ideas. The diversity of the founders surrounded by those who were accustomed to do construction of their own choice and persist in the market. parameter of impact assessment such as migration and acquisition floor is available for the needs of any multi-storey building located in the Zone-III earthquake zone, seismic effects apply to construction under different sizes of large half to reduce shear. Shear base reduction using a large pole size on the upper floors of a multi-dimensional building to analyze shear base reduction and check the integration of E-Tabs design software.

**14) Ashish Sadh, Ankit Pal (2020)**

In India the population is slowly increasing and the land is needed for survival. For that reason multi-storey construction is the best way to build in big cities where a small amount of goods are introduced. As the designer knows the structure of many stories provides a large floor space in a small space and is also helpful. therefore, it is necessary to combine the top composition. When building high altitudes there are many structural problems that occur, such as the effect of lateral load, lateral migration and stiffness etc. Therefore, in the highest construction it is important to know the various loads and their effect on the structure. There are many types of results used in construction and the causes of failure. The effect of lateral load is very important to consider such as earthquakes and wind loads. In some cases the wind load is more important than the earthquake load depending on the location and location of the object separated by codes. Air load or air performance is as dangerous as an earthquake as the previous study shows. Defining the air has two elements firstly it helps to produce energy and provides relief in a hot and humid environment and secondly it is a food that leads to being an engineer they believe in. As a design engineer seeking to protect his structure This wind effect will create and produce air movement in construction. As high-rise buildings move from an envelope to a high-rise

building, designers face challenges not only in choosing materials that will carry side effects such as wind and earthquake load but also in designing design methods that meet the requirements of reliability and operation under winds. and above the wind. In IS Code 875 (Part3) -1987, the basic wind speed is specified on the map and divided into levels. The shape and size of the building are very important in air analysis, because the air pressure depends largely on the open construction space as opposed to the wind speed.

**15) Ashish Sadh, Ankit Pal (2020)**

Air analysis over the years has been regarded as a high level of modern architecture such as that high-rise buildings are recognized as a motionless cantilever structure at its base and free from other endings. These high-rise buildings are not the same in the system and have distinctive features that can be captured by the wind and its manifestations. A key step in this research project is to present the position of these tall buildings with a L-shape plan with a 20-story building at a minimum wind speed of 39 m / s. Using the Staad pro software, 4 cases have been processed. The size of the plan differs from both estimates where air is ventilated in all four directions. Comparison of outcome parameters such as displacement, tilt, axial force in the column, beam cutting in the long and extreme direction is made for all models and suggestions are designed to choose which position is best.

**III. CONCLUSION**

Based on the miscellaneous investigators learning on Outtrigger system the following suppositions are to be prepared. The assumptions are below:

- Problem-related assembly due to the spine is limited and with the outrigger system, the structural elements can be optimized using the axial force and stiffness of the outer pillars.
- Systems reduce the space delay compared to the expired method. The earth space does not contain any columns and resides between the base and the outer pillars; more importantly, an increase in the functional capacity of the structure occurs.
- The main objective of the investigators is to increase the stability of the building used, which is why the increase is being detected by various investigators.
- The most widely accepted outrigger program for enduring seismic loads.
- Under the contact behaviour of the soil structure, the systems consist of a fixed base, the position contains

an outrigger in complex matters informing the migration of small amounts.

- The extreme investigation is grounded on the finest tallness, shear wall position and elevation, differences in outrigger depth etc.

#### IV. FUTURE SCOPE

The subsequent forthcoming operated as carried out to get the information of outrigger system in the structure and to find profounder concept and novel substantial idea through it. There are as follows

- Positions based assessment of the structure to get optimizes location for tremor resisting building.
- Outputs based on the competence of outrigger.
- Dimensional analysis: differences in the depth, size of outrigger wall.
- Use of different types of structural form such steel, bundled tube, bracing etc and comparisons between them.
- Dynamic wind analysis such as CFD analysis or wind tunnel.
- Earthquake approach comparison such as Response Spectrum Analysis & Time History Analysis.
- Usage of divergent type's base isolation in outriggers system.

#### ACKNOWLEDGEMENT

I extend my deepest gratitude to Mr. Ankit Pal, Assistant Professor and Head, Department of Civil Engineering, Oriental University, Indore, (M.P.), for providing all the essential data related to the project, learning of software tools and supervision to do successful accomplishment of this work.

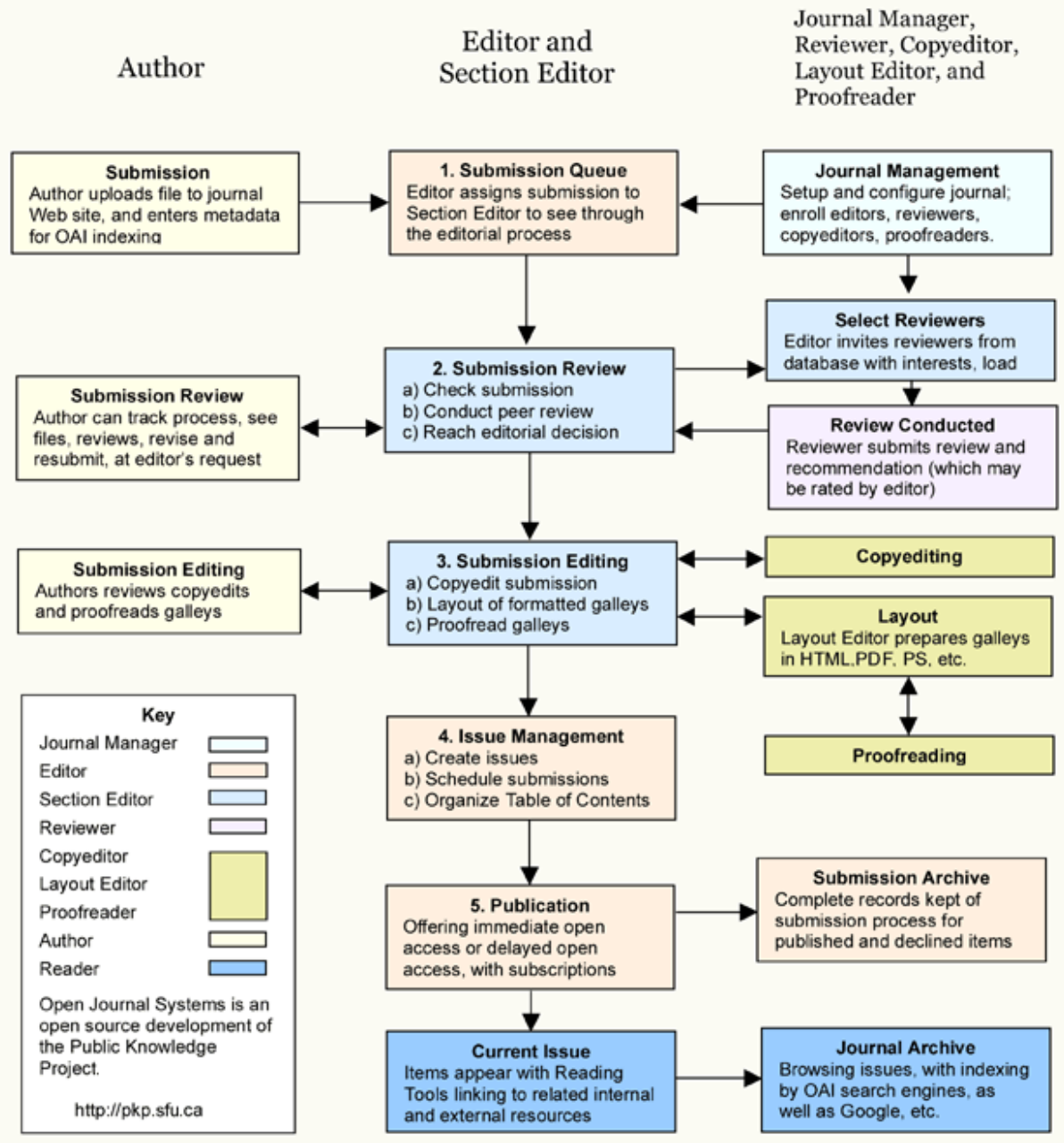
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