International Journal of Advanced Engineering Research and Science

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

(UAERS) An Open Access Peer Reviewed International Journal

Journal DOI: 10.22161/ijaers

Issue DOI: 10.22161/ijaers.74

AI PUBLICATIONS

AERS

Vol.- 7 | Issue - 4 | April 2020 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-7, Issue-4

April, 2020

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S. Suman Rajest

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Publisher

AI Publication Email: <u>editor.ijaers@gmail.com; editor@ijaers.com</u> Web: <u>www.ijaers.com</u>

FOREWORD

I am pleased to put into the hands of readers Volume-7; Issue-4: 2020 (Apr, 2020) 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.

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Global oil dependency and Security risk: "The scramble for oil Resource"

Dr. Charles Awoala Briggs

Southern University @ New Orleans, New Orleans, LA 70126. U.S.A.

Abstract— Exploration and production of crude oil is dependent on availability and access to reserves to enable a continued supply to satisfy the growing global demand for oil. Although oil is a depletable asset, it is a commodity that is irreplaceable with alternative sources such as natural gas and nuclear energy; therefore, there is the probability that in years to come people would live in a world without oil. Although many oil-producing nations have reserves, the Middle East seems to be more concentrated with oil reserves. The importance of oil has lead oil consuming nations to be concerned about the security of oil supplies from the major oil producing countries. The risk of oil supply has been a major security policy issue since the 1970's. Most of the Organization for Economic Co-operation and Development (OECD) economies' dependency on imported oil from the Middle East increased with the growth in political instability of the major oil exporting nations, OPEC's rising influence, the 1973-1974 Arab oil embargo (U.S. Department of State, 1976), and the nationalization of the upstream oil supply chain. Regrettably, all these could lead to, or give rise to erratic oil supply risk.

Keyword— Oil supply risk, oil Security, oil dependency, upstream oil supply chain risk.

I. INTRODUCTION

Global demand for oil is increasing, but supplies of this key energy source are limited, so availability will be constrained, and its price will rise with serious implications for prosperity and stability worldwide, creating a worsening security challenge. The Saudi spare capacity has deteriorated over the past decade, by one-half, from 3-4 million barrels per day to 1-1.5 million barrels per day. The loss of spare capacity will have strong implications for both the functioning of the oil market and the energy security agenda (Fattouh, 2006). To make matters worse, some experts question reserve estimates provided by national oil companies in the gulf and elsewhere, as the numbers are not independently audited. Without a clear understanding of how much oil is available, the world may be up for more nasty surprises (Cohen, 2007).Globalization today is drawing the oil producing nations together and increasing their interdependence, and the fates and prosperities of these nations are closely tied to the global economy. This globalization and interdependence are also creating new challenges for the oil industry; indeed, the biggest challenge is to provide significantly more oil at a reasonable cost in both a safe and environmentally friendly manner. Currently, the world's oil production and supply capabilities are reaching their peak while global oil production is barely one million barrels a day over global consumption. This means that the rising surge in demand from developing countries, especially China, will lead to global demand outstripping supply in the next two decades (Pocha, 2005:52). Recent rises in oil prices have spurred many new exploration activities, yet still, the oil industry faces the challenge of developing a comprehensive strategy to change the climate of oil investment, while building more tankers, pipelines, and refineries to adequately meet the rapidly growing global oil demand. Safety and security challenges in the oil supply chain are sometimes viewed as one physical security issue, but in essence there are emergency response, process control, physical and cyber security issues along the supply chain. Energy security conceptually means the "availability of energy at all times in various forms and in sufficient quantities and at affordable prices" (Umbach, 2003:141).In today's global economy, the importance of Africa's oil resources has indicated that the demand for energy is estimated to rise by more than 50 percent by the year 2030, of which 80 percent would still be met by fossil fuels (Global Energy Security Principles, 2006).

Indeed, the global economy operates based on a flawed premise surrounding the infinite and continued availability of natural resources and raw materials. However, it is a reality that the earth is a finite system with limited amounts of natural and raw materials that can be exploited and used towards capital accumulation. Consequently, the finite nature of the earth's resources is a potential catalyst for conflict and competition both between and within countries. As a direct result, the scarcity of the earth's resources has created an environment in which resource acquisition and subsequent security have taken center stage within many countries.The continued availability of affordable and uninterrupted supplies of crucial strategic resources has manifested into the securitization of resources and resource supplies (Rooyen and Solomon, 2007).

Like it or not, for as long as we continue to rely on petroleum as a major source of energy, our security and our economic wellbeing will be tied to social and political developments in these unpredictable and often unfriendly producers (Klare, 2004).

II. BACKGROUND OF THE STUDY

Oil serves a wide diversity of purposes, including transportation, heating, electricity, and industrial applications, and it is an input into over 2,000 end products (International Labor Organization 2002). It is used as a raw material in many chemical products, such as pharmaceuticals, fertilizers, plastics, solvents, and pesticides. Overall, petroleum products derived from oil, such as motor gasoline, jet fuel, diesel fuel, and heating oil, supply nearly 40% of the energy consumed by households, businesses, and manufacturers worldwide (Grant, K., Ownby, D., and Peterson, S.R. 2006). Despite the western multinational corporations' (the seven sisters) powerful economic control of oil production, other producing countries have an objective to control the supply and to earn a greater share of the oil income. Approximately 90 countries produce oil, although a few major producers account for the bulk of world output. The Middle East remains the biggest player in oil. Saudi Arabia alone possesses 21.9% of the world's proved reserves (BBC News July, 2008).

Oil resources play a very important role in the economic growth of every producing country; however, the reserves are not equitably distributed around the globe. According to a BP Statistical Review Report, about 61% of the world's proven oil reserves are located in the Middle East and Middle East countries who are producing about 30% of the total amount of the world oil production (BP, 2008 and Energy Information Administration (EIA), 2008).

The presence of oil has negative social and environmental impacts, from tanker accidents; further, routine activities such as seismic exploration and drilling have damaged the atmosphere and several ecosystems around the world. For example, crude oil spills from tanker ship accidents have damaged ecosystems in Alaska, the Galapagos Islands, Spain, and many other places around the globe. There are incidences of the search for oil, the likeliness of the oil industries to act in their best interests to optimize their profits, and the environmental destruction of oil leaks, that lead to protests and revolts by affected community groups. One unfortunate aspect of the oil industry is the heightened level of displaced peoples often associated with oil extraction in developing states. Once oil is discovered, it becomes the property of that country or, in the case of sales of concessions, the property of the company that first laid claim to it. In many cases the people who inhabited the region had no claim to the oil or right to the land. A gross example of this is the case of the Niger Delta Region where the Nigerian government has openly seized land and property from its own citizens for the sole benefit of companies such as Shell and British Petroleum (Salas, 2009).

Western countries are in search of new and secure oil farther away from the Gulf countries due to geopolitical risks, especially since 9/11 and the Iraq invasion. However, attention had shifted to West African countries, Central Asia, China and India, although the focus in China and India was more dispersed. In the global environment, the strategies used by the oil importing countries to secure oil reflect their perception of economic and political vulnerability. Overall, the countries that feel threatened by possible embargos, and supply disruptions tend to lean towards bilateral and regional alliances, while those who feel less threatened remain more market oriented in their strategies to secure oil for the economy (Noronha, 2005).

The 1973 and 1979-1980 oil shocks made "geopolitics of oil" the byword to describe the sources of uncertainty surrounding oil supplies and prices. Today, while geopolitics is not absent from the current oil shock, it is global economics that drive oil prices. In a world oil economy highly influenced by national oil companies, there are inevitable boundary issues, and in that sense, geopolitics still has a role to play (Munk, 2005). The stability of oil exporting nations is of paramount importance to the world oil

market. For example, the strike in Venezuela, the war in Iraq, and the disruptions of Angola and Nigeria oil were examples of what could happen if such incidents occur in other countries such as Saudi Arabia and Iran. Another OPEC oil embargo is very unlikely; however, if oil is ever used as a weapon to combat the United States or western foreign policy, or if sanctions were imposed on Iran, it will have devastating effects on the global economy.

Conflicts occur over control of oil, such as civil unrest or war that uses disruption of oil operations as a tactic, conflict with indigenous groups over oil development and even superpower geopolitics, e.g. control over Middle East oil reserves (O'Rourke & Connolly, 2003). Unfortunately, disagreement over control of oil revenue by ethnic groups has always destabilized countries and disrupted the flow of oil.

Research has shown that the price of oil accurately tracks geopolitical risk factors, with greater weights given to the politics of the Middle East. The greater the geopolitical risk at any time, the greater the price of oil and vice-versa (Shaunak, 2007). The issue of access to countries with oil resources is also mired in geopolitics. For both China and India, the Caspian Sea is a major attraction for its oil and gas resources. But the region is still difficult to access, given the geopolitics of the region and Russia's strategic interest to make it a part of its security system. The lack of a clear international legal regime on resource ownership centered around the issue of whether it is a sea or a lake, and the absence of institutions to ensure that oil development is smooth and instills confidence in international investors.

Moreover, even as the newly independent states of Azerbaijan, Kazakhstan, and Turkmenistan are eager to develop their resources and create international linkages, the region needs access routes to global markets for its energy resources. Since the existing transportation routes are mostly through Russia, attempts are being made to diversify these routes through other neighboring countries, both to increase geographical access to East and South Asia, and to reduce dependence on Russia. Until these issues – strategic, security, economic and legal – are resolved, the Caspian Sea energy resources will remain a potential source of great conflict as the scramble for resources increases. In the case of Venezuela on the other hand, China and India may benefit, as President Chavez sees oil as a 'geopolitical weapon' to contain the US. (Noronha, 2005).

III. LITERATURE REVIEW

In order to develop a comprehensive model for oil dependency and security risk and the oil supply chain network, some leading studies in fields of oil supply risk, oil availability and security risk, and oil supply chain risk management, are reviewed for this study.

Oil Supply Risk

Risk and uncertainty are a widely discussed issue in supply chain management literature and are often use synonymously. However, they are distinct concepts. Risk is often identified to be the consequence of uncertainty (Lalwani, Disney, & Naim, 2006). One of the most pressing areas for companies in today's global business environment is the assessment and management of risk. Managing risk is cited as one of the primary objectives of firms operating internationally (Ghoshal, 1987). In a modern complex decision-making environment, to mitigate risk, an organization must recognize the extent, likelihood, and consequence of the risk to the organization. Miller (1992) adopts the term 'uncertainties' to refer to the unpredictable nature of the operating environment in which companies operate, and then categorizes these uncertainties according to their source. Iwan, Suhaiza, and Nyoman (2009) argue that although supply chain management has always had a strong emphasis on risk, the notion of supply chain risk management has gained an increasing popularity in recent years due to increasing supply chain complexity. However, Faisal, Banwet, and Shankar (2006b) and Tang (2006) believe that effective supply chain risk management (SCRM) is an imperative for companies. Srividhya and Raj (2007) suggest that global corporations therefore need to develop and follow an all-encompassing and holistic risk management model - one that looks at all the uncertainties and their degrees of influence on the various segments of the global supply chain.

For the oil industry, the upstream sector is characterized as a "high-risk" industry due to the sizeable investment level, geological uncertainties, and other risks related to fiscal and political uncertainties with host countries. Therefore, the risks encountered in the upstream sector need to be addressed to ensure commercial viability of an oil project (Al-Thani, 2008). Risk management involves identifying the supply chain risk events, assessing the probabilities and the severity of impacts, prioritizing the risk event, and developing actions for mitigating the risk. It also involves the course of actions to consider in reducing the risks. According to (Iwan, Suhaiza, & Nyoman, 2009), risk management involves such options as transferring it to or sharing it with other parties, accepting it as it is, or avoiding the risk. Many studies exist in international literatures that identify specific risk in the oil supply chain. A proposed energy supply risk categorization falls into source dependence, facility dependence, transit dependence and structural risk, which includes natural disasters, political blackmail, terrorism, war, civil unrest, and etc (Weisser, 2005).

However, Stern (2002) categorizes risk in the energy supply to include import dependence, source dependence, transit dependence, facility dependence and security dependence. Fattouh (2007) categorizes risk in the energy supply to include war and civil conflicts, political instability, regime change, revolutions, successful terrorist attacks on oil facilities, export restriction, closure of trade routes, and sanctions. Mitchell (2002) stipulates that oil supply risk can be categorized according to the period: 1) Short term (12–18 months): disruptions of international supplies, 2) medium term (3–5 years): export cartel issues, medium term: political issues, 3) long term (10–15 years): resource shock, medium to long term: 'Real climate policy' shock.

Reports from the Department of Homeland Security (DHS), the U.S. Department of State, and the Federal Bureau of Investigation (FBI) have indicated that the petroleum industry may be a target of terrorism due to the inherent nature of the products used and its importance to the national infrastructure (American Petroleum Institute 2005). Attacks on oil installations have become the weapon of choice for the international terrorism, irrespective of the political system and social-financial boundary conditions of the society under attack (Steinhausler, Furthner, Heidegger, Ryndell, & Zaitseva, 2008).

Terrorist attacks, though not so often, can cause damages and disruption along the crude oil supply network. Specifically the petroleum industry may be a target for terrorism due to the following characteristics: 1) the physical and chemical properties of the products handled at petroleum sites, 2) the importance of petroleum to the national economy, 3) the importance of petroleum to national security, and 4) the symbolism of the industry as a cornerstone of capitalism and western culture (American Petroleum Institute, 2005). Regrettably, prominent terrorist leaders have consistently made it clear that the petroleum industry is one of their principal strategic targets. They have for several years denounced the West's "theft" of oil and resources from the Middle East and Africa; therefore, the strategy to attack oil interests is part of an overall "bleeduntil-bankruptcy" plan against the West and nations that are cooperating with the West and its corporate sector. The goal is to cut supplies or reduce them through any means (Goslin, 2008).Many Arab leaders understand the dynamic of the world's oil dependence. For example: in 1990, the late Yassir Arafat stipulated that:When the North Sea oil dries up in 1991, the United States will want to buy Arab petroleum. And when the American oil fields themselves run dry and oil consumption in the United States increases, the American need for the Arabs will grow greater and greater. (Mitchell G. Bard, 2006).

Terrorist attacks that have been carried out to date on oil infrastructure have caught oil producers unprepared. For example, al-Qaeda's February 24, 2005, attack on the Aramco facility in Abqaiq and Saudi Arabia sent shock waves through the world's financial markets. On the same day, the price of oil on international markets jumped nearly \$2.00 per barrel, despite the attack's complete failure (Cohen, 2007). Most analysts agree that the February attack, an additional attempt on March 28, 2005, and a 9/11-style assault in April 2007, all of which were successfully averted, were merely trial runs in a much longer campaign designed to disrupt the global economy in general, and the oil industry in particular (Stratfor Global Intelligence, 2006).

Since global economic survival depends on a continuous reliable supply of petroleum products, it is therefore imperative to mitigate security threats in this industry worldwide. The identified upstream crude oil supply chain risks includes 1) exploration and production risk, 2) environmental and regulatory compliance risk, 3) transportation risk, 4) availability of resource risk, 5) geopolitical risk, and 6) reputational risk. Briggs., Tolliver., & Szmerekovsky (2012).&(Briggs, C. 2017)

OIL AVAILABILITY AND SECURITY RISK

The oil industry is a combination of the global processes of exploration, extraction, refining, transportation, and marketing of petroleum products. Global demand for oil products is the fundamental driver of the oil industry; a relevant portion of the world economy and the growing worldwide welfare still relies on oil product consumption, both for industrial production and for transportation. The evolution of the Oil industry dates back thousands of years. Oil from its discovery was used in the Middle East in paints, lighting, waterproofing of boats and baskets, and even in some cases medication. Whale oil was used as a source of domestic light, which lead to an increase in demand for whales and subsequently an increase in the price of whale oil. As a result, commercial, industrial, and domestic users started seeking an alternative source, which later became widely known as "Black Gold" (Dimitrova & Lo'pez, 2005). Land oil wells were found below the seabed, which gave rise to exploration and the building of the first oil well in the open waters of the Gulf of Mexico.

In the 1920s land oil wells were found in Europe, and in the 1960s, exploration began in the North Sea, although without success until 1969 when a new field was discovered and explored west of Scotland in the Atlantic. Indeed, from 1948 to 1972, world oil consumption increased dramatically, hence this period was named "the golden age of oil". In 1960, the Organization of Petroleum Exporting Countries (OPEC) was formed, to unify the petroleum policies of the major 12 oil producing and exporting countries and began to control the oil business that benefitted its members. In 1961 the Organization for Economic Cooperation and Development (OECD) was formed which helped member countries expand in free trade and cooperate in issues of international economic importance: for example, dealing with the OPEC oil cartel.

In recent years, access to and control over oil is increasingly as important as actual ownership. As a result private companies are exerting critical control over the industry (O'Rourke & Connolly, 2003). Oil producing countries frequently exhibit some sort of nationalistic attitude towards their countries' natural resource endowments, hence the national oil companies (NOCs) are presumed to be the custodians of their countries' natural resources. A national oil company (NOC) is an oil company fully, or in the majority, owned by a national government. National oil companies that operate as an extension of the government or a government agency, including Saudi Aramco (Saudi Arabia), Pemex (Mexico), and PDVSA (Venezuela), support their government's programs either financially or strategically. The international oil companies (IOCs), including ExxonMobil, Royal Dutch Shell, and BP, are owned by their shareholders with the objective of maximizing shareholder's value. In contrast, the owners or shareholders of the national oil companies are the governments. As a result, NOCs were intended at their creation to do more than simply produce oil or gas for a nation (Marcel, 2006; McPherson, 2003; Stevens, 2008a; Van der Linde, 2000).

Exploration and production of crude oil is dependent on availability and access to reserves to enable a continued supply to satisfy the growing global demand for oil. Although oil is a depletable asset, it is a commodity that is highly irreplaceable with alternative sources such as natural gas and nuclear energy; therefore, there is the probability that in years to come people would live in a world without oil. Although many other oil producing nations have reserves, the Middle East seems to be more concentrated with oil reserves. The importance of oil has lead oil consuming nations to be concerned about the security of oil supplies from the major oil producing (OPEC) countries.

Hussain (2006) stipulate that under the right conditions, OPEC nations can meet the expected growth in the world oil demand by expanding its oil production if the oil industry will remain profitable, considering the fact that OPEC is not the only supplier of oil in the international market, and as a result, cannot guarantee stable price and availability of supplies to all consumers at all times.Further, Hussain (2006), also contends that to enable OPEC provide enough investments to increase capacity to meet the expected growth in oil demand it must be able to obtain reasonable oil prices in real terms, i.e, taking account of imported inflation and changes in the U.S dollar exchange rate; and a reduction of taxes in the major oil consuming countries that limits the growth in oil demand and thus reduces the income of oil producing countries.

This ultimately limits the producing county's ability to invest in their respective productive capabilities, such as exploration and development, and consequently they are unable to match significant increases in global oil demand. Given the global dependency on oil, an inadequate supply to meet the increasing global demand will be very devastating.

Cohen (2007) argues that the main problem of oil shortages today is not a lack of reserves in the ground, but a lack of access above ground. In the 1980's and early 1990's, several articles were written about ownership of oil resources. Thereafter, however, the industry received limited attention: oil prices were low, supply seemed secure, and the fall of communism opened new opportunities for the international oil majors (Wolf, 2008).

The risk of oil supply has been a major security policy issue since in the 1970's, as most of the OECD economies' dependency on imported oil from the Middle East increased with the growth in political instability of the major oil exporting nations, OPEC's rising influence, the

1973-1974 Arab oil embargo (U.S. Department of State, 1976), and the nationalization of the upstream oil supply chain. Regrettably, all these could lead to, or give rise to erratic oil supply risk. The threat of security of oil supply can be analyzed either in terms of demand for the producing country or supply for the consuming country. For the producing country oil security means security of demand, while for the consuming country it means security of supply (Opoku, 2009). Blum and Legey (2012) also contend that oil security is a key-element of economic development, therefore continuity, adequacy and affordability of energy supply must be guaranteed. Khatib (2000) also defines oil security as the continuous availability of oil in different forms, in sufficient quantities and at affordable price levels. Yergin (2006) defines energy security as the "availability of sufficient supplies at affordable prices." Kalicki and Goldwin (2005) similarly define energy security in terms of "provision of affordable, reliable, diverse and ample supplies of oil and gas and their future equivalents and adequate infrastructure to deliver these supplies to market."

Apparently, oil security issues are not a new concern; they have since become a matter of both national and international concern (Opoku, 2009). For example, oil producing nations, such as OPEC, also need security of demand from their oil, since the economic survival of such nations depends on revenues from oil exports in foreign currencies that are used in reverse to import goods and

required for development. Therefore, services any unexpected reduction in the demand for oil exports and hence oil revenue, will have economic and political impact on these countries.Regrettably, under such conditions the world could face a shortage in oil supplies, which would have negative effects on the global economy (Hussain, 2006). According to documented literature (Karl, 1997; Gary & Karl, 2003; Moody-Stuart, 2003; Christian, 2003; Kleveman, 2003; Stevens, 2003; Katz et al. 2004; Shaxson, 2005), oil can have increasingly negative impacts on low-income producing countries. These negative effects include low and sometimes negative economic growth for the country, poor provision of basic public services, weak governance, widespread poverty and insecurity (Keith, 2005). Ross (2001) confirms that these poor countries that are dependent on oil revenue often experience slower economic growth, high levels of corruption, higher military expenditure, and incredibly worse performance on child malnutrition reduction as well as adult illiteracy and are more vulnerable to economic shock. Poor nations that are dependent on oil sales for key revenues are often adversely affected by the ownership of the resource (Karl, 1997).

According to Energy Information Administration (EIA) report in 2008 depicted in figure 1, global oil consumption grew by 1.1% in 2007 and it was expected to increase in the following years.



Fig.1: Global Crude Oil and Liquid Fuel Consumption.

However, Energy Information Administration (EIA) revised its projections slightly upward for global oil consumption growth as the Asian-led recovery continues. China's consumption in December 2009, increased by 0.9 million barrels per day, or 12%, above year-earlier levels, as China's economic stimulus package continued to help push up both oil usage and economic growth. Due to the increased liquid fuel consumption by China, Energy Information Administration (EIA) revised its prediction for global liquid fuels consumption to grow by 1.2 million barrels per day in 2010 and 1.6 million barrels per day in 2011 after showing annual declines in 2008 and 2009(Energy Information Administration (EIA), 2010).

ECONOMIC FREEDOM AND OIL DEPENDENCY

Many oil fields around the world are headed for depletion. National statistics are unreliable at best, or classified at worst, and national oil companies control up to 80 percent of oil and natural gas reserves. The main problem of oil shortages today is not lack of reserves in the ground, but lack of access above ground. (Ariel Cohen 2007). Figure 2 below shows countries by their dependence on exports of fuel commodities, which include natural gas and coal, as well as oil and oil products. Saudi Arabia is ranked 11th. Countries where fuel accounts for more than 90% of total exports include Algeria, Azerbaijan, Brunei Darussalam, Iraq, Kuwait, Libya, Sudan and Venezuela. For an idea of which economies rely most heavily on oil, this chart using 2012 World Bank data shows oil revenue as a share of GDP. Saudi Arabia comes third, after Kuwait and Libya, with roughly 45% GDP depending on oil. (World Economic Forum 2016).



Fig.2: Fule exports as percentage of merchandise exports, 2013 unless otherwise indicated

World Bank data showing 2012 world oil revenue as share of GDP

Also, according to the U.S. Energy Information Administration (EIA 2010), U.S. liquid fuels consumption

depicted in figure 3, United States Crude Oil and Liquid Fuel Consumption, declined by 820,000 barrels per day (4.2 %) to 18.7 million barrels per day in 2009, the second consecutive annual decline.



Fig.3: United States Crude Oil and Liquid Fuel Consumption.

Despite the cold weather that gripped much of the nation in late December 2009 and early January 2010, total U.S. liquid fuels consumption in those two months still fell below the levels seen in the same months a year earlier. Nevertheless, EIA projects that total petroleum products consumption will rise by 180,000 barrels per day in 2010 because of the economic recovery that began in late 2009.

Among the major international oil companies, ExxonMobil ranked 14th, BP, 17th, Chevron, 19th, ConocoPhillips, 23rd, and Shell, 25th in 2006. These five firms only hold 3.8% of the world liquid reserves, which are in the United States and Canada. However, the top ten companies listed in Table 1 hold 80.6% of the total world liquid reserves (Robert Pirog 2007).

Rank 2006	Company	Reserves	Rank 2000	Company	Reserves
1	Saudi Aramco	264,200	1	Saudi Aramco	259,200
2	NIOC	137,500	2	INOC	112,500
3	INOC	115,000	3	KPC	96,500
4	КРС	101,500	4	PDV	87,993
5	PDV	79,700	5	Pemex	76,852
6	Adnoc	56,920	6	Adnoc	50,710
7	Libya NOC	33,235	7	Pemex	28,400
8	NNPC	21,540	8	Lybia NOC	23,600
9	Lukoil	16,114	9	NNPC	13,500
10	QP	15,200	10	Lukoil	11,432

 Table 1. World Liquid Petroleum Reserves Holdings (Millions of Barrels)

Source: Energy Intelligence Research, 2003.

Organization of Petroleum Exporting Countries (OPEC) members (Algeria, Indonesia, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela) account for roughly 76% of the world's proven oil reserves and 40% of world production.

OPEC countries and national oil companies already hold the majority of proven (published) oil reserves, and the percentage of reserves they hold is increasing. Evidently, this concentration further establishes their future importance as major players in the world oil market and could potentially increase market tension and upward pressure on prices as world oil demand rises. This increased oil demand and unequal access to reserves has led to situations where International Oil Companies (IOCs) struggle for access to hydrocarbon reserves, controlled by National Oil Companies (NOCs) (Ruud & Jon, 2008).In the '90s, highly volatile oil prices lead to a wave of consolidations in the oil market, which brought about structural shifts in the oil industry that have continued until the present day. During this period, a top echelon of four 'Super Majors' that was created (ExxonMobil, Royal Dutch/Shell, BP-Amoco, and Total FinaElf) have preponderance in the downstream, with 32% of global product sales and 19% refining capacity. This counterbalances to a large extent the dominant upstream positions of the four large state oil companies, Saudi Aramco, Petroleos de Venezuela, Iran's NIOC, and Mexico's Penmex. (O'Rourke & Connolly, 2003).



Table 2.

Brent crude oil spot prices averaged \$65 per barrel in November, indicating a decline of \$16/b from October, presenting the largest monthly average price decline since December 2014. EIA expects Brent spot prices will average \$61 in 2019 and that West Texas Intermediate (WTI) crude oil prices will average about \$7/b lower than Brent prices in the year 2020. NYMEX WTI futures and options contract values for March 2019 delivery that traded during the fiveday period ending December 6, 2018, suggest a range of \$36/b to \$77/b encompasses the market expectation for March WTI prices at the 95% confidence level. EIA estimates that U.S. crude oil production averaged 11.5 million barrels per day in November, showing an increase of 150,000 b/d from October. EIA expects that U.S. crude oil production will average 10.9 million b/d in 2018, up from 9.4 million b/d in 2017, and will average 12.1 million b/d in 2019.

EIA forecasts total global liquid fuels inventories will increase by about 0.3 million b/d in 2018 and by 0.2 million b/d in 2019. Global liquid fuels production is forecast to increase by 1.4 million b/d in 2019. Oil production is expected to grow in the United States to be partially offset by declining production elsewhere, notably in the Organization of the Petroleum Exporting Countries (OPEC), where EIA forecasts that liquid fuels production will decline by 0.9 million b/d in 2019. EIA expects global liquid fuels consumption to increase by 1.5 million b/d in 2019, with growth largely coming from China, the United States, and India. United StatesEnergy Information Administration (EIA 2018).

IV. RESEARCH METHODOLOGY AND PROBLEM DESCRIPTION

According to Blum and Legey (2012)energy security is not a new concept, however it requires new approach that covers supply and demand security. For several years different quantitative methods have been adopted to enhance rational decision making that involves multiple criteria, such as outranking method, judgmental modeling, weighted sum model, weighted product model, fuzzy sets, and AHP. In order to safeguard oil supply and demand security the AHP is considered as one well-known and mostused decision making models in situations where the decision criteria are based on multiple attributes.To the best of my knowledge there is no study to fill this gapit is therefore well suited for eliciting and modeling the risk management preferences in the upstream crude oil supply chain.

Analytic Hierarchy Process

The analytic hierarchy process (AHP) has found widespread application in decision-making problems involving multiple criteria in systems of many levels (Liu & Hai 2005). Tam and Tummala (2001) also identify its usefulness when several decision makers with different conflicting objectives are involved. The analytical hierarchy process (AHP) provides a framework to cope with multiple criteria situations involving intuitive, rational, quantitative and qualitative, aspects (Alberto, 2000). Hierarchical representation of a system can be used to describe how changes in priorities at upper levels affect the priority of criteria in lower levels (Chan, 2003). It organizes the basic rationality by breaking down a problem into its smaller constituent part and then guides the decision maker through a series of pairwise comparison judgments to express relative strength or intensity of impact of the elements of the hierarchy (Saaty & Kearns, 1985). The AHP methodology is a flexible tool that can be applied to any hierarchy of performance measure (Rangone, 1996).

In this paper, the decision relates to the choice of one of the alternatives. The three components identified in the problem solving are 1) system decomposition, 2) comparative assessment, and 3) synthesis of priorities. System decomposing refers to the formation of the hierarchical structure with the basic objective that is with its goal, criteria and objectives, and alternatives. The mathematical model is the second component of the process where the priorities (weights) of the elements are placed at the same level of the hierarchical structure and calculated. The mathematical model is the basis for generating the ranking scale. The third component of the model means that the generated local priorities of the criteria and alternatives are synthesized into the total criteria alternative priorities.

The application of this method begins with the necessary definition of the hierarchy model and its elements with the goal at the top, criteria as sublevels in the middle and, finally, alternatives at the bottom. The next step is to generate a mathematical model. This model is based on mutual pairwise comparison, i.e., at each level of a hierarchy structure its elements are subjected to pairwise comparison.

On the basis of the mathematical model, and from the assessment of the relative importance of the elements of the corresponding level in the hierarchy structure, local priorities, that is, weights of criteria as well as alternatives, are derived, and then synthesized in the total alternative priorities. In the end, the ranking list of the ranking values of the alternatives is obtained, so that the sensitivity analysis can be conducted.

The AHP has been a helpful methodology used in solving decision problems in studies such as supplier selection, forecasting, risk opportunities modeling, plan and product design, etc. (Siddharth, Subhash, & Deshmukh, 2007), as well as universally used in solving multi-attribute decision-making problems (Saaty, 1980). Dey (2001) described AHP as an effective tool for project selection. Dey, Tabucanon, Ogulana, and Gupta (2001) used AHP for cross country petroleum pipeline selection. Dey (2004b) used AHP in a decision support system for inspection and maintenance, a case study of oil pipelines. Nataraj (2005) used AHP as a decision-support system in the petroleum pipeline industry. Mustafa and Ryan (1990) used AHP for bid evaluation.

Despite the positive attributes, popularity, and simplified concepts of AHP that is widely reported in the literature, it is continuously being criticized for its inability to adequately handle the inherent uncertainty and impression associated with the mapping of the decision maker's perception to exact numbers. In the traditional formulation of the AHP, human judgments are represented as exact numbers. However, in many practical cases the human preference model is uncertain and decision makers might be reluctant or unable to assign exact numerical values to the comparison judgments (Felix & Niraj, 2005).

Although Belton and Gear (1985) and Dyer and Wendel (1985) criticize the AHP saying it lacks theoretical basis, Harker and Vargas (1987) and Perez (1995) counter the criticisms and contend that the AHP in fact, is based on a firm theoretical foundation.

AHP Application in Crude Oil Supply Chain Risk Management

Risk assessment is most powerful when historical data or subjective expert opinions are available; however, in a situation of uncertainty, potential outcomes cannot be described in terms of objectively known probability distributions, nor be estimated by subjective probabilities (Haimes, 1998). The application of AHP to the upstream crude oil supply chain risk assessment decision problem entails three broad phases:

1). Structuring the complex decision problem as a hierarchy, displaying the ultimate objective or the overall

goal of risk management, the various risk factors and the alternative criteria of the decision maker. This hierarchical structure enables the decision-maker in structuring the complex system into manageable sub-system.

2). The prioritization process accomplished by assigning numbers from a scale developed by Saaty to represent the importance of the criteria. A matrix with pairwise comparisons with these attributes provides the means for calculation. The decision maker evaluates each criterion against all others and can express a preference between each pair as equal, moderate, strong, very strong, and extremely preferable (important). These judgments can be translated into numerical values on a scale of 1 to 9, with 1 being equal importance and 9 being very strongly important (Saaty, 2000). The decision maker evaluates each criterion against all others, and value of relative importance is assigned to more important criteria and the reciprocal to the lesser important. Elements at each level of the hierarchy are compared with each other in pairs, with their respective "parents' at the next higher level. With the hierarchy used here, matrices of judgments are formed.

3) After assigning all the relative comparisons, the principal eigenvector of the effects table is calculated for each criterion, which is normalized across all the criteria to equal 1 (Levy &Gopalakrishnan,2009). With regard to the recommended steps by Saaty (2006), the hierarchy structure to model the upstream crude oil supply chain risk isshown in figure 4.

This section of the study is devoted to the categorization of risk that is taken into consideration in the risk assessment of the upstream crude oil supply chain. Since global economic survival depends on a continuous reliable supply of petroleum products, it is therefore imperative to mitigate the supply chain risks in this industry worldwide. The hierarchy structure to model the upstream oil industry supply chain risk, as shown in figure 4 identifies some upstream crude oil supply chain risks: (1) exploration and production risk, (2) environmental and regulatory compliance risk, (3) transportation risk, (4) availability of oil resource risk, (5) geopolitical risk, and 6) reputational risk. However, the alternative options proposed to manage the upstream crude oil supply chain risk as specified are: 1) Risk Acceptance. 2) Terminate or Forgo Activity. 3) Transfer or Share Risk. Briggs., Tolliver., & Szmerekovsky (2012).

It is therefore important to provide a methodology for identifying, analyzing, evaluating, and selecting a risk

treatment (mitigation) to manage these risks. Multi-Criteria Analysis Method and the Analytic Hierarchy Process was used to evaluate and prioritize these risks, as they are suitable methodologies to solve decision-making problems, while focusing on the upstream crude oil supply chain. (Briggs, 2017).

RISK ASSESSMENT AND PRIORITIZATION

Model Description



Fig.4: Oil Industry Risk Management Model

The Hierarchy Structure of the Petroleum Industry Supply Chain Risk.

Adopted from: Briggs., Tolliver., & Szmerekovsky (2012). Managing and Mitigating the Upstream Petroleum Industry Supply Chain Risk. Leveraging Analytic Hierarchy Process

Procedure

AHP application to the upstream petroleum supply chain risk entails three broad phases:

1). Structuring the complex decision problem as a hierarchy, displaying the ultimate objective or the overall

goal of risk management, the various risk factors and the alternative criteria of the decision maker. The structure of the hierarchy is organized by placing the objective at the first level, criteria second level, and decision alternatives at the third level as shown in figure 4. The identified decision criteria (risks) are: exploration and production, environmental and regulatory compliance, transportation, **availability of oil resource**, geopolitical and reputational risks. The alternative or preferred options of managing the risk specified at level three are:accept and control the risk, terminate and forgo activity, transfer or share risk. The prioritization process is accomplished by assigning number from a scale developed by Saaty to represent the importance of the criteria. A matrix with pairwise comparisons with these attributes provides the means for calculation. The decision-maker evaluates each criterion against all others and expresses a preference between each pair as equal, moderate, strong, very strong, and extremely preferable (important). These judgments are translated into numerical values on a Saaty's scale of 1 to 9. shown in Table 3, with 1 being equal importance and 9 being very strongly important (Saaty, 2000).

Table.3: Saaty's 1-9 Scale of Relative	Importance for Pair-Wise	comparison (Saaty, 20)06)
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Identity of Importance	f Definition	Explanation
1	The two objectives are equally important	Two activities contribute equally to the objective
3	One objective is moderately more important than the other	Experience and judgment slightly favor one activity over another
5	One objective is strongly more important than the other objective	Experience and judgment strongly favor one activity over another
7	One objective is very strongly more important than the other objective	An activity strongly favor one over another; its dominance demonstrated in practice
9	One objective is absolutely more important than the objective	Importance of one over another affirmed on the highest possible order
2,4,6,8	Intermediate Values	Used when compromise between the priorities are needed

Solution Representation

In the upstream petroleum industry supply chain risk analysis, the AHP is a useful technique to accommodate the multiple dimensions and conditions that constitute supply chain risk.

1. Establishing the pairwise comparison matrix A is as follows: Let $C_1, C_2, ..., C_n$ represent the

set of elements, and a_{ij} represents the quantified judgment on a pair of elements C_i and C_j . Here, the element a_{ij} of the matrix refers to the relative importance of the *i*th factor in response to the *j*th factor yielding an $n \times n$ matrix A as follows:



Here, $a_{ii}=1$ and $a_{ij}=1/a_{ji}$; for all i,j=1, 2, 3n. Therefore assigning the elements $C_1, C_2..., C_n$ to the numerical weights $W_1, W_2, ..., W_n$, reflects the recorded respondent judgments obtained. For example, from the Saaty's scale value of 1-9 in Table 1, if arespondent compares two elements, exploration/production risk (C_1) to environmental and regulatory compliances risk (C_2) and specified that C_1 is very strongly more important than C_2 then the numerical weight assigned to this pairwise comparison, $a_{12} = 7$, indicating that C_1 is 7 times more important than C_2 , forall $a_{ij} = 1$. However, if $a_{ij} = \alpha$ then for consistency, it is required that $a_{ji} = 1/\alpha$. Therefore, if $a_{12} = 7$, then $a_{21} = 1/7$ must hold.

2. Due to reciprocity, the application of the AHP, requires that if $a_{ij} = \alpha$, then $a_{ji} = 1/\alpha$, with $1/9 \le \alpha \le 9$. Since the matrices of the pairwise comparisons of an element at one level determine the achievement of the preceding level's objectives, the pairwise comparisons of the attributes at level 2 with one another in relation to their importance to the objective at level 1 in the hierarchy will require only n (n-1)/2 comparisons to build the matrix with a dimension n × n. Therefore, in the case of the petroleum industry, at level 2, the pairwise comparisons of the six attributes (risk factors) will result in a 6 × 6 pairwise comparison matrix.

Then at level 3, for each of the 6 attributes, the same procedure when used for pairwise comparison of the threealternatives will result in six matrices of size 3×3 . When the input matrices of the respondent's judgments are compared to themselves, the principal diagonal elements are all at unity, confirming that each element has equal importance. Therefore, if the elements *i* and *j* are judged to be equally important, then $a_{ij} = a_{ji}$ and $a_{ii}=1$, indicate that the lower triangle elements of the matrix are now the reciprocals of the upper triangle elements.

3. The AHP measures how consistent the evaluator's judgment is, by utilizing the consistency ratio

(CR), which is the ratio of the consistency index over random index. Considering A as a consistency matrix, the relations between weight W_i and judgments a_{ij} are represented as $W_i/W_j = a_{ij}$ (for all i, j = 1, 2 ... n) with assigned relative weight entering the matrix as an element a_{ij} , with a reciprocal entry $1/a_{ij}$ at the opposite side of the main diagonal will present the matrix of the pairwise comparison as follows:

(Eq.1)

AHP stipulates that since the evaluators do not necessarily know the vector of the actual relative weights, it is difficult to accurately construct the pairwise comparison of the relative weights of matrix A, rendering this observed matrix A to have inconsistencies. Several estimations made by evaluators may have created series of inconsistencies that need to be checked. Therefore, the weight W can be estimated from the following equation:

$$\Delta A * \Delta W = \lambda_{max} * \Delta W$$
 (Eq.3)

Where ΔA denotes the observed matrix of pairwise comparisons, λ_{max} is the maximum or principal eigenvalue of ΔA and ΔW is the vector estimator of W. According to Saaty (1980) since the maximum eigevenvalue λ_{max} is always greater than or equal to *n* (the number of elements) it should be an acceptable estimator of *n*. Conversely, when the observed value of ΔA is consistent, the value of the maximum eigevenvalue λ_{max} is always greater than or very close to *n*, allowing for the construction of the consistency index CI, and consistency ratio CR as follows:

C I =
$$(\lambda_{max} - n) / (n - 1)$$
 (Eq.4)

C R = (CI / ACI) * 100. (Eq.5)

Here ACI represent the average index of randomly generated weights. The AHP measures how consistent the evaluator's judgment is by utilizing the consistency ratio (CR), which is the ratio of the consistency index over the random index (RI) using equations 4 and 5 and the approximated random indices from Table 2.

Size of matrix (n)	1	2	3	4	5	6	7	8	9	10
Random Indices(RI)	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

Table.4: Approximated Saaty's AHP Random Indices (RI).

A consistency ratio (CR) which estimates the extent of inconsistency in each pairwise comparison matrix must be below a specific threshold. According to Saaty (1980), a deviation in consistency ratio of less than .10 or 10% is acceptable without adverse effect on the result, but considered to be inconsistent if greater than .10 or 10% and therefore the judgment is expected to be revised.

4. Aggregating the weights of the decision elements to provide a set of ratings for the decision alternative. Finally, the sensitivity analysis option of the Expert Choice enables the decision maker to graphically explore to what extent the overall priorities are sensitive to changes in the relative importance (weight) of each attribute or criteria.

Data Collection

In order to achieve the objectives of this study a survey questionnaire technique approach was used to collect data to specify the order of importance of the upstream petroleum supply chain risks. The questionnaire was designed to collect opinion of subject matter expert (Risk Managers) in the petroleum industry requiring them to respond to several pairwise comparisons where two categories at a time are compared with respect to the major goal.

Geometric mean scores were computed from the individual expert scores on Saaty's 1-9 scale provided by the petroleum executives. The Expert Choice 11.5 software package (2000-2004) based on AHP is used to estimate the weights of importance of the six major risk, as well as test the inconsistency among the individual expert's preferences. These judgments are entered employing Saaty's pairwise comparison scale in Table 5. The decision makers evaluate each criterion against all others and values of relative importance is assigned to more important criteria and the reciprocal to the lesser important. For example, comparing the geometric mean values of geopolitical risk to all other risk criteria, it shows the lowest value, indicating less important risk for the petroleum industry to manage.

Table.5: Geometric Mean of Combined Experts' Judgment Pairwise Comparison Matrix of Major Objectives with Respect	t to
the Goal	

	Exploration/ Production Risk	Environmental and Regulatory Compliance Risk	Transportation Risk	Availabilit y of Oil Resource Risk	Geopolitical Risk	Reputational Risk
Exploration/						
Production Risk	1	1.231144	1.048122	1.490182	2.085348	1.799592
Environmental and Regulatory						

Compliance Risk	.812252	1	.0581811	.933033	1.334188	1.474768
Transportation Risk	.954087	1.718772	1	2.724154	2.839053	1.987134
Availability of Oil Resource Risk	.671059	1.071773	.51186	1	1.533675	1.533675
Geopolitical Risk	.479536	.686201	.35223	.652029	1	.797577
Reputational Risk	.691503	.835959	.578068	.698827	1.253797	1

V. EMPIRICAL RESULT

Data Analysis

The pair-wise comparison of all the risk criteria generates a priority matrix as given in table 5, which that Transportation Risk, shows (.263),Exploration/Production Risk (.198)and Environmental/Regulatory Compliance Risk (.161) are the top three major risk areas in the upstream petroleum supply chain, followed by availability of oil resource risk (.150), reputational risk (.124) and geopolitical risk (.105).

Table.6: Priority Matrix for the Major Objectives

Objective	Priority	Rank
Transportation Risk	.263	1
Exploration /Production Risk	.198	2
Environmental and Regulatory Compliance Risk	.161	3
Availability of Oil Resource Risk	.150	4
Reputational Risk	.124	5
Geopolitical Risk	.105	6
Inconsistency Ratio	0.03	

Sensitivity Analysis for Major Decision Objectives

The sensitivity analysis option of Expert Choice Software enables the decision maker to graphically explore the response of the overall alternative policy options and changes in the relative importance (weight) of each attribute or criterion. This is an important aspect of using AHP in analyzing problems, since results are based on subjective expert assessments. A series of sensitivity analyses were conducted using Expert Choice Software includes 1) performance, 2) gradient, 3) dynamic, 4) head to head, and 5) two-dimensional plots. Each of these five graphical modes expresses different viewpoint to a sensitivity analysis, enabling the user to easily manipulate the criterion priorities and instantly observe the impact of the change that is reflected in the ranking of alternative.

Performance Sensitivity Analysis

The performance sensitivity analysis depicted in Figure 1 represents the variation of the alternative policies' rankings to changes in each criterion. It shows the ratio of each alternative's weight percentage to criteria weights.



Fig.5: Performance Sensitivity Analysis.

Determining the best risk mitigating strategy, the decision maker will read the overall priority from the observation of the right "y"-axis and the overall priority for each alternative risk management strategy. The right "y" axis represents the overall priority of each alternative (with the OVERALL axis showing the overall priority of each criterion). The result shows that accept and control risk is about .45 (45%), transfer or share risk is about .31 (31%), and terminate or forgo risk is about .25 (25%). The vertical bars represent the derived relative priorities of each criterion. The left "y" axis represents the relative priority of each criterion as synthesized from the expert's pairwise comparisons. Based on the result, exploration and production risk is about .20 (20%), environmental and regulatory compliance risk is about .18 (18%), transportation risk is about .28 (28%), availability of oil resource risk is about .16 (16%), geopolitical risk is about .10(10%), while reputational risks is about .11(11%). In reference to alternative policy priorities with respect to each major objective while reading from the right "y" axis, with respect to exploration and production risk, accept and control risk is about .91 (91%), transfer or share risk is approximately .40 (40%), and terminate or forgo activity is about .35 (35%). For environmental and regulatory compliance risk, accept and control risk is about .70(70%), transfer or share risk is approximately .55(55%), while terminate or forgo activity is about .42 (42%). Regarding transportation risk, accept and control risk is about .70 (70%), transfer or share risk is about .55 (55%), and terminate and forgo activity is about .40 (40%). With respect to availability of oil resource risk, accept and control risk is about .85 (85%), transfer or share risk is about .40 (40%), and terminate or forgo activity is about .40 (40%). For geopolitical risk, accept and control risk is about .70 (70%), transfer and share risk is about .55 (55%), while terminate or forgo activity is about .41(41%). With respect to reputational risk, accept and control and transfer is about .71 (71%), transfer and share risk is about .55(55%), while terminate and forgo is about .40 (40%). Finally, for the overall, accept and control risk is about .75 (75%), which is still the best risk mitigation strategy followed by transfer or share risk which is about .30 (30%), and then terminate or forgo activity at about .25 (25%). It can be seen in Figure 6-A scenario 1 that changing the criterion value with respect to environmental and regulatory compliance risk from .18 to .30 does not change the ranking of the alternatives, and that accept, and control risk still remain the number one alternatives.



Fig.6-A. Performance Sensitivity Analysis: Scenario 1. With Respect to Environmental and Regulatory Compliance Risk.

It can be seen in Figure 6-B scenario 2, that changing the criterion value with respect to transportation risk from .28 to .35 did not change the ranking of the alternatives and that accept, and control risks still remain the number one

alternative. However, upon conducting the sensitivity analysis for the rest of the decision criterion such as availability of oil resource risk, the rankings still remain insensitive.



Fig.6-B: Performance Sensitivity Analysis: Scenario 2. With Respect to Transportation Risk

VI. SUMMARY AND CONCLUSION

Risk is defined as a potential future event that may influence the achievement of objectives; that includes upside and downside risks. Effective risk management increases the value of business decisions because conscious choices are made in relation to risks that have an impact on, or result from, these business decisions. The objective of risk management is not, therefore, arbitrarily to reduce or eliminate risk. In general, many people are involved in managing risk, and risk management, which is an integral part of the group's management activities (strategy, planning, execution, operation, monitoring, and appraisal); it is not a separate activity. Risk management is the responsibility of those who are accountable to deliver the associated objective; therefore, the identification of the risk can only have value or meaning when explicitly linked to the objective.

This research involves the evaluation of the actual oil industry to identify and select an appropriate upstream

crude oil supply chain risk management model leveraging analytic hierarchy process (AHP). The AHP provides a framework to cope with multiple criteria situations involving intuitive, rational, quantitative, and qualitative aspects. This study shows that the AHP is appropriate for developing such a model. It organizes the basic rationality by breaking down a problem into its smaller constituent parts, and then guides the decision maker through a series of pairwise comparison judgments to express relative strength or intensity of impact of the elements of the hierarchy. The AHP methodology is a flexible tool that can be applied to any hierarchy of performance measure; in addition, the AHP model is effective in decision making. Themost essential goal of this research is to identify the potential risk sources, model the risk management, analyze and evaluate the potential impact of risks, and propose risk treatment in terms of the most important risk to manage and finally select the appropriate alternative options to minimize, such as accept and control risk, terminate or forgo activity, and transfer or share risk.

To achieve the objectives of the research, a survey questionnaire approach was used to collect data to specify the order of importance of the upstream crude oil supply chain risks. The questionnaire was designed to collect opinion of subject matter expert (risk managers) in the oil industry. The result of the survey questionnaire was used as input to the AHP, and the result of the pairwise comparison of the major objective indicates that the most important risk to minimize and manage in the oil industry is transportation risk with priority of .263 (26.3%). This verifies the fact that transportation in the petroleum supply chain is the central logistic that links the upstream and downstream functions, playing a crucial role in the global supply chain management in the oil industry.

Exploration/production and environmental and regulatory compliance risk are also identified as major risk factors with priorities of .198 (19.8%) and .161 (16.1%) respectively. With respect to major objectives or goals, the most preferable risk management policy option based on the result of the composite score is accept and control risk with a score of .446 (44.6%) followed by transfer or share risk at .303 (30.3%). The least likely is terminate or forgo activity .251 (25.1%). In most comparison processes it is obvious that some inconsistencies would occur. However, Saaty (1980) specify that an inconsistency ratio of about .10 (10%) or less may be considered acceptable without adverse effect on the result. The overall inconsistency ratio for the aggregate response is .03 which is below the Saaty's recommended threshold for an acceptable inconsistency.

However, the results also indicate inconsistency ratios for the different decision alternatives. With respect to; transportation risk inconsistency is.05, exploration and production risk is .02, environmental and regulatory compliance risk is .05, availability of oil resource risk is 0.0, reputational risk is .05 while geopolitical risk is .05. Overall, the respondent judgments indicate reliable expert judgment.

To gain more in-depth insight of the problem and result, sensitivity analysis options of the Expert Choice Software was performed to further study the effect of changing the weights of criteria on the overall weight of the alternatives. The results of such analyses also indicate that transportation risk is most prominent while accepting and controlling risk is also the most prominent alternative risk management option. In the oil industry, accepting and controlling risk for example; reputational risk became an issue as a result oil spill. Companies in the oil industry have a long history of neglecting environmental issues but consequently as a result of public outcry, accepted the risk of oil spill and put in place some appropriate controls to reduce their reputational risk as much as possible. Transportation risk in the oil industry could be managed to an acceptable level. However, these companies in the industry today deal with several issues such as; globalization, regulatory compliance, increased environmental pressures, mergers and acquisitions that combine make operational risk management a complex and difficult task for the oil industry.

According to Ariel Cohen (2007), Two-thirds of the world's oil reserves are concentrated in the increasingly unstable Middle East and are controlled by members of the quasi-monopolistic Organization of Petroleum Exporting Countries (OPEC). Over the years, OPEC has been quick to cut supply and slow to increase production, bringing oil prices to today's high levels. Most OPEC member countries and other oil producers have high levels of government economic regulation and corruption, as documented in the Index of Economic Freedom, published by The Heritage Foundation and The Wall Street Journal. Thus, consumers are effectively paying two premiums on oil--one for security and one for suppliers' economic inefficiency and monopolistic behavior.Collaborative interest can also mean collective security and corporative protection of the flow of oil, which benefits both producing and consuming nations. A shortfall or slack in this endeavor may play into the hands of insurgents and international terrorists that seek to alienate, divide, and defeat national interests, especially industrialized western nations. Considering the importance of the oil supply risk issue, a number of future potential research areas can be recognized to achieve an integral examination of the subject area. In fact the quantification and assessment of each risk's probabilities might be an important and demanding task that probably has never been attempted. This might also be true for the impact of each of the risks as well. Recent events have suggested that greater clarity is needed in terms of who is responsible for managing risks, especially transportation and exploration/production and availability of oil resource risk.

This study has opened the door for further studies to be conducted and to investigate the risk impact on other sectors of the oil industry.

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Prototype of robotic mechanical prosthesis of upper limb at low cost

Thiago A. do Carmo¹, Regina E. S. Cabette², Renato G. Gomes³

¹Mechanical Engineering - Salesiano University Center of São Paulo - Unisal, (Rua Dom Bosco, 284 - Centro, 12600-100, Lorena - SP, Brazil)

²Nuclear Engineering Graduate Program, Federal University of Rio de Janeiro - UFRJ/COPPE/PEN, (Av. Horácio Macedo, 2030, Bloco G, Sala 206 – CT, Fundão, 21941-972, Rio de Janeiro - RJ, Brazil)

³Nuclear Engineering Graduate Program, Military Institute of Engineering (Praça General Tibúrcio, 80, Praia Vermelha, 22290-270, Rio de Janeiro - RJ, Brazil

Abstract — The development of prostheses with robotics and programming solutions can be a viable low-cost alternative for simulating the functions lost by disabled people. These prostheses can be used as part of recovery and reintegration of these people with limitations, such as picking up objects and feeling textures due to the loss of part of the arm, either in the surgical process, due to genetic malformation, or by accident. Mechanized prostheses still have a high value of market, which contribute to low purchasing power, making the acquisition of this type of material unfeasible. Based on this reality, the present work aims to improve mechanical prosthesis of the upper limb with anthropomorphic characteristics focusing on low financial cost. To this end, we sought to develop prosthesis composed of mechanical parts designed in simplify3D V4.1 software for printing on a 3D machine (Anet A8), whose modeling was performed by the Autodesk Inventor program (student version), also employing EMG and force sensors Strain Gauge, whose commands were programmed on a nano Arduino platform. The results showed that the EMG sensors capture the neural signals and route them to the nano arduino providing the opening of the fingers of the projected mechanism. The force sensors also presented the closing of the fingers in a satisfactory way. Therefore, the work was relevant for the social aspect, in the development of mechanical prosthesis with accessible values, not compared to the values practiced by the market. The importance of works of this nature demonstrate the results of interdisciplinary knowledge in engineering solutions under current demands in the presentation of viable alternatives that can be improved in future research and in the creation of products.

Keywords— Mechanical prosthesis, anthropomorphic, electromyography, robotics, 3D printing

I. INTRODUCTION

The development of prostheses for the rehabilitation of amputees has been evolving in the market, however these mechanisms have a disadvantage in commercial acquisition. The prices charged for these prostheses are above the acquisition conditions for a large part of the population undergoing rehabilitation. The purchase of a prosthesis by people with low acquisition value ends up not being viable, and thus, they opt for non-automated mechanisms with low mechanical control and interaction with the user [2]. Studies are carried out to measure how expensive it is to develop low-cost mechanisms. In view of this problem, aiming at the design of prostheses with low cost, 3D printing has stood out in the academic environment, as it is possible to print models with characteristics similar to those of humans, giving it the ability to approach the resourcefulness of real human parts [1].

The interaction between man and prosthesis is based on the reading of the electromyography activity, where the measurement of the electrical activity in the muscle ventricle is performed through electrodes superficial to the muscle ventricle. Based on muscle contraction, it is possible to control the parts of the prosthesis by manipulating neuromuscular activity [3]. However, the high cost of these prostheses is due to the technological application and the materials that make up their structure, such as titanium or carbon. The sensors used in the structure perform the precise measurement of neural activity, and thus, situations like these allow isolating movements, giving the mechanism the ability to perform such movements similar to the original human physical structure [4].

The present work aims to present the development and improvement of upper limb prosthesis with anthropomorphic characteristics focusing on low financial
cost. The project will consist of parts consisting of a 3D printer, using EMG sensors and strain gauge force sensors.

Thus, relying on mechanisms aimed at assistive technology, such as the use of 3D printing, it is believed that there is a possibility to develop a mechanism capable of improving the social interaction of a person with physical limitations, increasing their ability to handle objects with greater skill, and also assist in a better quality of life [7].

II. MATERIALS AND METHODS

In order to develop a mechanism capable of matching up with human reality, during the planning for the design of the project, a compatible sketch was designed for printing. The equipment used was the AnetA8 printer. Based on this model, a line of development was traced in which each segment should be modeled within the AutoDesk - Inventor student version 2018 platform.

Each structure was designed in such a way that all parts were able to interact mechanically, being then equivalent to the bone structure present in the composition of the human hand (Figure 1), which is composed of 27 bones. Thus, at the end of the modeling of the structures, the equivalent of 37 pieces was reached, all of them structured so that it was possible to pass internal cables to perform the movement of the fingers during an action (Figure 2).



Fig. 1: Comparison between real model (left) & Developed in this work (right).

In its internal structure, perforations were arranged for the passage of cables with a diameter of 2 mm, the cable used in the assembly was of the type nylon monofilament with a diameter of 0.62 mm with mechanical resistance of 407.12 N (Newton), and to fix the fist by hand and fingers (thumb, ring and minimum), hexagon steel screws with a diameter of 12mm and a length of 70mm were used. Due to the easy deformation of the PLA material when inserting the screw, it was not necessary to use nuts to keep the structure fixed. To join the finger links, 1.5 mm hard copper was used in all joints.



Fig. 2: Structure for cable routing.

To perform the printing of this 3D model of the prosthesis, the AnetA8 printer was used, as seen in Figure 1. This equipment comes from the factory with some limitations, such as: it does not have depth sensors to detect the approach of the extruder nozzle to the table and the sensors present are of the limit switch type. This feature, when not manually adjusting the table, can cause a collision between the extrusion nozzle and the table. Also, after the first impression, there may always be a mismatch of the side butterflies that attach the platform to the lower Z-axis carriage. In view of such measures, it is deemed necessary to carry out the automation of these calibration processes in order to increase the print quality and reduce the amount of adjustments between each print.

As a measure for the level switch with end-of-stroke characteristics, an inductive sensor was implemented due to its characteristic of detecting metallic materials, due to the printing platform having metallic characteristics. With the change of the Y axis sensor, it was necessary to update the firmware of the printer itself, modified to Merlin version 1.1.9. This version provides table calibration at 4, 6 and 9 points of precision. This calibration also allows that during printing the first layers are well adhered to the table avoiding deformation or poor filling of the initial layers. Based on the unevenness of the table, supports of the lock type were printed in the printer itself, in order to avoid loosening the butterflies that hold it, these modifications were made available on the website Thingiverse - Digital Designs for Physical Objects.

The filament adopted to compose the prosthesis in this first phase was the PLA. Its use was due to the assumption that this component suffered less impact on its structure during the sudden change in temperature, as the anetA8 printer has no control against external changes in temperature. This aspect, the material can be altered by a low intensity breeze and contribute to the solidification of the melted material. The PLA has a melting point of approximately 190°C, its adhesion to the table is much simpler, so it is unnecessary to apply substances to improve the adhesion of the filament in the first printing layer (MACHADO, 2018). The software used for printing and configuring AnetA8 parameters was simplify3D V4.1. This software allows you to estimate how much filament will be consumed in each piece and its printing time. With these parameters it is also possible to assess how much energy will be spent to keep all and equipment up and running.

To perform the movement of the prosthetic fingers, high torque 13 kg / cm servo motors were used when powered at 4.8v, with 4.8 - 7.2 V operating capacity. The gears that make up the MG996R model (Figure 6), are made of metal which allows less wear between the gears and allows greater reliability in torque during the movement of the fingers, which can prevent wear on the gears and loss of efficiency during the movement of the prosthetic fingers.

The electrodes used were surface and EMG Advancer sensors to collect the electrical activity present in the muscle ventricle during contraction. They will be distributed over the biceps brachii muscle 1 in its medial part (muscle ventricle), one at its insertion (radial tuberosity) and the other on the brachioradial muscle. The EMG Advancer sensor (Figure 3) works directly with an amplified (rectified) signal, which allows direct use in a microcontroller.



Fig. 3: Sensor EMG Advancer V3.

http://qqtrading.com.my/electromyography%20sensoremg-muscle-activity-monitor-kit> acesso em 08 novembro 2019.

To measure the pressure of the fingers on the surface of the palm, the use of a force sensor with a measuring range between 100grams to approximately 10kg was adopted, with a detection area of 15mm in a circular format. They were conceived to interact motors and fingers, being the best option for the use of DAIYAMA fishing line MAX force model of diameter 0.62mm with capacity to support up to 40kg.

Evaluating situations where the contraction stops performed by the engines were necessary, stain gauge sensors were inserted in the palm of the prosthesis. The purpose of this sensor was to prevent structures from being detected during the closing movement of the fingers, and during contact, it prevents the fingers from closing irregularly, causing damage to the structure. The sensor has a circular shape with approximately 10 cm in diameter and is located on the palm of the prosthesis.



Fig. 4: Sensor Strain Gauge.

https://www.robocore.net/loja/itens-eletronicos/resistorsensivel-a-forca-redondo> acesso em 16 novembro 2019.

III. RESULTS

With the positioning of the EMG sensors on the biceps musculature, it was possible to observe the signal propagated in the muscle ventricle at the moment when the muscle fiber is stimulated. Thus, Figure 6 shows peaks above 200 mv for contraction of the muscle ventricle. In this step, the EMG sensor, in addition to measuring the information, enlarges it so that it is possible to read through the analogy input of the arduino nano 3.0 (Figure 6).



The signal measured by the sensor is measured and amplified by operational amplifiers included in the EMG advancer V3 sensor. Still in Figure 5, on its left side we will have illustrated the input of the signal emitted in the muscle ventricle, where it has alternating AC characteristics with voltages from -90mv to + 90mv, and so that the signal can be interpreted by the controller analog input, the signal needs to be rectified to continuous DC, in this specific case 4.15V shown on the right side of the graph in Figure 6.



Fig.6: Graph. 2 Stimulus 1: Biceps brachii. During execution of the opening and closing functions of the prosthetic fingers, specific values were set that could be easily interpreted by the logic implemented in the micro

controller, in other words the Setpoint used was ≥ 200 mv. Thus, when reaching the setpoint, the prosthesis will perform the function of closing the fingers.

In the same way, Figure 7 shows the contraction, but with regular periods of isometry of the biceps. That is, not to changes in the stimulus that may cause noise during the execution of the function that will close the prosthetic fingers.



Fig.7: Stimulus 2: Biceps brachii.

To control the excessive closing of the fingers, in addition to the rotation control of the servo motors limited to 180°C, also with the close function, parameters were included to control the strain gauge force sensor inserted in the palm of the hand, where the same when measuring equivalent force at 300g, the function closes and pauses and after 5 seconds the function opens, responsible for returning the fingers to their initial position.

Regarding the Strain Gauge sensor, the resistance variation when different from "0", the controller will use the analog port reading stored in the variable (fsrADC) named (FSR_PIN) to perform the voltage calculations (fsrV). The VCC values were predefined with the value of 4.98, a voltage similar to the Arduino analog port defined in a datasheet equal to 5V.

Then the resistance (fsrR) is calculated with values of R_DIV equal to 3230.0 (3.3k Ohms). Then the estimated force calculation will be given based on the change in resistance as mentioned above to define the electrical conductance, then estimate the force exerted on the pressed area, where the resistance values (fsrR) less than or equal to 600 must perform the expression F = (fsrG - 0.00075) / 0.0000032639 and greater than 600 F = fsrG / 0.00000642857. Finally, uniting all the components, the prosthesis is finalized.

IV. DISCUSSION

During the initial tests with a force sensor positioned in the palm of the hand, there were satisfactory results, however, there is a need to implement a larger group of sensors allocated to the fingers and palm. In this way, a single sensor is capable of capturing the pressure exerted by the objects during the closing of the fingers, since when implementing the 3.3k Ohms resistance, it was observed that even before the object touches the surface of the sensor, the same detects the approach of the object, taking then a pre-detection of the structures that come close to the contact surface of the sensor.

The EMG sensors adopted for the development of the project have some limitations, namely: measurement of only one muscle EMG stimulus and noise and setpoint readjustments for all moments. For this reason, there was a need to reposition the target musculature. The results in the graphs of figures 6 and 7 were made with gain adjustments in the measured signal, providing a clean image of the signals, there was also the need to control the measurement environment, being then adopted as a protocol the superficial cleaning of the skin where they were the electrodes were fixed with 70% alcohol, also the removal of hair in the measurement area.

The results showed that, based on the implementations performed, the sensory application proved to be satisfactory in view that the results measured between the prosthesis and the target musculature, were measured and converted into movements for the equipment. Thus, the force sensor was able to stop the movement, preventing the fingers from closing in such a way as to damage the joint structure of the prosthesis. The structures printed in PLA filament are also sufficiently controlled during the assembly steps, considering that they were able to withstand a force exerted by the servo motor equivalent to 13kg in the process of pressing the fingers. On the other hand, when closing and opening the fingers, it was observed that the cables were loosened overtime, this phenomenon occurred because the line had a smooth surface, so the moorings overtime loosened, to heal this problem was adopted for the practical purpose of securing the moorings in such a way as to be permanent.

Based on the development of the project, it was possible to obtain the final acquisition value of the project with investment costs equivalent to R\$ 2,000.00. Based on similar research, when compared to the current one, it was well known that many authors reached values between R\$ 2,000.00 to R\$ 10,000.00, which when compared to the current market average of approximately R\$ 200,000, 00, makes the construction of the mechanism viable with investments of approximately 1% to 5% of the current market value, thus enabling the acquisition by people less financially favored.

V. CONCLUSIONS

The objectives proposed in this research were achieved. The projected prosthesis responded well to the expected stimuli, and the costs were low in the order of R\$2,000.00 Aiming at future studies involving the improvement project of mechanical prostheses, sensors that may simulate the touch of a surface similar to human skin may be provided, as well as the insertion of new force and EMG sensors to better treat the stimulus signals dissipated in the muscle ventricle. In this way, the project should pass through new structural dimensions such as modeling and printing of new parts that can reduce limitations of the current structure, for example, the non-displacement of the fingers on the Cartesian x axis. As a means of providing greater flexibility through the printed structures of the prostheses, the use of filaments such as TPU (polyurethane thermoplastic), total or partial, is estimated for items that may require multidirectional behaviors, such as prerotation of the fingers.

The servo motors used in the arm structure take up too much space to the real needs, aiming at the use for people with only hand amputations, it will be necessary to use smaller motors, and also the space needed for their allocation in the prosthesis structure.

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Revista Interinstitucional Brasileira de Terapia Ocupacional-REVISBRATO, v. 2, n. 2, p. 398-413, 2018

Leaf anatomy and histochemistry of Oriza (*Pogostemon cablin* Beth., LAMIACEAE): Medicinal plant used in community Arari region, Itacoatiara, Amazonas

Dra. Deolinda Lucianne Ferreira¹, Dra. Maria Silvia de Mendonça², Dra. Maria Graciomar Pacheco de Araujo³, Branca Flor Murrieta Lescano⁴, Dra. Maria Olívia de Albuquerque Ribeiro Simão⁵

¹ Universidade do Estado do Amazonas – Centro de Estudos Superiores de Itacoatiara – CESIT/ UEA Email: dlferreira2010@hotmail.com

² Universidade Federal do Amazonas – Laboratório de Botânica Agroflorestal – LABAF/UFAM

⁴ Universidade do Estado do Amazonas - Centro de Estudos Superiores de Itacoatiara - CESIT/UEA

⁵ Universidade Federal do Amazonas - Centro de Ciências do Ambiente - CCA/UFAM

Abstract— Lamiaceae (Labiatae) is one of the largest Angiosperm families (with over 7500 species). Many authors confirm that 25 species from this family are medicinal, both native from Brazil and exotic. This work aimed to characterize the anatomy and histochemistry of the leaves of Oriza (Pogostemon cablin) and identify the key substances of pharmacological importance present in the leaves. The leaves were collected in the Monte Cristo community, Itacoatiara, and were studied via light microscopy and scanning electron microscopy (SEM), following standard anatomy and histochemistry protocols. For electron microscopy, sections were dehydrated in ethanol at different concentrations, undergoing critical point, metallization and then photomicrographed with the SEM. The front view epidermis appeared anfi/hypostomatic (but functionally hypostomatic) with diacytic stomata. The mesophyll is dorsiventral, with palisade parenchyma in a single layer of cells and the spongy parenchyma with 4 or 5 layers, witch two are maiden of parallel cells and the others are irregular. Petiole is non-cylindrical, with a semicircular arrangement of woody fascicles. Histochemically slices reacted to pectin, starch, proteins and phenolic compounds, tannins, acidic lipids, so that oriza showed all the substances assessed in the tests. The presence of the recorded compounds and the anatomical characterization may assist taxonomic pharmacological and allelopathic studies.

Keywords— plant cell cuts, taxonomic studies, pharmacognosy, taxonomic studies, electron microscopy medicinal plant.

I. INTRODUCTION

The use of medicinal plants is a very common practice in many parts of the country, especially in inner cities (Silva 2012). The use of drugs, plants and their derived, directly or indirectly, for the treatment of diseases affecting human beings who seek to achieve physical, mental and social well-being and has been a very common way, especially in developing countries, where the World Health Organization estimates that 80% of the population relies on traditional medicine (Oliveira *et al.*, 2014). Among the families of plants that have shown greater representation and a large number of species in ethnobotanical surveys in relation to medicinal plants, the Lamiaceae family, Asteraceae and Fabaceae has always been in the top positions (SILVA; FARIA, 2014).

The Lamiaceae family has a cosmopolitan distribution, including about 300 genera and 7,500 species, and of these 23 genera and about 232 species occur in Brazil. Among the genera of this family, *Pogostemon* was introduced in Brazil and consists of 80 to 90 species, including aquatic subshrubs and herbs (BLANK *et al.*, 2013).

³ Universidade Federal do Amazonas – Instituto de Ciências Biólogicas - UFAM

The importance of the species of the genus Pogostemon is related to allelopathy being found by Souza Filho et al., (2009) the constituents of the essential oils of this species synonymous *P. heyneanus* Benth that identified 15 constituents, with the major compounds alcohol patchouli (21.9%), α -bulneseno (11.8%), α -guaieno (8.6%), seicheleno (6.6%) and α -patchuleno (6.3%) with a repellent action, in addition they are used in folk medicine, have food use and compose incenses in Chinese culture (Ramya *et al.*, 2013).

Pogostemon cablin commonly known as oriza is a plant widely used for medicinal purposes, mainly for the treatment of child sickness, headache and heart problems (CASINO, 2010). The species has its center of origin in India and is grown in Indonesia and Malaysia, intensively, as in South America the plant is grown in Paraguay and Brazil, drawing attention by having an essential oil with characteristic odor, persistent and canforáceo (Maia et al., 2001).

In anatomical studies conducted with *Pogostemon cablin*, commonly also known by the common name of patchouli in order to determine the types and micromorphological characteristics of trichomes, the results showed that there were eight distinct trichomes types: two non-glandular six glandular trichomes. The non-glandular trichomes are simple, unicellular and multicellular and glandular trichomes are short, with long peduncle, peltate, fingerlike, filiform and fusiform (RUSYDI *et al.*, 2013). In this study, it was not held histolocalização substances in the leaves, and the nature of substances.

For the diagnosis of vegetable drugs are considered important factors such as the nature of the cellular walls and cellular inclusions of organic and inorganic nature can be revealed by histochemical analysis (Oliveira *et al.*, 2005).

In the presence of chemicals in the plants Pogostemon gender and specifically in *Pogostemon cablin*, it is necessary to analyze and identify compounds through immunohistochemical studies to try to justify the therapeutic capacity (SILVA and FARIA, 2014).

In the Monte Cristo community, Itacoatiara, Amazonas, the Pogostemon cablin is used mainly to treat heart problems, in the form of tea, which encouraged the interest for this study. Thus, this study aims to characterize anatomically Oriza leaves (Pogostemon cablin), identifying the main substances in tissues by immunohistochemistry as a way of providing information for further nafarmacologia research, in addition to the anatomical characterization sheet in general, because previous studies and available literature concentrate efforts only on the trichomes characterization.

II. MATERIAL AND METHODS

Study area and botanical material collection

The botanical material used in this study was collected after an ethnobotanical survey in Arari region, Itacoatiara, Amazonas, in a rural community called Monte Cristo. The criteria used for choosing *Pogostemon cablin* was the crossing of information between plants mentioned for the treatment of heart and other diseases related to the circulatory system, with the historic municipality of diseases that proved that such diseases have caused the greatest number of visits or death incidences in 2014.

Leaves were chosen because they are used in the preparation of tea to cure possible heart problems. The samples were collected in the morning, in a total of three individuals, withdrawing only mature leaves and in good phytosanitary conditions and replicas, fixed in FAA (formaldehyde, acetic acid, ethyl alcohol 70%) for 24 hours. After this period, they were preserved in 70% ethanol for further analysis.

The plant was herborizada and incorporated into the herbarium collection of the Center for Advanced Itacoatiara in Amazonas State University Studies - CESIT / UEA with number of voucher specimen Hitam 4300-4302. The material was identified by specialist INPA herbarium.

Light microscopy: anatomy and histochemistry

The study of light microscopy was performed in Agroforestry Botany Laboratory of the Federal University of Amazonas - Labaf / UFAM in Manaus, in the period from May to September 2015.

The anatomical analysis was made of the median limb portion of the petiole and leaf set from cross sections made freehand with razor aid in manual microtome. The sections were clarified with sodium hypochlorite solution to 20% safrablau stained and mounted in glycerine.

In the dissociation of the epidermis, sections were taken from the apex, edge of the middle region of the rib base and the leaf blade subjected to the hydrogen peroxide solution and acetic acid in the ratio 1: 1 (Franklin, 1946). After insertion into the solution, the material was kept for 24 hours in an oven at a temperature of 45 $^{\circ}$ C. Subsequently, the sections were cleaned with the aid of a soft brush to remove the mesophyll and stained with Safranin O, passing in an ethanol series and retrofitting of the blade. Trichomes and stomata were classified according to the literature (METCALFE, CHALK, 1950; Appezzato-THE-GLORY and CARMELLO-WARRIOR, 2003; CUTTER, 2002).

The epidermis was also obtained through paradermal cuts freehand in order to confirm stomata classification and evidence in greater detail trichomes, epidermal cells and epidermal appendages.

Slides were analyzed with the aid of optical microscope and recorded with imaging obtained with the optical microscope Axioskop MC 80 camera. For histochemical tests of the leaf sections of fresh material was not subjected to reagents and were photographed to document the original color of the analyzed tissue (white).

]With other sections tests for the detection of chemical components of tissue were performed as detailed in Table

Reagent Test (Author)	Group of detected (reaction)
Red SUDAN III (Pearse, 1972)	Lipids (Orange Blushing)
Iron Chloride III (Johansen, 1940)	Total phenolic compounds (Blushing brown to black)
Red Ruthenium (Johansen, 1940)	Pectins (red blush or color pink)
Lugol (Jensen, 1962)	Starch (purple blush to blackish blue)
Xylidine Ponceau - XP (Berlyn&Miksche, 1976)	Proteins (red heart)
Vanillin Hydrochloric (Mace & Howell, 1974)	Phenolic compound - tannin (red heart)
Blue Nile (Cain, 1947)	Neutral lipids (pink) and acid lipids (blue)
Phloroglucinol (Johansen, 1940)	Phenolic compound - lignin (red or pink blush)
Dichromate Potassium (Gabe, 1968)	Total phenolics (Blushing reddish brown)

Table 1. Histochemical tests applied to identify chemical compounds in the leaves of oriza (Pogostemon cablin).

For all reactions were made photographic records noting the presence or absence of the analyte.

Scanning Electron Microscopy (SEM)

For Scanning Electron Microscopy, cuts the median portion, edge in the middle region and petiole previously dehydrated in ethyl alcohol 90% (10 minutes) and alcohol 95% (15 minutes) and absolute alcohol (twice for 10 minutes) and dried in critical model Bal-Tec CPD 030 critical point dryer). The samples were then pasted on metal support with silver-based glue and subjected to plating with gold, Bal-TEC SCD 050 apparatus - Sputter Coater, then being examined and photomicrographed in Electron Microscope JEOL Scanning - JSM - 6460 LV -Scanning Electron Microscope. The sample processing stage took place at the Electron Microscopy Laboratory of the National Institute of Amazonian Research and reading in microscopic laboratory of the University of the State of Amazonas - UEA.

III. RESULTS AND DISCUSSION

The epidermis cells presents in front view with different forms on the adaxial and abaxial being more straight walls with light windings in the adaxial side (Figure 1A) and more sinuous on the abaxial surface (Figure 1B).

The abaxial epidermis is covered by cuticular ornamentation with random orientation observed only in Scanning Electron Microscopy - SEM (Figure 1C) and adaxial epidermis by a layer of thin and striated cuticle also observed only in SEM (Figure 1A). The cuticular ornamentation was described as CUTLER et al. (2011).

The stomata are diacytic (1A figures, 1B, 1C) and are present on both sides of the sheet, more numerous in the abaxial (Figure 1B), classifying it as amphistomatic, results also confirmed in Scanning Electron Microscopy (Figures 1A and 1C).

The species studied were collected in full sun exposure area, which can influence the varied manifestation of anatomical and also external morphology, such as the wall or thickness of the epidermal cells that correspond to the first barrier to filter solar energy. According Taiz and Zeiger (2004), anatomical features are contrasting in leaves of the same plant, depending only on the different light regimes to which it is exposed. The species *Leonurus sibiricus* L. Lamiaceae also in Electron Microscopy adaxial epidermis scan showed similar characteristics with papillary cells, trichomes and glandular, differing only in the type of stomata which was identified as anomocítico (DUARTE; LOPES, 2005). The nature of the cell wall may also be related to the metabolic activity of the plant. In analyzes performed with the species *Melissa officinalis* (Lamiaceae) there was an increase in the thickness of the epidermal cells in adaxial and the abaxial were no significant changes (BRANT *et al.*, 2011).

Still on the outline of the cell walls and on the distribution of stomata can be compared with the other species also the Lamiaceae family leaves *Hyptidendron canum* (Pohl x Benth) Harley, whose skin, in front view, had to be different, having hypostomatic sheet and adaxial epidermis in front view, presenting cells with straight anticlinal wall thickened and abaxial epidermis cells with straight wall to wavy, anisocytic and diacytic (FIUZA *et al.*, 2010). diacytic stomata are more common in the family Lamiaceae (METCALFE, CHALK, 1950), but the anisocítico and anomocítico types can also be found, as recorded in the works of CASTRO *et al.*, (2015) and Duarte and Lopes (2005), respectively, for ruddy Hyptis species POHL ex Benth and *Leonurus sibiricus* L

LIMA (2010), in a study with other Lamiaceae, *Ocimum gratissimum* L. pointed out that the leaf of this species proved amphistomatic presenting stomata diacytic, more frequent on the abaxial surface, differing only in the location of stomata on the same level of epidermal cells.

The leaves of *Scutellaria agrestis* A. St.-Hil. ex Benth also used by riverside communities in the Amazon are amphihypostomatic with stomata of the diacítico type, being located slightly elevated relative to the other epidermal cells (OLIVEIRA *et al* ., 2011), such characteristics described for this species resemble results found for *Pogostemon cablin*.

Pogostemon cablin in epidermal trichomes still exist on both sides, but higher number on the abaxial and also on the center rib (Figure 1D). trichomes and glandular were identified. The trichomes are multistage (two to three cells) and uniseriate and are of tapered shape, with the base made by increased epidermal cells adjacent (1G Figures, 1H, 1I) and glandular with multisseriate base and Split head (3 4 cells) (figure 1K) are pedunculated with one or more cells of different size, with the largest have reduced peduncle and are in epidermal depressions (figure 1J) and smaller feature prominent stem with respect to its size and are at the same level of ordinary epidermal cells (figure 1L). In a study by other authors with the species in question, the adaxial and abaxial leaves investigated showed numerous glandular trichomes and the bristles. According to the morphology of glandular trichomes, there were three types of trichomes two of the three external trichomes are short stalk, Peltate trichomes and a long stem attached (GUO *et al.*, 2013).

Sandes *et al.*, (2012) study also *Pogostemon cablin*. They turned their attention only to the secretory structures of essential oils, describing and characterizing only the presence and morphology of glandular and glandular trichomes that are distributed in the leaf blade (SANDES *et al.*, 2012).

In observations made with other species of the Lamiaceae family, Faria (2008) identified the presence of glandular trichomes of two types, peltate and capitate and non-glandular trichomes uni simple multicellular. In the study of Milanezi-Gutierre (2007) with the commonly known as false Boldo plant (*Plectranthus barbatus* Andrews) it was found that, in the limbo of both species occur five types of trichomes in both adaxial as abaxial and *Vitex agnuscastus*, also species belonging to the family Lamiaceae, Braga *et al.*, (2014) considered as glandular or glandular.

The trichomes usually have characteristic shape within species and have taxonomic significance and therefore, is credited also the function is relacionda with the water balance of the plant, one hairy thick surface tends to restrict the flow of air drying (CUTLER, 2011).

For Ramya et al., (2013), the essential oil is an ingredient used as a "base" material in the perfume industry and the kind Pogostemon cablin studies report that has application not only in perfumes but also therapeutic, medicinal, like incense and food flavorings. These properties justify the concentration of studies only focused on the morphology of trichomes present in the leaf, because, according to Navarro and El Qualidi (2000), the trichomes may still represent an easy tool for Pharmacognostic characterization of plant to be easy observation and analysis.

In cross-section, of *Pogostemon cablin* leaf mesophyll presents dorsiventral with single-layered epidermis on both sides (Figure 1D). In the region of the center rib, the cells are of regular shape (Figure 1D), and the leaf blades, have rectangular shapes. The upper epidermis is papilhosa (Figure 1E), with stomata slightly above the epidermal cell layer (not shown).

For *Lavandula angustifolia* species Mill and *Lavandula dentata* L. leaves have dorsiventral mesophyll, similar to the species under study, consisting of palisade on the adaxial surface, consisting of a layer of cells,

corresponding to one third of the thickness of the mesophyll, and the cells with rounded shapes with a length corresponding to one and a half length to its width (Riva *et al.*, 2014).

The lower epidermis of *Pogostemon cablin* still displays intussusception in limbo extension on opposite sides, separated by the central rib (Figure 1E). SANDES et al. (2012) observed in both mesophyll faces of Pogostemon cablin trichomes and glandular. The non-glandular trichomes are multicellular and uniseriate, formed by two basal cells, one to three intermediate cells and tapered cell at its end.



Fig.1: Cross section, paradérmico and images for scanning electron microscopy - SEM of the leaf blade of Pogostemon cablin Benth. A and B. Characterization of adaxial and abaxial epidermis (ADR - straight adaxial epidermis, ABS - skin winding abaxial, EST - stomata); C. Complexion abaxial SEM (TT - tector trichomes, OC - random cuticular ornamentation); D. Cross limbo Court (RNC - region of midrib, FV - vascular bundles); E. Region outside of the rib in limbo (INV - intussusception, PP - palisade, PL - spongy parenchyma, EP - papilhosa epidermis). F-G. trichomes observation at different angles and shapes (TG - glandular trichomes, TGC - glandular trichomes with short stalk, TGL - glandular trichomes with long peduncle).

Just below the upper epidermis, the palisade is presented in a single layer of cells arranged in parallel (Fig 1D and 1E) can be interrupted by idioblasts, secondary beams fiber sheath projections or projections (not shown). In the spongy parenchyma cells are arranged parallel. Are vascular bundles of small arms between the palisade and spongy parenchyma (Figure 1E).



Fig.2: Cross section of the petiole. A. petiole with indentations at both ends; B. Beams in a semicircle; C. Trichomes and glandular on adaxial and abaxial, similar to the limbus; D. Complex stomatal above the epidermal cells; E. Four layers of angular chollenchyma; F. vascular system in a horseshoe shape. (R - Reentrâncias the petiole, FVSM - Beams Vascular Semicircle, TG - Glandular trichome, TT - trichome Tector EC - stomatal in petiole, CA - Collenchyma Angle, SVF - Beam Horseshoe Vascular G. Ornamentation of cuticular trichomes SEM. . H. glamndulares trichomes and glandular SEM.

In the region of the midrib, the appearance is biconvex. The adaxial region of the ridge is more prominent and more concave than in abaxial and has one to two layers of collenchyma (fugura 1D). The epidermis of the two faces

may be interrupted by larger cells located at the base of the trichomes.

The cortex is populated by parenchymal cells constituted of large and intercellular spaces and the vascular bundles are open side (Figure 1D).

Petiole in cross section does not show a cylindrical shape and rather concave, which has the spherical recessed surface presenting with upper recessed at both ends (Figure 2A), therefore the liberolenhosos beams are arranged in an open arc (Figure 2B). Evidence is a uniseriate epidermis, covered with a thin cuticle and trichomes and glandular both adaxial and in abaxial similar to those described for the limbus (Figure 2C). Stomatal complexes occur above the other epidermal cells (Figure 2D).

The non-glandular trichomes present aplenty including preventing you from entering the closest to the skin cell structures (Figure 2G and 2H). In increase, the non-glandular trichomes showed a cuticular ornamentation (Figure 2G) described, according to Cutler *et al.* (2011), and between the trichomes also observed glandular trichomes (Figure 2H). Martins and Martins (2003), in studies of the *Mentha* species *pulegium* in electronic photomicrographs, also found the presence of ornamentation in the cuticle of glandular trichomes.

Table 2.	Histochemistry of metabolites present in
	Pogostemon cablin.

Test	Result (leaf and petiole limbo)
Red SUDAN III (Pearse, 1972)	(+)
Iron Chloride III (Johansen, 1940)	(+)
Red Ruthenium (Johansen, 1940)	(+)
Lugol (Jensen, 1962)	(+)
Xylidine Ponceau - XP (Berlyn & Miksche, 1976)	(+)
Vanillin Hydrochloric (Mace & Howell, 1974)	(+)
Blue Nile (Cain, 1947)	(+)
Phloroglucinol (Johansen, 1940)	(+)
Dichromate Potassium (Gabe, 1968)	(+)

Beneath the epidermis was observed up to four layers of angular chollenchyma, interrupted in the regions where the stomata (Figure 2E). In the middle region of the petiole, there is a concave shape on the adaxial and convex face on the abaxial surface. The vascular system in a horseshoe shape is formed by side beams, showing sclerenchyma tic cap externally to the phloem (Figure 2F).

The results of several authors for Pogostemon gender focus in the study of trichomes and glands by the interest in the essential oils and other Lamiaceae family species have varied anatomy. For all histochemical tests applied in the courts that species (Table 2) confirmed the reaction of analytes, showing the results with the positive sign (+).

In chlorophyll vegetables, vegetable double membrane and cytoplasmic is cellulosic and its other constituents, such as peptic substances (pectose, pectic acids, metapécticos and callose). Even when the plant is more mature secondary membranes can be of various natures, lignified, suberous, cutinized, cerificadas with hemicellulose and silicified. Still another important factor in diagnosing the plant cell corresponds to the drug inclusions (starch, aleurone, inulin, oil droplets, silica, and calcium oxalate crystals carbonate and other various contents (Oliveira *et al.*, 2005).

The cuticle is thin at both sides of the sheet. lipid droplets were found in the cytoplasm of cells isolated from tissue parenchyma (Figure 3A). Some cytoplasmic substances in the cells of the adaxial epidermis and palisade reacted to sudan III ethanol, also blushing in glandular trichomes (Figure 3B). In studies by Guo (2013) by histochemical tests for the detection of Pogostemon cablin lipid compounds Benth, yielded positive results indicating the presence of total lipids labeled with the dye Sudan black B.

For the Blue Nile both mesophyll cells as the petiole crosssection stained only for acidic lipids, not manifesting peculiar pink color of neutral lipids (Figure 3C and 3D). According to Lima and Martins (2011), the secreted substance is accumulated in periplastidial space trichomes of Ocimum gratissimum L. (Lamiaceae) and reacted positively to Sudan Black B tests, Sudan IV and Blue Nile indicating the presence of lipophilic compounds.

Phenolic compounds are expressed by the full extent of the leaf blade, presenting more concentrated in the abaxial epidermis region, the palisade and spongy parenchyma and was also manifested in the area of the midrib (Figure 3E). The glandular trichomes of the petiole reacted showing the presence of the compound (Figure 3F).

Phenolic compounds are substances that are noted for their antioxidant, anti-inflammatory, antitumor and estrogenic, suggesting the action of some phenolic compounds in the prevention of coronary heart disease and cancer (TOMÁS-BARBERAN; ESPÍN, 2001). This information may justify the fact of oriza (*Pogostemon cablin*) be used by Community Arari in the region for the treatment of diseases of the circulatory system, such as the heart.

Chemical analysis of extracts of *Rosmarinus officinalis* L. commonly known as rosemary (Lamiaceae) and can be used for combating circulatory disorders, and as an antiseptic and cicatrizing recommended by HPLC-DAD method revealed the presence of phenolic compounds: Chlorogenic acid, caffeic acid, rutin, rosmarinic acid, quercetin, kaempferol and carnosic acid (FRESHNESS et al., 2013). As *Rosmarinus officinalis*, Lamiaceae other

species present in its chemically flavonoids and phenolic acids, such as Miller *Lavandula angustifolia* (lavender) (caffeic acid and rosmarinic acid), *Stachys officinalis* (L.) Trev. (Brutônica) (caffeic acid, chlorogenic acid and rosmarinic), *Orthosiphon spicatus* Bak. (Ortossifon) (rosmarinic acid, caffeic acid, ursolic acid, glycolic acid and benzoic acid) (Cunha *et al.*, 2012).



Fig.3: Histochemistry metabolites present in Pogostemon cablin leaf cuts Benth featuring reaction. A. Reaction of Sudan III staining the cytoplasm of single cells of parenchyma tissue; B. Reaction in glandular trichomes, presence of lipids; C. Lipids acids in the mesophyll; D. Presence of acid lipids in the petiole; E. Positive reaction to phenolic compounds in palisade and lacunosos parenchyma, and greater concentration in the rib; F. Reaction also in Glandular trichomes and petiole; G.
Presence of structural pectins in leaf blade and; H. petiole structural pectins; I. Reaction confirming starch in the leaf blade; J. Starch petiole with formation of starch sheath; K. lignin Presence in conducting vessels of limbo; L. petiole with tannins; M. Reaction confirming proteins in glandular trichomes. (PP - parenchyma palisade, PL - spongy parenchyma, TG - Glandular trichome, ADP - Complexion adaxial papillose, CA - Collenchyma Angle, CP - Wall Cells, BA - Sheath Amilífera).

In the area of leaf blade was detected the presence of structural pectins, including cells of trichomes and the epidermis of the leaf and petiole limbo (Figures 3G and 3H). Unlike what happened with the kind described in issue in *Ocimum* L. species *gratissimum* also the Lamiaceae family, ruthenium red unreacted, featuring the absence of pectins in plant tissue cells (SANTOS, 2013). Starch was found mainly in the parenchyma cells of the leaf blade, the petiole showed the formation of a starch sheath (Figure 3I and 3J).

In another study of *Pogostemon cablin* in applying lugol on various vegetative organs cuts, we observed the presence of starch grains in the roots, leaves and petioles, confirming the results detected in this study for the leaf blade and petiole of this species (Storcks; DESCHAMPS, 2012). Contrary to the results of this, Lamiaceae family species as *Mentha piperita*, not reacted to lugol therefore did not show the presence of starch in the evaluated sheets (CONCEPTION *et al.*, 2009).

For phloroglucin oriza the flushing cuts reacted only in the area of the conducting vessels (Figure 3K and 3L). In histochemical tests phoroglucine for *Hyptis stricta* Benth species, the xylem cells in the midrib region and the petiole showed up lignified (SILVA, 2012), similar to that observed in *Pogostemon cablin*. For the detection of proteins showed reaction only in the glandular trichomes (3M).

In the case of phenolic compounds, applying the test with potassium dichromate, sections were reacted confirming the presence of these compounds in the blade and also in the petiole (Figures 3N and 3O). For the specific identified the presence of tannins in the glandular trichomes of the lamina and petiole of oriza leaves (Figure 3P).

Histochemical tests revealed the presence of phenolic compounds, which provide an indication of the presence of some secondary metabolites, such as, for example, tannins. In the Lamiaceae family, is a kind of tannin that has the ability to precipitate proteins, but it is not suitable for tanning the skin, known as "tannin of Labiatae" (Toledo *et al.*, 2004).

In characterizing ethnobotany and histochemistry of medicinal plants in Goias, Lamiaceae family species were subjected to histochemical tests and obtained as a result of starch, total phenolic compounds, lipophilic compounds and tannins (SILVA and FARIA, 2014) similar to the substances detected in the species that study.

The studies that have been conducted such corroborate the importance of ethnobotanical survey data and ethnopharmacological in the selection of plants with therapeutic potential and bioactivity screening. The results show a significant contribution to the characterization of essential oils activity, confirming the presence of plant areas where there is production as in other species of the genus, but in need of chemical and pharmacological studies to confirm the real action in traditional medicine, addition of secondary compounds and plant extracts flora which can be used in folk medicine.

IV. CONCLUSION

Anatomical nature character of diagnostic values were recorded in this study, such as the presence of glandular trichomes and the presence of primary and secondary compounds confirmed the histochemical tests to complement what exists in the literature for Pogostemon genre. The work that has been carried out focus on to describe the morphology of glandular trichomes to be an area of concentration and production of essential oils characteristics of the species, in addition to mentioning the tectores. Complementing what already exists in the literature was recorded here the anatomical characteristics of the sheet as a whole differs from the other work that can contribute to the correct identification of the species. Thus the description showed stomata diacytic characteristic of the Lamiaceae family, with amphistomatic leaves, dorsiventral mesophyll and epidermis in both unistratified faces. Also in the upper epidermis was observed the buds and stomata slightly above the cell layer. A striking feature was the present intussusception in the cross section separated by the central rib, which seems it is a glandular cavity. The petiole is not cylindrical, with liberolenhosos beams in a semicircle and below the epidermis layer there are cells composing the angular chollenchyma. The species reacted positively to all histochemical tests confirming the presence of various substances such as lipids, phenolic compounds, proteins, starch, tannins and pectins. In electron microscopy demonstrated layer of ornate and random cuticle on the abaxial epidermis and also in granular form in trichomes petiole, results not seen in light microscopy. This information can be considered relevant to aid in the identification of the species, contribute pharmacognostic studies, phytochemicals, industrial, food and other involving the economic value of the species, in addition to demonstrating the quality control of it for medicinal use.

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Diversification Strategies for the development of family Agriculture

M.Sc. Adriana Wachholz¹, M.Sc. Osvaldo Daniel dos Santos Pinheiro², M.Sc. Débora Regina Czupriniaki³

¹Doctoral student in the Postgraduate Program in Regional Development at the University of Santa Cruz do Sul - UNISC, Brazil and Master in the Postgraduate Program in Administration at the University of Santa Cruz do Sul - UNISC, Brazil. ²Master by the Graduate Program in Administration at the University of Santa Cruz do Sul - UNISC, Brazil.

Abstract— The article presents the theoretical framework of diversification strategies for the development of family farming, using the Resource Based Vision method as an analytical tool, aimed at its application in the rural context. This emphasizes the resources that enhance the capacity and economic performance of family farming. Considering this, the present research aims to analyze the diversification strategies for the development of family farming. Initially, the article recovers the context of family farming. It then makes considerations about the Resource Based View and the diversification of agriculture, investigating the references from the main authors. Thus, it presents the theoretical status of the approach and analyzes its potential for studies on the potential of the method in favor of diversification in family farming.

Keywords— agricultural diversification; competence; Resource Based View.

I. INTRODUCTION

A broad process of transformation in the socioeconomic sector changed the agricultural sector in the course of the 20th century. Family farming, responsible for a large part of the world food production, faces major problems to achieve greater profitability and sustainability, thus compromising the continuity of the activities of small rural producers (PERONDI, 2007; SCHNEIDER, 2003). The adoption of competitive strategies in family production aims to help rural properties in the efficiency of internal resources, essential assets for the formation of skills (REIS; RICHETTI; LIMA, 2005).

Agricultural production in Brazil, therefore, is one of the main factors responsible for the country's trade balance. The use of the term Family Farming was recently adopted in Brazil, resulting from the implementation of a federal policy aimed at this segment, the Program for Strengthening Family Farming - PRONAF. Years later, with the enactment of Law 11,326 / 2006, guidelines for the family sector were established (BRASIL, 2006).

Throughout history, the agricultural sector in Brazil has undergone several cycles and transformations. These changes were based mainly on the composition of crops, the incorporation of new technologies, the modification of the structure of the organization of factors of production and the modernization of activities (SCHMIDT; BOHNENBERGER, 2009; KARNOPP; 2012). As Neves (2007) points out, family farming is a socioeconomic category and can be understood in several ways, depending on the context in which it is addressed. Therefore, in the general field, family farming corresponds to the forms of organization of production in which the family is, at the same time, owner of the means of production and executor of the productive activities.

According to the 2010 Agricultural Census, Brazil has 5,175,489 agricultural establishments; of these 85.9% have less than 100 hectares and are family-based (IBGE, 2012). Considering this agrarian reality, it is possible to understand the characteristics of internal organization and insertion in the market of this form of production. With the growth of competition in rural areas, these properties seek to improve both in technology of equipment, improvement in the development of rural tasks, investments, information and in a good management of the property. These new procedures, adopted by farmers, influence agricultural economic performance (GEIDE; FERRAZ; BELTRAME, 2006).

Thus, the diversification of family farming is understood not only as a strategy adopted for growth of the rural segment, but as one of the important characteristics of subsistence and survival of the members of this sector (ELLIS, 2000; PADILHA, 2009; PERONDI, 2007; SCHNEIDER, 2003). Therefore, it presents a risk reduction, because it means that producers do not depend exclusively on a single production culture. Diversification has been the target of several specific incentive programs developed by the Ministry of Agrarian Development (MDA), such as economic diversification, improved productivity, adequate exploitation of resources, use of technological machinery and equipment, among others.

According to Grant (1991) and Barney (1991), organizational competences are understood as part of the productive, managerial and innovation capacity. The identification of resources used in organizations is relevant to direct the actions of specific programs, strengthen existing resources and prospect or create new resources. It is also noted the importance of verifying the existence of organizational skills formation, defended by the Theory of Resource Based Vision, as the key to organizational competitiveness (GRANT, 1991; BARNEY, 1991; FLEURY; FLEURY, 2003; PENROSE, 2006).

Considering this, the present article aims to analyze the diversification strategies for the development of family farming. To this end, rural family properties are seen as family businesses that need to allocate their that resources appropriately and can achieve competitiveness through the development of internal skills (PADILHA, 2009). To understand this context, questions are raised about the characteristics of family farming, the resources available on the properties and the diversification strategies that are viable for the development of this form of production.

II. FAMILY AGRICULTURE

For Ploeg (2014) the importance of family farming for rural / regional development rises beyond the production of food on the property. For the author, the family members of a property are able to control the existing resources on the property, such as land, crops, equipment, buildings and their practice in using their resources. For Deponti (2014, p. 12), family farming is understood:

> [...] as a social form of work and production, organized socially, economically, productively and environmentally under the aegis of territorial diversity and its multiple mechanisms of perpetuation is translated as a rural / regional development strategy that implies a search for alternatives to the traditional agricultural development pattern.

According to Schneider and Cassol (2013) the concept of family farming emerged in the early 1990s in the political and scientific fields. In Brazil, the term family farming came to be understood as a differentiated social form and as a segment within a larger group of farmers. In developed countries, however, the term had already been legitimized (SCHNEIDER; CASSOL, 2013).

The main milestone in the country occurs with Federal Decree No. 1946 (BRASIL, 1996), when the Brazilian government created the National Program for Strengthening Family Agriculture (Pronaf), directing public resources and agricultural credit to rural men. Although the term is already used at various times, its legal definition only happened in the following decade, with Federal Law No. 11,326, of July 24, 2006 (BRASIL, 2006). At that moment, a new concept is added to the theme, that of "rural family entrepreneur". This refers to the farmer who practices his activities in rural areas and who meets the same requirements as the family farmer. These requirements are linked to land, work, income and the form of property management. This law thus establishes, in Article 3, the need to comply with the following principles:

I - does not hold, in any capacity, an area larger than 4 (four) fiscal modules;

II - predominantly use the family's own labor in the economic activities of its establishment or enterprise;

III - has a family income predominantly originating from economic activities linked to the establishment or enterprise itself;

IV - run your establishment or enterprise with your family; (BRASIL, 2006).

The Family Agriculture Law remains valid, however, there was an amendment to item III of Art. 3, through the publication of Law No. 12,512 of 2011. This started to be considered as follows: "[...] have a minimum percentage of family incomes originated from economic activities of your establishment or enterprise, as defined by the Executive Branch"(BRASIL, 2011). This change empowers the Executive to change the minimum family income.

Although the term "family farming" was not yet included, Federal Law No. 4.504 of 1964, known as the Land Statute, already provided some definitions. These would serve as a reference for the current concept. According to Art 4, item II, family property is defined as:

> The rural property that, directly and personally exploited by the farmer and his family, absorbs the entire workforce, guaranteeing their subsistence and social and economic progress, with maximum area fixed for each region and type of exploration, and eventually work with the help of third parties. (BRASIL, 1964).

For Karnopp (2012, p. 100) the transformations promoted in the rural environment, were successful in "[...] science, technology and information, which meant, in practice, the incorporation of advances in the productive process, such as mechanization, the incorporation of new technologies, accelerating spatial transformations ". A characteristic feature of rural properties of great relevance are the resources that enhance the capacity and economic performance of family farming.

III. THE RESOURCE-BASED VIEW (VBR)

The Resource Based View (VBR) or also defined as *Resourse Based View* (RBV) is a theory that argues that resources, capacities and the different ways in which these are combined are responsible for the difference in the performance of companies (BARNEY; HESTERLY, 2007; GRANT, 1991). For VBR, the organization that has an effective corporate strategy has the ability to bring in income generating capabilities and resources.

For Barney and Hesterly (2007) this theory proposes that the internal resources of organizations are sources of competitive advantages. Thus, the importance of VBR is related to the look on the resources and capabilities presented by organizations, including both tangible and intangible attributes, enabling the implementation of strategies in the market.

Wernerfelt (1984) highlights that tangible resources are those that can be measured and accounted for, such as facilities, machinery and equipment. Intangible assets, on the other hand, are those that cannot be measured or quantified, difficult to be identified and transferred due to their link to the company, that is, rooted, inherent to the firm. As for their subdivisions and categories, Grant (1991) presented six categories, which Padilha et al. (2010) defines the:

• Financial: tangible resources related to the company's financial availability, such as loans, financing and investor capital;

- Physical: tangible resources related to the company that comprise the facilities, machinery, equipment, land, materials and products;
- Human: intangible resources that include individual and collective capacities and competences;
- Organizational: tangible resources that comprise the routines and formal processes developed by the organization;
- Technological: tangible resources that can be acquired on the market or developed by the company itself;
- Reputational: intangible resources that refer to the intangible assets of the firm's perception by customers, that is, the brand.

The definition of strategic resources, for Barney and Hesterly (2007), is a very complex task, because in order to achieve them, it is necessary to have a very systemic view of the organizational context. They make it possible to encompass the possibilities of obtaining competitive advantages through the recognition of potential strategic resources. This approach makes it possible to analyze the competitive advantages based on the organization's resources - which are mostly endogenous, but can also be identified through ownership with the environment (DIERICKX; COOL, 1989).

IV. APPLICATION OF THE RESOURCE-BASED VIEW IN THE RURAL CONTEXT

The sales market for most rural producers can be defined as competitive, but also due to the diversity of the technology used, its implementation and the products derived from cultivation and livestock for sale. Thus, rural properties have important performance differences. The limited rationality of individuals, access to information, the difference in volume, and the difference in forms of perception, cognition, among other characteristics that make the performance of heterogeneous and complex properties must also be observed (PENROSE, 2006).

The more uncertain the environment, the greater the need for the ability to interpret. In rural areas there are many uncertainties, since there are some uncontrollable factors, such as climate, temperature, among others. Another characteristic is that the superior performance between peers or competitors in agricultural production is not seen as a risk related to competition (GALDEANO et al., 2008). The survey of strategic resources in rural properties, according to Gafsi (2006), is complex and multidimensional. The author highlights the importance of these resources in rural properties, both to ensure sustainability and to play a multifunctional role in their interaction with the community. This is because, one must not forget, in addition to a company, rural property in family farming is a cell with kinship ties that becomes the center of decision-making that affects its members.

The use of environmentally friendly practices has a positive influence on opportunities in the agricultural sector, leading to closer relationships between performance variables (GALDEANO et al., 2008). Family farming presents differences that are linked to the type of information that each farmer has the technologies and financing to which he has access, public policies, products, technical assistance received, among others. The process is even more complex, because decisions in this sector are made both by the producer, and by his wife, children and successors, thus having a participatory character, especially with regard to the concept of family farming (MELO, 2003; SOLANO et al., 2006).

The farmer's decision is also linked to components of tradition, learning, infrastructure, as well as psychological, social and economic factors. The strength or influence of these elements in the decision also depends on the characteristics of the farmer. The infrastructure of a rural property, such as machinery, installations and equipment, also has a strong force in the decision-making process (MELO, 2003; LIMA et al., 2005). Therefore, the identification of the resources of a rural property ends up facilitating the implementation of diversification strategies for the development of family farming.

V. AGRICULTURAL DIVERSIFICATION

Padilha (2009) presents two definitions about diversification. The first defends diversification as a competitive advantage, as it addresses the growth of the organization through the allocation of surplus resources. The second, on the other hand, defines it as a way of rural livelihood, since it works as a way of reducing risks through the selection of an income portfolio with a low or negative correlation between them. For Ellis (2000), it must be understood as a process of diversification developed by rural families whose objective is to improve life.

According to Ellis (2000), the cause of diversification in the rural area has to do with seasonality, with risk strategies, with the job market, with the credit market and with the behavior towards the necessary

adaptations in the segment. Regarding seasonality, it refers to the production cycle during the year, which requires intercalation between cultures. For families that live on this production, there must be an intercalation between highrisk and low-risk strategies, that is, seeking to complement or even have a variety of activities. The job offer is also quite seasonal, as much depends on the progress of production, thus identifying the needs of manual labor. The credit market is a very relevant factor, as opportunities for expanding ownership, the acquisition of machinery or equipment arise from it. Finally, the adaptation behavior appears when an unexpected situation arises, leading farmers to seek solutions for what happened. Padilha (2009), in turn, defines strategic assets, which he considers as the main resources when it comes to the livelihoods of rural families. They are natural, physical, human, financial and social capital.

Regarding the local economy and the territory, the results of diversification are clear when considering that regions with diversified local economies can create favorable environments for the sectorial integration between agriculture, commerce, industry and services. Thus, regional diversity can generate greater security and reduce instabilities resulting from fluctuations in the labor market and sources of income. It helps, therefore, to form regions that obtain comparative and competitive advantages through economies of scope, which can reduce transaction costs and generate positive territorial externalities. The creation of strategies that enable diversification therefore depends, among other factors, on the performance monitoring of rural properties.

VI. ECONOMIC PERFORMANCE OF RURAL PROPERTIES

According to Martins (2003), for a good management of the rural property it is necessary to measure the economic performance, which has been evolving with the adoption of new technologies. Santos, Marion and Segatti (2009) state that the role of the rural manager is to plan, decide and evaluate results, having to make decisions about what, when and how to produce. Therefore, good management includes controlling such activities and evaluating the results.

For AssafNeto and Lima (2011), economic performance is obtained through assessing the current moment of organizations through data presented through financial statements and, from that, it is possible to create a planning for future proposals. It is noted that there is a wide possibility of using economic indicators, each of which has the purpose of seeking to analyze different aspects of performance.

Andreatta (2009) also states that the agricultural sector has some specificities related to biological factors. The productive and reproductive cycles have their own characteristics, and farmers are conditioned to accept what comes from nature. It also points out that aspects related to economic policy also have a significant impact on the agricultural sector. This is because credits, subsidies, price quotations, interest rates, among others, are important for the development of the rural sector. In the study by Accarini (1987, p. 195), the author already discussed the peculiarities of the agricultural sector, saying that:

[...] the consequences of the peculiarities discussed tend to reduce the economic return of rural activities, as they contribute to depress sales prices and revenues, to raise costs and to slow down the recovery of investments made in different forms of capital.

According to Santos, Marion and Segatti (2009), the manager must know the internal and external factors that affect the economic results of his family property. External factors include product prices, climate, history and trends, the existence of a market for products, credit and financing policy, among others. For the internal factors, the authors point out the size of the agricultural company, the yields of crops and creations, the productive activities, the capacity of the labor force, the equipment for use and, also, an analysis of the personal conditions of the rural producer.

VII. FINAL CONSIDERATIONS

The theme of agricultural diversification refers to the question of how rural families organize themselves and build mechanisms for distributing resources, which, in essence, takes the question to the field of competitive advantage. Therefore, when advocating diversification, we are dealing with ways of producing and ordering the available resources and technologies that, in different social contexts, require devices for efficiency, coordination, cooperation and control.

For a good management of the rural property, a new phase of studies and references was inaugurated that sought to reorient the actions and conceptions of development. It is in this context that an immensity of propositions about the emerges Resource Based View (VBR), in which the approach to diversification and the sales market are inscribed. This is defined by most rural producers as competitive, but it is also marked by the diversity of the technology used, its implementation and products derived from cultivation and livestock for commercialization.

There is still a lot to do in this thematic field, starting with the definition of a matrix for the analysis of diversification and the market. As a way of making the final considerations of this article and in order to leave it open, it is possible to present the following analysis, which indicates three points of understanding of diversification in family farming. Although they are interconnected and interdependent, the first point refers to the production unit, in which diversity presents itself as an attribute and manifests itself in the form of the combination of resources and capacities presented by family farming, including both tangible and intangible assets. It is the intersection between the property and the family unit.

The second point refers to the local economy, or what can be called a social context or even territory, here understood as the space used and appropriated by the actors present and acting in it. It is an intermediate view between the actors and the processes that are located in certain spaces that have physical, historical, social and cultural conditions. After all, the third point refers to more general contacts with regions and with processes that take place on a national and even global scale. It is, therefore, the macro environment, which affects diversification, enabling the implementation of strategies in the market, economic structures in which these processes are inserted.

And, in each of these points, different effects related to the diversification processes can be perceived. In the first, the effects of diversification can be more visibly identified because they manifest themselves as attributes that are clear, such as the increase in the portfolio of activities and products offered by farmers. Thus, the alternatives for their insertion in the markets are expanded and the seasonality and stagnation of agricultural income is reduced.

Likewise, diversification reduces dependence on sectorial price fluctuations and generates innovations and technical changes within the property that can save resources. But it also implies new ways of handling and using plants, animals and space, making the properties and the landscape itself diverse. It also has effects on social relationships, since the satisfaction levels of diversified farmers tend to be higher because they have greater interaction with consumers or even with the local community. Diversification allows for changes in the quality of life in rural areas, allowing not only farmers, but also the markets around them, greater access to varied products. It also reduces the risks of producers and allows the development of differentiated forms of culture that encourage land renewal and less wear on the environment. Finally, with regard to the broader level, it is believed that the application of the Resource Based View in the rural context may be the basis on which to build a more varied and democratic form of development, which will not only allow difference, but it will stimulate and cultivate it.

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Experimental Studies on Load Settlement Behavior of Cohesion less Soil using Bamboo

Bipasha Das¹, Dr. (Mrs.) Nayanmoni Chetia²

¹M.Tech Student, Department of Civil Engineering, Jorhat Engineering College, Jorhat, Assam, India ²Assistant Professor, Department of Civil Engineering, Jorhat Engineering College, Jorhat, Assam, India

Abstract— The advent of industrialization has led to implementation various modern structures and mega construction but due to lack of good quality of soil it has become difficult for engineers to work or build on it. Ground improvement is required to change various properties of soil such as removal of air voids, increase in shear strength, reduction in compressibility etc. More over susceptibility to liquefaction, permeability etc can be also reduced by these techniques. Micro pilings, use of geotextile, use of reinforcement are some of such technique available. An attempt has been made to use bamboo mats in single layers in sub grade soil to improve the bearing capacity. Bamboo mats are cheap, locally available and may prove to be a sustainable solution in this field. At first bearing capacity of sub grade soil has been found out experimentally in the load test arrangement and the analytical values have been calculated by using Terzaghi (1943), Meyerhof (1963), Hansen(1957,1970), Vesic (1973), IS: 6403-1981. Proximity in experimental and analytical results (Terzaghi) in particular validates the acceptability of the experimental results. Comparison was done for bearing capacity of the sub grade of bamboo as reinforcement. The parameters studied in this experimental investigation included the effects of the location of the top reinforcement layer of the bamboo grid.

Keywords—Bamboo reinforcement, Bearing Capacity, Settlement, Soil reinforcement.

I. INTRODUCTION

Various types of ground improvement techniques are required to utilize all types of soil, to improve soil parameters. Nowadays, numbers of ground improvement methods are available to overcome the problem. Horizontal and vertical reinforcements are used in shallow foundation to improve the bearing capacity of soil on which the structure stands. Many experiments are conducted on reinforced soil to improve the bearing capacity of soil and reduce the settlement to make it usable in future (Binquet and Lee 1975, Fragaszy and Lawton 1984; Guido, Chang and Sweeny 1986; Mandal and Sah 1992; Omar et al 1993a, 1993b; Das and Omar 1994; Shin and Das 2000; Dash, Abu-Farsakh et al 2013). Metal strips, geo textile, geo nets and conventional geo grid such as uniaxial and biaxial geo grid are used to conduct the experiments. The high cost of synthetic polymer has forced the researchers to explore the application of natural material in place of synthetic components. The cost of geo synthetic plays an important role in its selection. Very few researchers have done research on the application of natural synthetic on improving the bearing capacity of soil and reducing the settlement (Akinmusuru and Akinbolade 1981; Dixit 1985; Mandal and Manjunath 1994; Datye and Gore 1994; Sitharam and Hedge 2015; Dutta and Mandal 2016; Lal et al 2017; Dong et al 2010) but not much research has been done in this field.

Bamboo to improve the bearing capacity of the soil is the oldest and the cheapest technique. The easy availability of bamboo at low cost and eco-friendly nature proves that it is better than many costly geo synthetic materials available in market. Due to its tensile properties even being a natural reinforcement material bamboo has been accepted as a substitute to much geo grid reinforcement. The parameter studied in this experimental investigation includes the effect of the bamboo reinforcement on the bearing capacity and settlement of soil at different desired depths.

II. METHODOLOGY

A model steel tank of size 0.95m x 0.95m x 0.95m is prepared to conduct the plate load tests at the Jorhat Engineering College, Jorhat, Assam. It is made up of a loading frame, inverted hydraulic jack of capacity of 20kN, pumping unit, steel plates loaded with concrete cubes. The

width of the test box is not less than 5 times the size of the test plate, so that the failure zones can freely develop without any interference from sides (Basheeruddin and Narayan, 2016). To measure the magnitude of applied load pre calibrated pressure gauge is used. Deflection dial gauges of 0.01mm least count placed to measure settlements of plates due to applied load.



Fig1: Test set up

III. MATERIALS USED

3.1 SAND

The material used for this study is sand from Mariani (Bhogdoi River) of Jorhat district, Assam. The sand is cleaned to remove the unwanted materials from it. It is oven dried and then sieved through IS sieve size of 4.75mm and portion passing is taken for the experiment. The properties of the sand namely uniformity coefficient (C_u), coefficient of curvature (C_c) (ISSCS), Zone of the sand (IS:383-1970), grading characteristics D_{10} , D_{30} , D_{60} are determined according to the mentioned Indian Standard Codes . The sand is classified as poorly graded sand (SP) with specific gravity 2.65.



Fig2: Grain Size Distribution

|--|

D ₆₀	D ₃₀	D ₁₀	Cu	Cc
0.53	0.37	0.28	1.89	0.92

3.2 MODEL FOOTING

Model footing (MF) for the tests is made up of mild steel plate having diameter 0.18m and thickness 0.006 m. Model footing surfaces are smooth.



Fig3: Model Footing

3.3 BAMBOO

Mat of <u>Bambusa tulda</u> (Jati Baah) which is chemically treated with copper chrome boron (CCB) of length 0.9x0.9 m, splints of width 3mm and thickness 1mm are prepared in Rain Forest Research Institute, Jorhat, Assam. The bamboo strips used are arranged in the planer form of bidirectional (square aperture) where the connection patterns are inter-woven, orthogonally interlocked for maintaining the equal aperture size during the preparation of bamboo grids for the research.



Fig 4: Bamboo Mat

TESTING PROCEDURE

Load tests are conducted on the model test tank and test procedure is taken as per the guidelines from IS 1888:1982 for plate load test. The average relative density of 59.87% is adopted for all model tests. The average relative density and unit weight of sand bed is maintained as 59.87% and 16.04 kN/m³, respectively. The number of drop is selected from the calibrated graph at a required density (59.87%) for all experiments. The number of drop obtained from the graph is maintained for all experiments during the preparation of the sand bed. A level is used to

level the sand surface before placing of reinforcement and the model footing. Model footing is placed centrally, under the spindle of jack so that plate, reaction girder and spindle are coaxial. Load is applied in cumulative equal increment of 10kg where the dial gauge readings are recorded for each load increment. For the test with reinforcement is placed in the desired depth from the model footing and the same test procedure is repeated

4.1 INTERPRETATION OF RESULTS

The average settlements are calculated taking the average of the dial gauge readings. The cumulative settlement corresponding to load is observed which will be later plotted. Load intensity as ordinate and respective settlements as abscissa are plotted on log-log scale according to IS: 1888-1982, the yield value of soil which is determined as ultimate bearing capacity.

V. RESULTS AND DISCUSSION

The outputs are verified by comparing the experimental results of the model footings with analytical bearing capacity equations provided by Terzaghi (1943), Meyerhof (1963), Hansen(1957,1970), Vesic (1973), IS: 6403-1981. From the direct shear test the angle of internal friction (\emptyset) obtained for loose, medium and dense sand are 27.5[°], 31[°], 35[°].

Table 2: Bearing Capacity Calculation with



Diameter of plate, B = 0.18 m, Thickness of plate							
$D_f = 0.006m$, $q_{ult} (kN/m^2)$ $D_r = Relative density$							
	D _r (%)	ذ	Ter	Mey	Han	Ves	IS 6403-1981
Loose sand	34.8	27.5 [°]	14.75	18	10.04	15.37	14.89
Medium sand	59.87	31 [°]	25.82	38.26	18.75	26	26.12
Dense sand	70.24	35 [°]	46.13	81.38	36.26	49	46.67



Fig.5: Ultimate Bearing Capacity V/S Angle of Internal Friction



Fig.6: Ultimate Bearing Capacity V/S Relative Density

Bearing capacity of model footing of diameter 0.18m found out to be 23.80 kN/m² experimentally this is extracted from load-settlement graph. It matches with the results obtained from Terzaghi equation. Hence it can be concluded that results obtained from the experimental set up is reproducible.



Fig 7: Load-Settlement Plot for Medium Sand (Unreinforced)

5.1 EFFECT OF VARYING DEPTHS OF BAMBOO REINFORCEMENT

The bamboo reinforcement having size of 0.9m x 0.9m, splints of width 3mm and thickness 1mm which are chemically treated with (CCB) placed in the sand bed at a depth of 0.5B, B, where B is the diameter of the model footing to obtain the bearing capacity of the model footing.



Fig 8: Load-Settlement Plot for Medium Sand Reinforced at depth 0.5B



Fig 9: Load-Settlement Plot for Medium Sand Reinforced at depth B

VI. CONCLUSION

This paper gives an idea on the effect of bearing capacity of model footing with the insertion of bamboo reinforcement at a depth of 0.5B, B on locally available Bhogdoi sand. Based on the experimental and numerical study the following interpretation may be drawn.

- 1) Ultimate bearing capacity for model footing validated with various bearing capacity equations showing a similar values.
- 2) Comparison of the values of the ultimate bearing capacity from the theoretical equations depicting Meyerhof has the highest values whereas Hansen has the lowest.
- 3) The improvement of bearing capacities due to insertion of bamboo sheets is represented by "*Improvement Factor*" is the ratio of reinforced bearing capacity to unreinforced. The value is 1.43 and 1.14 at a depth of 0.5B and B respectively from footing.

ACKNOWLEDGEMENTS

I would like to express my special thanks to Dr. (Mrs) Nayanmoni Chetia, Assisant Professor, Civil Engineering Department, Jorhat Engineering College, Jorhat, for her excellent guidance and encouragement to write the paper and support during the course of my work. I am thankful to the staff of RFRI, Jorhat for their help.

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Organizational Innovativeness in 21st Century: First Decade Construct Analysis

Júlio Francisco Blumetti Facó, Alexandre Acácio de Andrade, Fernando Gasi

Engineering, Modeling and Applied Social Sciences Center, Universidade Federal do ABC, BRAZIL

Abstract— This research study explores the dimensions of the capacity to innovate of the organizations (innovativeness) related to the transformation industry. The literature review concerning innovation and the capacity to innovate, consisting of theoretical development plus empirical studies, allowed authors to develop a three-dimension model to operationalize the organizational innovativeness construct: a) Stimulus or Incentive to Innovate/Reward for Innovation; b) Generation and Selection of Ideas; c) Adoption and Use of Ideas. Additionally, we observed the adherence of this three-dimensional model in Brazilian manufacturing companies.

Keywords— Capacity to Innovate, Innovation, Organizational Innovativeness, Transformation Industry.

I. INTRODUCTION

The search for innovations brings about challenges and dilemmas for the organizations [1]. Executives and academics of the business world face many examples and questions while searching for innovations, such as: When should they invest in an idea? When should they give up on an invention? Where should they innovate? For whom or with whom should they develop innovations? When should they innovate? How can they innovate? These questions arise because there are several uncertainties concerning the implementation and the return that something new may bring.

Alternatives to try to reduce these uncertainties have been proposed both by academics and businessmen. These alternatives explore many different approaches: studying innovation success stories [2], looking at sources of innovations in the companies [3], considering proposals of frameworks for innovations [4] and diffusion of innovations [5], analyzing the innovation process in the companies [6], among other approaches.

However, there has been little attention dedicated to exploring the characteristics – and dimensions – that involve an organization's capacity to innovate [58][59], which is the opportunity we explore in this study.

Besides this brief introduction, the article presents a bibliographical review concerning the organizations' innovativeness as well as a proposal for measuring it, goes on to detail the methodology used in the study, and concludes by presenting the results and application of the method.

II. ORGANIZATIONAL INNOVATIVENESS: THE CAPACITY TO INNOVATE OF THE COMPANIES

Academic literature presents various studies that in some way approached, but didn't conceptualize the theme of organizational innovativeness in an objective manner [7]; [8]; [9]; [10]; [11]; [12]; [13]; [14]; [15]. However, an implicit definition found by all of these authors includes an organization's capacity to innovate as a competence that is intimately tied to the process of innovation.

Rogers and Shoemaker [16](p. 27) initially defined innovativeness as "the degree of adoption (sooner or later) of new ideas by an individual related to the other members of the system."

More than three decades later, the same [5] (p. 267) confirmed that definition, but added the adoption of new ideas, not only by an individual but by "any other unit of adoption," for example, a group. Thus, in the opinion of these authors, the term innovativeness is more related to the capacity of diffusion of innovations than to the capacity of generation of innovations.

Another concept similar to Rogers, but with a greater emphasis on services, is proposed by Parasuraman[17] when he defines the "technology readiness" construct (p. 308). To this latest author, this concept refers to people's propensity for using new technologies to reach their personal and professional goals. Thus, he also emphasizes the diffusion of innovations. Additionally, [17] suggests that the capacity to innovate works as a driver for the technological readiness studied in his research. Lumpkin and Dess[18], in their research study, also touched on the capacity to innovate of the company, however, their main focus was directed toward the study of the entrepreneurial orientation of the organizations. These authors identified some of the drivers for entrepreneurial orientation on the part of the company, and its ability to innovate was among those drivers. In this way, the company's capacity to innovate reaches the status of keycomponent of its entrepreneurial orientation, because this capacity reflects an important way in which an organization seeks for new opportunities.

Carolyn Solo[19] (p. 417), on the other hand, views a company's capacity to innovate as a "normal" part of its activities and its business. For the author, the act of innovating is nothing more than "ordinary business activity."

In the next decade, Lawrence Mohr[20] (pg.112) defined the capacity of an organization to innovate as the capacity of accomplishing a successful introduction, into a real situation, of means or ends that are new to that particular situation in question.

Mohr[20] had also already identified several studies concerning inventively or creativity in the organization, pointing in several well-defined directions. Nevertheless, there was little consensus concerning the capacity to innovate of the organizations in the studies consulted by him, and this gap is pointed out even to this day ([21]; [22]; [12]. However, [20] found indications that both creativity and the level of informality in an organization influence the company's capacity to innovate.

Concerning creativity, an extensive study conducted by [21] deserves recognition. These authors sought to conceptualize the term organizational creativity and found definitions for innovation similar to those given by other authors ([20]; [5]; [23]). Yet, in the proposal of [21], innovation gives place to organizational creativity, transforming innovation into a sub-set of the wider theme of organizational change, which is the central focus of these authors' research.

[24] also suggested a definition tied to the creativity of the company. These authors defined innovativeness as the capacity of a company to use all of their creative resources to the maximum. However, they relate the theme exclusively to the development of new products and processes. Among the authors who proposed a definition for a company's capacity to innovate as a construct, we would like to cite Wang and Ahmed[25] (2004). In their work, these authors defined a company's capacity to innovate as the "innovative ability of a company" in the introduction of new products on the market, or opening of new markets, using combinations of strategic orientations combined with an "innovative process and behavior" ([25], p. 304). Although these authors propose five dimensions for the innovation capacity, which are: product, market, process, behavioral and strategy; the theoretical cut they present refers almost exclusively to new products as the main agent and determinant of a company's capacity to innovate.

The [25] were not the only ones who attempted to define the dimensions of a company's capacity to innovate. Eight years earlier, [26] had already evidenced the need to analvze the innovativeness construct from а multidimensional perspective, just as the theme of innovation is also multidimensional. These authors presented two dimensions that, in their view, explained the capacity to innovate; they were: the administrative dimension and the technical dimension. Despite the originality of these proposals of multidimensionality, neither [26] nor [25] made any kind of distinction concerning the typologies and dimensions of innovation related to an organization's capacity to innovate, treating them as synonyms in their studies.

Recently, [27] also proposed a definition for the capacity to innovate a company. According to the authors, "innovativeness is universally perceived as exploring something new that has not existed before" (p.556). Similarly, this definition is the conceptualization given by [22]. These authors classified the capacity to innovate of a company according to its propensity to support and participate in new ideas, experimentations and creativity for the development of new processes.

DEFINITION OF ORGANIZATIO	NAL INNOVATIV	ENESS	SOURCE
PREDOMINANT CHARACTERISTIC	OBJECTIVE	IMPLICIT	SOURCE
	X	•	[28]
Adoption of Inpovations	X		[29]
DEFINITION OF ORGANIZATION/ PREDOMINANT CHARACTERISTIC Adoption of Innovations Adoption/Execution of new Tasks Adoption/Execution of new Tasks Creation of Something New Creation of Something New Culture to Innovate Development of New Products and Processes	X		[30]
	DEFINITION OF ORGANIZATIONAL INNOVATIVE MINANT CHARACTERISTIC OBJECTIVE X Adoption of Innovations X X ion/Execution of new Tasks X ion/Execution of new Tasks ion/Execution of ne		[31]
Adontion/Execution of new Tasks		X	[7]
Adoption/Execution of new Tasks	X		[32]
		X	[8]
		Х	[33]
		Х	[9]
		Х	[10]
		Х	[11]
		Х	[12]
Creation of Something New		Х	[13]
	X		[34]
		Х	[14]
		Х	[35]
	X		[25]
	X		[27]
		Х	[36]
		Х	[37]
	X		[38]
Culture to Innovate	X		[39]
	X		[40]
	X		[22]
	X		[24]
	X		[41]
Development of New Products and Processes	X		[42]
		Х	[43]
		Х	[15]
Innovation Diffusion		X	[7]
First – to -market	X		[44]

 Table 1. Characteristics of the Definitions of Organizational Innovativeness

Based on the analysis of the bibliographical sources consulted, we were able to observe that almost as many as half of the authors never proposed an objective definition for the theme of organizational innovativeness. Many of these authors implicitly associated the theme with the ability of the company to create something new; while the other half of the authors proposed some objective definition – many of which we have presented in the preceding paragraphs. Thus, it is possible to enumerate the predominant and most outstanding characteristics

employed by these authors in their definitions, whether objective or not, concerning the organizational capacity to innovate. These characteristics are shown in Table 1.

As illustrated in Table 1, the academic literature presents several studies that, in some way, approached the theme of organizational innovativeness, but did not conceptualize it in an objective manner (e.g. [7]; [8]; [9]; [10]; [11]; [12]; [13]; [14]; [15]. However, an implicit definition found by all of these authors includes an organization's capacity to innovate as competence which is intimately tied to the process of innovation.

A counterpoint to studies that evaluated the capacity to innovate of companies from an intra-organizational perspective must be given. In this sense, the studies of Grodal[45] emerge. According to [45], studies concerning the innovative competence of the firm have traditionally been linked to some of the company's internal factors, particularly to investments in Research and Development (R&D). The author claims that the alliances between (or among) companies also play a central role in determining the innovative competence of the firms, demonstrating that innovation occurs in the value chains in companies which are immersed in multiple contexts[45].

Thus, the inter-organizational perspective also needs to be taken into consideration. In the words of [45]: "innovation is not a sole consequence of organizations but also of networks of organizations". Nevertheless, the present study will not be using the value chain as a unit of analysis. Instead, we will use the company as a unit of analysis, as will be shown in detail in part 3 of this research study.

III. MEASURING ORGANIZATIONAL INNOVATIVENESS

We find it necessary to make some comments concerning the use of patents as proxies for innovation, as was done by various authors, such as [46], [47], [48], or even [49] himself.

According to [50], patents have been used for over fifty years as indicators of technological activities. Some of the difficulties for using patents are associated with the fact that the companies vary in their propensity to generate patents, and this fact ends up limiting the generalization of the conclusions of the research studies that use them. Even for the companies that use patents, they do not reflect the amplitude of their innovations or even their effort to innovate, because, according to [50], a significant number of innovations occur out of the scope of the areas and activities of R&D in the companies, and are not patented. Thus, they are not considered in the measurements of innovations that make exclusive use of patents.

Another difficulty lies in the need for understanding which type of activities the patent measurements are related to. In some cases, the patents may exclusively measure inventions, instead of innovations, as was alerted by [50] (, p. 513), "in some cases, patent statistics are assumed strictly to measure invention, as distinct from innovation". According to [51], the invention is the idea, or the knowledge, which precedes the development, commercial exploration and diffusion of new products and processes. In other cases, the activities related to patents may be considered "an intermediate output of resource inputs in activities of R&D" ([50], p. 513).

Therefore, "patents may be applied to every cycle of the development and commercialization of innovations," and, thus, a source of bias for more ample analysis ([50], p. 514). In any case, after considering these limitations, statistics based on patents can be powerful study tools that allow for inferences and verifications which are relevant for specific cases in innovation studies.

An analysis of the bibliography proposed in Table 1 (shown previously) permits the detailing of each article related to the measurements, sample, and methods used by each author. This data is presented in Table 2. It is worth noting that, in the studies consulted, there is a strong orientation toward the firm as a unit of analysis, as well as toward the use of surveys, both primary and secondary data, for the observation of the organizational innovativeness construct. Another conclusion that seems to jump out at you when analyzing the studies concerning the organizational capacity to innovate is the treatment given to the innovativeness construct, which is many times dealt with as a synonym of innovation.

It is also possible to observe from Table 2 that the empirical studies for the measurement of the capacity to innovate vary, particularly related to their proxy.

UNITY OF ANALYSIS	METHOD	SAMPLE/SECTOR	SOURCE
	Case Study	4 Companies (with the same manager) / Civil construction	[9]
	Case Study	Small and medium-sized companies / Diverse	[36]
	Survey	71 / Hospitals	[7]
	Survey	382 companies / Diverse	[28]
	Survey	1450 companies/manufacturing (Germany)	[12]
	Survey	181 companies(revenue superior to US\$100.00 MM/year /diverse	[42]
	Survey	148 companies / Diverse (totaling 5 countries)	[44]
	Survey	228 small and medium-sized companies / Diverse	[39]
	Survey	Approx. 200 companies / Diverse (Great Britain)	[25]
Company	Survey	Britain) [2] 102 companies/technology service providers [2]	
	Survey	233 companies/manufacturing (Holland)	[15]
	Survey (4 statements)	93 companies / Diverse	[38]
	Survey (4 statements)	453 companies / Diverse (USA)	[40]
	Survey (5 statements)	107 companies/manufacturing and services (Taiwan)	[34]
	Survey (adoption of innovations)	182 / Hospitals	[52]
	Survey (3 statements)	1818 companies / diverse (three countries in Europe)	[32]
	Survey (2 statements)	169 companies/computer - HW (Taiwan)	[41]
	Survey (number of innovations)	134 / banks (USA)	[8]
	Survey (R&D)	76 R&D companies	[35]
	Survey (Patent)	143 companies/pharmaceutical	[41]
	Survey (Fortune Magazine Ranking)	Approx. 1000 companies / diverse (except financial)	[27]
	Survey (Innovation Ranking)	50 companies/shoes	[14]
Company and business units	Survey	101 companies or units / Service and Manufacturing	[24]

Table 2: Previous Studies about the Organizational Innovativeness

Company and employee	Survey (one statement)	616 supply chain managers / diverse	[31]
	Survey	247 employees in 19 companies / diverse	[29], [30]
	Survey	871 engineers / diverse (Singapura)	[13]
Employee	Survey (one statement)	110 public managers in 58 countries/public	[37]
Innovation National	Theoretical Analysis		[10]
System	Theoretical Thiarysis	-	[11]
New Product project	Case Study	12 large companies / varied (Sweden)	[33]

In some cases, measurements for innovation diffusion are used (e.g. [7]), in others, measurements related to the generation and implementation of ideas, products and processes are applied (e.g. [24]; [42]), or even the measurement which considers market response time (e.g. [44]).

Much has been published concerning the factors which contribute to the "innovative success" of the companies ([1]; [53]; [54], to mention only a few). These factors may be related to aspects of the culture and structure of the organizations, composition of project groups, transference and flow of information and knowledge (inside the organization and the groups), leadership and management abilities, or even, attitudes toward changes, among other things. All of these are aspects to which it is difficult to have access within the companies, as observed by [54].

The need to define both the construct as well as the conditions for its outlines, operationalization and application is imperative to obtaining better results.

[27] also alerted us to the difficulty in collecting data in quantity about the capacity to innovate of the organizations. The solution found by [27] was the use of a secondary database consisting of the Fortune magazine ranking for the issues concerning the innovation capacity of the companies.

In their research about the identification of dimensions of the companies' innovation capacities, [25] prepared a questionnaire which included the 5 dimensions for analysis proposed by them. The authors made use of a research protocol with statements on a 7-point Likert scale, ranging from 1 = "totally disagree" to 7 = "totally agree". The population was composed of 1500 companies in Great Britain with at least fifty employees each. The research protocols were sent by mail in the form of a letter (reply paid) to directors or senior executives in the organizations. The return rate was around the order of 14%. [19], [22] and [55], on the other hand, used proxies such as new products, new processes or patents in their attempt to measure how innovative a company was.

Related to the measurement of the culture, stimulus, and rewards for innovation, [56] attempted to operationalize an organization's capacity to innovate by measurements connected to the culture to innovate.

Based on everything we have seen thus far which is related to organizational innovation capacity, the dimensions proposed for its analysis in this research are:

• Stimulus (Incentive)/Reward for Innovation: The conditions of the internal or external environment of the company which permits and facilitate the appearance of novelties (innovations).

• Generation and Selection of Ideas: the initial stage of the development process of something new, focusing on the generation of novelties (innovations).

• Adoption and Use of Ideas: the final stage of the development process of something new, focusing on the implementation of novelties (innovations).

Next, the characteristics of the sample and the methodology used for collecting the data will be presented.

IV. METHOD

The Sample

One of the most complex stages of this work was the identification of the organizations to be studied. They not only needed to be companies whose importance was recognized in the sector of the transformation industries, but they also needed to be at least significantly representative of their segment.

Additionally, another critical aspect was the constitution of a group which, because of its diversity, would be representative of a wide spectrum of the business world, specifically related to the transformation industry.

Another fundamental characteristic would be the ease of access to the information, not only through publications but, especially, by the voluntary opening of the company doors to the researcher. Thus, 9 manufacturing companies were willing to cooperate with the present research and permit the adherence tests of the three-dimensional model proposed as the construct of this research.

Based on the OECD classification, [57] proposes that studies involving the measurement of innovation be divided into 4 categories according to the intensity of their activities of research and development (p. 157):

a) High-technology industries (e.g. aviation, pharmaceutical, telecommunications equipment, electromedical, etc.)

b) Medium-technology industries (e.g. electrical equipment, vehicles, chemical industry, etc.)

c) Medium-low technology industries (e.g. coke, oil refinement, rubber and plastic products, fabrication of metal products, etc.)

d) Low-technology industries (e.g. wood, cellulose, paper, recycling, products for printing and publication, food products, textiles, etc.)

For this research study and to facilitate the analyses and conclusions, as a starting point, we used the classification proposed by OECD and by [57], with the grouping of the medium-high and medium-low technology forming a new group called medium technology.

Therefore, Table 3 shows the three groups that we made use of in this research, illustrating the number of companies in each group that were used as objects of study for the analyses, as well as associating them to the identified complexity level of their products.

Table 3:	Classification	of the	Companies	of the	Sample
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GROUP	SAMPLE
High Technology – HT (high-complexity products)	3 large companies
Medium Technology – MT (medium-complexity products)	2 large companies
Low Technology – LT	4 companies (3 large
(low-complexity products)	and 1 medium)
TOTAL (Transformation	9 companies
Industry)	

The Collection of Data

This stage of the methodology constituted of intensive direct observation techniques, in the form of semistructured interviews conducted with key people directly involved in the process and the innovation activities of the company.

To guarantee the validity of the answers on the part of the respondents, we opted for selecting those who occupied medium or high management positions in the companies of the sample. In some cases, it was possible to ensure that the high management representative of the company be the president himself. However, in most cases, the representatives were directors or managers.

Moreover, as a form of support to the research and observations, we consulted two key persons in FIESP (São Paulo State Industry Federation Organization – high and medium management) who acted as a yardstick of the opinions and views of the transformation industry segment as a whole. Table 4 represents the list of those interviewed in each organization.

Table 4:	List of	f inter	views
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GROUP	LEVEL OF THOSE INTERVIEWED
High Technology – HT (high-complexity products)	3 medium management + 3 operational
Medium Technology – MT (medium-complexity products)	2 medium management + 2 operational
Low Technology – LT (low-complexity products)	3 high management + 1 medium management + 2 operational
FIESP (SaoPauloStateIndustryFederationOrganization)	1 medium management + 1 operational

Otherwise, it is worth noting an important point concerning the possible bias that high and medium management can bring to the study. One of the gaps pointed out by [5](p. 409) in research studies about the theme of organizational innovativeness concerns the fact that they are mostly concentrated on data obtained from the high management of the organization, which, according to the author, may not reflect the opinion of the organization as a whole in regards to innovation. To minimize this problem, the analyses, whenever possible, sought to collect evidence from other levels of the organizations consulted.

V. RESULTS AND CONCLUSIONS

The analyses related to the innovation capacity of the companies are presented below. For this analysis, we made use of the measurements proposed for each of the three dimensions related to a company's capacity to innovate:

- Stimulus (Incentive)/Reward for Innovating.
- Generation and Selection of Ideas.
- Adoption and Use of Ideas.

These analyses are detailed in the topics below.

Stimulus (Incentive) and Reward for Innovating

All of the companies in the three groups (HT, MT, and LT) claimed and agreed that they have incentives for innovation; however, the HT and MT groups indicated that they have some reservations in the sense that those incentives are sometimes not very well explored or used to the maximum of their potential to generate knowledge and to develop innovations.

Another point that emerged concerning this subject concerns the remuneration for the innovations and ideas of the employees. We observed that the remuneration actions are on very different levels of maturity in the companies of the sample. While some companies are concerned about reviewing and possibly revising their policies for acknowledgment and remuneration of ideas, as was cited by a company in the HT group: "We are always thinking of the best way to be able to acknowledge these ideas," others, such as one of the companies in the LT group, already make use of events and non-monetary awards for ideas that have been implemented.

On the other hand, the scenario is completely inverted regarding the existence of processes that support innovations or various initiatives. The HT and MT groups, besides citing examples of processes, methodologies and innovation programs in their companies, also stated that there are various processes in place to support initiatives and ideas. This differs from the LT group, which stated that it has some innovation programs, however, they are too little adherent to be able to act as efficient support for innovations, except for two of the organizations in this group whose responses and arguments were similar to those given by the HT and MT groups. One of these two organizations of the LT group said, "We have an innovation program [by means] of the generation of incremental ideas (...) and, it has already brought a return of R\$ 19,00 for every R\$ 1,00 invested in innovation."

It is interesting to note that all of the companies in the three groups cited some program of suggestions as an example of an innovation program; according to the words of one of the high management members of one of the companies of the LT group, "stimulating and keeping up the generation of ideas is important, but being concerned about the accomplishment of those ideas is equally important."

One of the companies of the same LT group, in particular, has obtained large numbers of ideas from employees (several dozen ideas/year); and the company has implemented at least half of the ideas generated, having found it necessary to develop an IT (information technology) platform capable of withstanding and managing this flow of suggestions. The practical results are some incremental innovations that have been implemented in the whole scope of the company (products, services, processes and the business as a whole), in addition to more significant innovations that have generated dozens of patents in Brazil and around the world.

The innovation process implies "experimentation, and there is no guarantee of permanent success," according to one of the people interviewed. Thus, the issue concerning the treatment of the non-successes of ideas and initiatives is relevant to an environment of either stimulus or repression of innovations. Only one of the companies in each group (HT, MT, and LT) stated with conviction that the non-successes were transformed into learning experiences. One of those companies explicitly states that mistakes or failures in innovations represent nothing more than investment in training (learning experiences).

It is noteworthy that two of the companies of the LT group are starting to engage in and disseminate an orientation program for innovation in their respective organizations. From the words of one of those interviewed, "the innovation process as a whole is a relatively new process; the company is still learning to deal with the successes and non-successes of ideas."

However, none of the companies widely discloses or publicizes these non-successes internally. According to the words of one of the people interviewed, these nonsuccesses "are disclosed to an interest group," normally made up of managers.

An important point brought up by the companies in the sample (especially in the HT group) is that the difficulties do not lie only in the area concerning the care in registering and storing past information and experiences. The difficulty lies in creating mechanisms – according to those interviewed – which make it "faster and easier to consult" this information, concerning both successes and non-successes.

In general, situations that offer greater stimulus seem to be concentrated more in the HT group than in the MT and LT groups, with some exceptions that have already been pointed out in the LT group.

Comments on the dimension of the generation and selection of ideas in the three groups in the qualitative study have been made below.

Generation and Selection of Ideas

Concerning the clients and suppliers as sources of innovation generation, we were able to observe distinct differences, both from one source to another, as well as among the groups analyzed.

Clients have greater relative importance than suppliers as to the inspiration for ideas and novelties of any nature in the companies researched. Combined with this understanding, all of the cases identified opportunities for the generation of value and ideas from their suppliers, as one of those interviewed explained, "With the suppliers, we are still on the brink of evolution; we can still extract even more value from them than we are extracting today as sources of innovations and information for products and processes."

Yet, in the three groups studied, HT, MT, and LT, there is a variation of the relative importance for both agents – clients, as well as suppliers – from one group to another. The HT Group is the one that places greater emphasis on the use of clients and suppliers as sources of inspiration and novelties. On the other hand, the relative importance of these agents is greater in the group of MT companies than in the LT.

There is only one company in the LT group which seems to be an exception to previous analyses. This company, in particular, pointed to the little use and exploration of ideas and novelties in a systematic way, coming either from clients or from suppliers, as one of its deficiencies. One of those interviewed in the company stated, "We practically never use clients and suppliers as sources of innovation; this is a point we are working on." In a complementary way, the president of this same company also stated that "The clients [in this market] are good followers, but not innovators."

In addition to the clients and suppliers as sources of ideas, the people interviewed also pointed to the employees of the companies themselves, the exchange of information (formally and informally) among them, and participation in discussion forums, congresses, and different events as essential factors for the generation and selection of ideas. From the words of one of the respondents, "Actually, there are various [sources of innovations]; the company team itself produces the elements and is induced to look at novelties wherever they may be." It is an entirely different situation when we analyze the role of the leadership in the generation, sharing and selection of ideas. The LT group places greater emphasis (than the MT and HT groups) on the role of the managers in the stimulus and exchange of ideas and suggestions, promoting an interchange of initiatives among colleagues, including those of different areas. In this aspect, the HT group "spoke in unison" when stating that "Managers stimulate an innovative environment, but there is always room for more [stimulus]," to borrow the words of one of those interviewed.

On the other hand, when analyzing the dimension of generation and selection of ideas in terms of innovations of products, services, processes or of the business as a whole, the companies in the HT, MT and LT groups show similar behavior, as has been detailed in the following paragraphs.

In the HT group, the efforts for a generation of ideas/novelties are more oriented toward products or services and processes than toward the business as a whole, as was illustrated by the words of one of the respondents in this group: "I see innovation in everything [in products, services, processes, and the business], but to establish a ranking, the innovation in product and process would be ahead of the others. Today, the innovation of a business model is fundamental, however, no one changes their business model every year, therefore, product innovation stands out more." The efforts of the MT group for the generation of ideas/novelties are more markedly orientated toward products and services, and not so much toward processes or the business as a whole. In the LT group, the efforts for the generation of ideas/novelties are more directed toward processes than was found in the other groups. An example of this last group can be illustrated by the following statement which was extracted from the interviews in this group: "We greatly innovated a product in the past and it was very good. It would be worth it for the company to focus on that product and increase its scalability and margins; from that point, we began intensifying efforts towards more improvements in processes."

Finally, the last dimension we analyzed concerning the innovation capacity of the companies (detailed in the following topic) can be illustrated by the following statement, given by one of those interviewed: "What we believe is that innovation does not simply happen; it needs to be generated, stimulated and encouraged, or it will not happen. You also need the time to create it, and there is the time to implement it."

Below, we explore the dimension for adoption and use of ideas for the three groups in the qualitative study.
Adoption and Use of Ideas

Complementary to what was presented in the previous topic, the efforts for the generation of ideas/novelties, particularly related to processes, are translated into innovations that are not only adopted in the companies that introduced them but also are referenced in the sectors in which they act. This is the specific case of the LT group, as explained by one of the respondents: "We practically changed the market with the innovation we made in the production process, and we continue to make improvements."

However, in the HT and MT groups, this scenario is not the same. Companies in both of these groups did not identify the recent innovations in their processes as being references in the segments in which they act. Some of those interviewed pointed to the fact that, in some moments, the companies in which they act are benchmarking in processes, and in others, they are not. This perception can be illustrated by the following sentence: "Many times, companies come to us wanting to know things [in the context of processes], and, other times, we are the ones who go to them."

About the development and implementation of innovations in products, all of the companies consulted, in some way, described themselves as being among the main "companies of reference" in their respective sectors. In this regard, we found no distinction among the groups studied. It is interesting to point out that none of the companies described itself as a company of reference in innovations of products/services in its sector, even if it had been one month or years before. Even companies that usually launch new products before the competitors did not call themselves companies of reference. This fact was observed in more than one case study, where the people interviewed were cautious when it came to set themselves up as a reference for product innovations, making sure to also give credit to their competitors. "Concerning product innovation, the competition has also done a good job in these last two years," one of those interviewed said.

On the other hand, regarding the adoption and use of ideas and later launching of products, we observed a clear distinction among groups. The companies of the MT and LT groups took a shorter period for the "maturation" of ideas and the launching of products than that of their competitors, as was explained by one of the respondents: "The company's strategy is to occupy this market [niche]; basically, the strategy is to create products before the competitors do. It [the company] tries to avoid competition." This does not mean that their products are all necessarily more innovative than those of their competitors, but that they are launched - on average - before those of the other competitors.

The companies of the HT group, on the other hand, showed more signs of inertia when it came to the launching of products ahead of their competitors. The companies of this group have been more cautious concerning launching new products ahead of the competitors, whereas their strategies include being quick followers, as illustrated by one of the interviews given: "There is always something that the market launches before us; the decisive process here in this company is not always the fastest; but, for example, if the company notices that some [new product] launched by a competitor worked, it will many times follow by launching a product that is more innovative."

VI. DISCUSSION AND CONCLUSION

This research study purposed to explore the dimensions of the innovation capacity of the organizations belonging to the transformation industry, composed of manufacturing companies in the state of São Paulo, Brazil.

As seen previously, the literature concerning innovation and the capacity to innovate, through its theoretical development and empirical studies, allowed the author of this present study to propose a model made up of three distinct dimensions to operationalize the organizational innovativeness construct:

• Stimulus (Incentive)/Reward for Innovation: The conditions of the internal or external environment of the company which provides and facilitate the appearance of novelties.

• Generation/Selection of Ideas: Initial stage of the development process of something new, focusing on the generation of novelties.

• Adoption and Use of Ideas: Final stage of the development process of something new, focusing on the implementation of novelties.

Additionally, we observed the adherence of this threedimensional model in the empirical studies conducted in the three study groups: High, Medium and Low Technology.

Also, it is important to examine some of the limitations of this study which could contribute to framing the structure of future studies. The first limitation, evident in this kind of work, is concerning the use of a base of only 9 companies, which could be expanded, increasing the size and extension of the base in the future, to permit other inferences and observations. Otherwise, although the innovation capacity has been treated as an independent variable in most of the discussions in this research, it is important for the decisionmakers in the companies that the innovation capacity of the organizations also be treated as a dependent variable, focusing on methods for its creation and maintenance, with variables different from those treated in the present study.

Finally, through these analyses, we sought to contribute to the knowledge in the area of Business Administration, more specifically, to expand the empirical studies of Brazilian companies under the aegis of innovation.

ACKNOWLEDGEMENT

The authors are grateful to CNPq for supporting this research and also thanks to the Innovation and Sustainable Competitiveness Forum (FICS / UFABC) for intellectual support.

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Frequency of Phytotherapics Prescribed by Doctors in Rondônia, Western Amazônia of Brazil

Carlos Alberto Paraguassú-Chaves¹, Allan Kardec Duailibe Barros Filho², Lenita Rodrigues Moreira Dantas³, Fabrício Moraes de Almeida⁴, Christian Diniz Carvalho⁵, João Viana Fonseca Neto⁶

¹PhD in Health Sciences - University of Brasília - UnB, Brazil; PhD in Science - University of Havana (Cuba); Post-Doctor in Health Sciences - UnB and Degli Studi D'Aquila University - IT. Professor at the Federal University of Maranhão – Brazil.

²PhD in Information Engineering. Universidade de Nagoya – Japan; Frontier Researcher. The Institute of Physics and Chemistry (RIKEN), Japan. Professor at the Federal University of Maranhão, Brazil.

³Bacharel and Specialist in Geography. Bachelor in Law. Researcher at the Higher Institute of Health Sciences and Environment of the Amazon – AICSA.

⁴PhD in Physics (UFC), with post-doctorate in Scientific Regional Development (DCR/CNPq). Researcher of the Doctoral and Master Program in Regional Development and Environment (PGDRA/UNIR). Leader of line 2 - Technological and Systemic Development, and Researcher of GEITEC — Federal University of Rondônia, Brazil.

⁵PhD in Information Engineering. Federal University of Maranhão, Brazil. Researcher at the Federal University of Maranhão, Brazil. ⁶PhD in Electrica Engineering. Federal University of Paraíba, Brazil. Professor at the Federal University of Maranhão, Brazil.

Abstract— Objective: to analyze the frequency of herbal medicines prescribed by doctors based on records of manipulation pharmacies in the period of 4 (four) years. Methods: this is a descriptive study with a quantitative approach, with retrospective and cross-sectional data, from the collection of information in an electronic registry of manipulation pharmacy in a context of the State of Rondônia, in 4 (four) Amazonian municipalities, subspace 2 (two) from Rondônia - Western Amazon, according to the spatial model of Paraguassú-Chaves [14]. Results: In the first stage of the research (2015 and 2016) 5.576 were prescribed and in the second stage (2017 and 2018) 7.600, with an increase of 2.024 prescriptions. The phytotherapics with the highest frequency were sine (21.07%), ginkgo biloba (14.9%), kava-kava (14.20%) and sacred cascara (12.62%). In general, the senna and the sacred cascara indicate the population's search for weight loss products, kava-kava to combat insomnia, nervous tension, agitation, distress problems or everyday malaise, ginkgo biloba to combat general circulatory problems and peripheral circulatory disorders (intermittent claudication) and cerebral vascular insufficiency. The general practitioner (general practitioner) with 36%, gastroenterologist 21%, gynecologistobstetrics 11%, urologist 9.7%, angiologist and vascular surgeon 9% and cardiologist with 5.8% were the professionals in the medical specialties who prescribed the most. Of the medical prescriptions of the general clinical specialty, senna with sacred cascara (35%), ginkgo biloba (20%) and dry senna extract (17%) stand out. Of gastroenterology, 77% correspond to glucomannan, garcinia cambogia. Of the gynecology-obstetrics, isoflavones 40% (26%), senna (20%), combination of kava-kava, isoflavones and senna (17.6%) and ginkgo biloba (14%). From urology, senna dry extract (63%), of the specialty angiology and vascular surgery 57% of horse chestnut and 42% of ginkgo biloba. Cardiology stands out with 88% ginkgo biloba recipes out of the total recipes prepared by doctors specializing in this area. Conclusions: the consumption of herbal medicines has increased significantly in the last years of the research in the cities of Ariquemes, Jaru, Ouro Preto do Oeste and Ji-Paraná, in Rondônia, Western Amazon, Brazil. Among the possible reasons for the increase in the consumption of herbal medicines are the search to find an alternative to synthetic medicines, the advances in the scientific area that allowed the development of herbal medicines known to be safe and effective, and the trend of the population, for less aggressive therapies intended for care primary health care.

Keywords— Phytotherapics. Doctor's prescription. Rondônia. Western Amazon.

I. INTRODUCTION

Phytotherapics are defined as products derived from plants used for medicinal purposes and to promote health [1]. They are considered natural, but not necessarily innocuous. For the Health Surveillance Secretariat of the National Health Surveillance Agency of Brazil - ANVISA, herbal medicine is any medicine technically obtained and elaborated, using only vegetable raw materials for prophylactic, curative or diagnostic purposes, with benefit for the user [2]; [3]. According to Brazil [4] herbal medicine is the product obtained from active vegetable raw material, except for isolated substances, with prophylactic, curative or palliative purposes, including herbal medicine and traditional herbal medicine, and it can be simple, when the asset comes from a only medicinal plant species, or compound, when the asset comes from more than one plant species. Herbal medicines are considered to be those obtained with the exclusive use of active plant raw materials whose safety and effectiveness are based on clinical evidence and which are characterized by the constancy of their quality.

Silva [5] states that ANVISA is the Brazilian national agency whose function is to regulate and supervise the production of herbal medicines. In the opinion of Silva [5], who works as a pharmacist specialized in handling plant products and preparing herbal medicines, some health professionals, when prescribing herbal medicines, say that they do not have side effects. They say that, because they are natural, they have no side effects and also have no adverse reactions, although studies prove that there are undesirable and toxic effects [5]. The main objective of the legislation is to guarantee the quality of the herbal medicine, and this means that all batches must be produced with the same quantities of the active ingredient. This condition assures the patient the consumption of the same active amount, even if using another manufacturer than the usual one. It is this standardization that will be a reference for the quality of the herbal medicine [5].

According to Ferreira [6], medicinal plants can be defined as plants that have biological activity, with one or more active principles useful for human health. The use of medicines, supplements and teas based on these plants is characterized as herbal medicine. Wong [7], states that the use of plants for medicinal purposes is the oldest form of disease treatment. And it announces that the difference between herbal medicines and medicinal plants, according to ANVISA, is in the fact that medicinal plants are those whose purpose is to cure diseases, whereas herbal medicines are those with isolated, defined and standardized substances. Phytotherapy is a form of medicinal therapy that has been growing notably in recent decades. Within this perspective, Brazil was expected to be a privileged nation, considering its extensive and diversified flora, holding approximately one third of the world flora. In addition, there are a large number of research groups in the country that have contributed significantly to the development of the chemistry of natural plant products, chemotaxonomy, pharmacology of natural products and other related areas. However, Brazil does not have a prominent role in the world herbal medicine market, even behind the least technologically developed countries [8].

Phytotherapy is more significant in developed countries, while in developing countries the investment in studies, technologies and research does not receive due investment and, consequently, are considered inexpressive [9].

According to Pinto [10], the World Health Organization (WHO) believes that currently the practice of using medicinal plants is considered the main therapeutic option for approximately 80% of the world population. However, according to Wong [7] many approach phytotherapics as a whole, not distinguishing between the different drugs in this group. However, it is more appropriate to evaluate each herbal medicine with an approach similar to that of synthetic drugs, that is, based on solid scientific evidence, particularly in controlled clinical studies.

The Amazon region, for having a large amount of raw materials for herbal medicines, has aroused the interests of the international pharmaceutical industries [11]. King [11] in "Medicinal chemistry: principles and practice" records his amazement when he asks "we expected Brazil to be privileged, as it has one third of the world's herbal medicine, however we lag behind less developed countries than Brazil". Brazil is home to approximately 22% of the species of medicinal plants on the planet, which means an unparalleled richness of biodiversity and, consequently, a huge competitive advantage for the country. Considering plant biodiversity, the Amazon Forest holds the largest reserve of medicinal plants in the world [9]. However, according to Paraguassu-Chaves, Batista, Silva Junior [12], although Brazil is considered the world's breadbasket in varieties of plant species, despite increasing research on medicinal plants, more than 90% of the Brazilian flora is still unknown by Brazilian scientific community. Which justifies the vast majority of herbal medicines consumed in Brazil to come from other countries. Everything suggests that public health policies related to herbal medicines are still very modest, almost incipient in Brazil, lack of incentive for

scientific research and a little more interest and goodwill from research institutions in Brazil.

The National Health Surveillance Agency of Brazil -ANVISA recognizes, among those phytotherapics with the largest number of scientific studies, a list of plant drugs that are allowed to obtain simplified registration by the industry [3], with no need to validate therapeutic indications and safety of use. According to Ribeiro, Leite, Dantas-Barros [13], in "Profile of the use of phytotherapie medicines in communitary pharmacies of Belo Horizonte, under the influence of the national legislation" of the list of herbal medicines sold with and without prescriptions, containing 34 plant species, the majority are exotic plants, that is, those that do not thrive spontaneously in Brazil, originating in other countries, especially in Europe and North America, where local plant species are the target of a greater number of scientific research. To elucidate the statement of the aforementioned authors, it is currently estimated that, in countries like Germany, phytotherapy is the main form of therapeutic approach, while allopathy is in the background. The vast majority of doctors prescribe herbal medicines regularly. As a consequence, sales of this type of medicine grew. In Africa, for example, 80% of the population depends on the use of these drugs, which represent alternatives in view of the high cost of synthetic drugs. France is an example of what happens in Germany, since herbal medicines are predominantly sold in pharmacies.

Recent studies carried out by Silva [5] in this same research region pointed out that the most frequency of the prescribed phytotherapics were cáscara-sagrada (20.64%), senna (18.35%), ginkgo biloba (13.76%), kava-kava (12.39%) and isoflavone (11.47%). The others found, but less frequently, were artichoke, horse chestnut, chitosan, ginseng and valerian.

According to Silva [5], the results found in the municipality of Ariquemes are similar to those found in the municipality of Jaru (both in Rondônia), since again the sacred cascara prevails in the frequency of herbal medicines. The sacred cask, senna, ginkgo biloba and kava-kava represent, in Ariquemes, the total of more than 65% of the frequency of indication for manipulation, but emphasis should also be given to isoflavone, with 11.47% of prevalence (which does not occurred in the other cities of Rondônia surveyed). In his research, Silva [5] proves that the relationship between doctors and handling pharmacies is quite expressive. Of 6.584 prescribed recipes in the period surveyed, 5.136 (78%) herbal medicine recipes were filled with medical prescriptions.

Theoretically, this percentage of manipulation of herbal medicines from medical prescriptions should involve a considerable safety margin, given that a prescription should give the patient a high degree of unity that is, the patient is treated according to his particularities, and medicines are prescribed according to the specific needs of individuals.

Our concern was to answer the following question: What is the highest frequency of herbal medicines prescribed by medical professionals in the municipalities of Ariquemes, Jaru, Ouro Preto do Oeste and Ji-Paraná, in Rondônia, Western Amazon, from the records of handling pharmacies?

The objective of the research was to analyze the frequencies of medical prescriptions for herbal medicines in a region of the Amazon, based on records of manipulation pharmacy in the period of 4 years.

II. METHODS

Descriptive study with a quantitative approach, with retrospective and cross-sectional data, from data collection and information in an electronic registry of manipulation pharmacy in a context of the State of Rondônia, comprising 4 Amazonian municipalities, subspace 2 of Rondônia - Western Amazon, according to the model of spatiality of Paraguassú-Chaves [14]. The data and information correspond to 2 periods of medical prescriptions. The first period corresponds to the years 2015 and 2016 and the second period 2017 and 2018. The commercial establishments holding the data and information were not cited to preserve the integrity of the source. Data were collected and transformed into information from medical prescriptions in electronic records of 4 handling pharmacies, one pharmacy per municipality.

The 4 manipulation pharmacies surveyed are regulated by ANVISA, the Regional Pharmacy Council and the Resolution of the Collegiate Board - RDC 67/2007. According to Silva [5], this technical regulation establishes the minimum requirements for the exercise of handling activities and magisterial preparations and pharmacy workshops. The sample corresponds to 100% of the prescriptions prescribed by doctors and that were available in the handling pharmacies in the municipalities of Ariquemes, Jaru, Ouro Preto do Oeste and Ji-Paraná, in Rondônia, Western Amazon.

The Authorization Consent Term - TCA was applied to those responsible for pharmacies for the manipulation of databases. The data not filled in correctly in the spreadsheets or with some inconsistency were neglected, removed from the statistics due to lack of reliability. This limitation in data collection is very common in the various data entry systems that feed the Unified Health System in Brazil - SUS and private health systems, compromising the veracity of data and information. A situation that deserves very special attention in the management of the Brazilian health system.

The data were organized with the aid of statistics and represented in the form of tables. The tables were separated by municipality according to the prescribed herbal medicines and their frequency. The data referring to medical specialties that prescribed herbal medicines was organized in the form of a table with content of frequencies.

The research project followed the legal precepts recommended by Resolution 196 of the National Health Committee of Brazil - CNS-CONEP. At the Research Ethics Committee of the Faculty of Education and Environment - Faema, an application was made to waive the evaluation of the Research Ethics Committee, as this is na investigation with the exclusive use of a database.

III. RESULTS AND DISCUSSION

3.1 Frequency of herbal medicines prescribed by doctors

In the period of 4 years of study in 4 pharmacies handling herbal medicines, 13.176 prescriptions by doctors were prepared. In the years 2015 and 2016, the first stage of the research, 5.576 prescriptions and 7.600 prescriptions in the years 2017 and 2018. There was an increase of 2.024 prescriptions between the first and the second stage of the research. Yunes, Pedrosa, Cechinel Filho [15] in the study Pharmaceuticals and herbal medicines: the need for the development of the herbal and herbal medicine industry in Brazil, observed an increase in the use of herbal medicines by the Brazilian population. According to these authors, some factors may explain the increase in the use of these drugs, such as the advances in the scientific field that allowed the development of herbal medicines known to be safe and effective, as well as a strong tendency of the population to seek less aggressive therapies intended for care primary health care.

In the municipality of Ariquemes, in 2015 and 2016, 616 were prescribed and in 2017 and 2018, 1.108 herbal prescriptions were prescribed, resulting in a period of 4 years, 1.724 prescriptions prescribed by doctors. The medical prescriptions during the study period were: senna dry extract (30.84%), ginkgo biloba (21.10%),

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glucomannan, garcinia cambogia dry extract (17.20%), horse chestnut dry extract (10.38%) and to 40% isoflavones (6.81%). The first five products: senna, ginkgo biloba, glucomannan-garcínia cambogia, horse chestnut and isoflanovas, account for more than 86% of the frequency of prescribed herbal medicines, with emphasis on the first two with a frequency above 20% each one. (table 1).

The high frequency of glucomannan, garcinia cambogia and horse chestnut are highlighted only in municipality of Ariquemes. While the 40% isoflavone prescribed in Ariquemes was also only prescribed in the municipality of Jaru (8.05%). Valerian, Asian powder-centella gorse, Long Jack, hamamelles and elderberry (+ hairy vine, dish vine, powdered coceania) were prescribed in negligible frequency, as well as eggplant, green tea and gelatin. The sacred cascara deserves a very special attention for its prescription associated with other herbal medicines and in isolation.

Table 1: Frequency of herbal medicines prescribed in the municipality of Ariquemes.

Phytotherapics	Frequency (%)
Senna dry extract	30.84
Ginkgo biloba	21.10
Glucomannan, Garcinia Cambogia	17.20
Horse chestnut	10.38
40% Isoflavones	6.81
Kava-kava	3.57
Secred Cascara	3.24
Ginseng powder	1.62
Valerian	1.62
Long Jack	0.97
Carqueja powder, Centella asiática powder	0.64
Eggplant	0.62
Green tea	0.32
Hamamelles	0.30
Hairy vine, Dish vine, Cocleania powder	0.30
Gelatine	0.30
Other herbal medicines	0.40
Total: 1.724 prescriptions	100%

Source: Manipulation Pharmacy

In the municipality of Jaru, 1,987 were prescribed in 2015 and 2016 and 2,254 in 2017 and 2018, totaling 4,241 medical prescriptions during the study period. The sacred cascara (18.31%), senna (17.71%), ginkgo biloba (15.75%), kava-kava (15.44%%) and the phaseolamine (9.66%), were the most prescribed herbal medicines by doctors in handling pharmacies. (table 2).

The first five products: cáscara-sagrada, senna, ginkgo biloba, kava-kava and phaseolamine, represent 76.87% of the frequency of the prescribed herbal medicines, with emphasis on the first four with a frequency above 15% of prevalence each. Senna and ginkgo biloba continue to be highlighted frequently, as occurred in Ji-Paraná and Ariquemes. The sacred cascara and kava-kava are similar to the frequencies of Ji-Paraná.

Table 2: Frequency of herbal medicines prescribed in the
municipality of Jaru.

Phytotherapics	Frequency (%)
Secred Cascara	18.31
Senna	17.71
Ginko biloba	15.75
Kava-kava	15.45
Phaseolamine	9.66
Isoflavone	8.05
Artichoke	4.44
Horse chestnut	4.13
Garsinia Camboja	2.21
Chitosan	1.29
Other herbal medicines fitoterápicos	3.00
Total: 1.724 prescriptions	100%

Source: Manipulation Pharmacy

In Ouro Preto do Oeste, 3.681 prescriptions were carried out, of which 1.539 were prescribed in 2015 and 2016 and 2.143 in 2017 and 2018. Senna with (23.26%), kava-kava (19.10%), sacred cascara (12.02%), chitosan (9.94%), ginseng (9.55%) and ginkgo biloba (9.09%) were the most prescribed herbal medicines by medical professionals.

The 5 herbal medicines with the highest amount of prescriptions represent more than 73% of frequency. The data are similar to those found in Ariquemes, Ji-Paraná and Jaru, with emphasis on senna and ginkgo biloba. The sacred cascara and kava-kava are similar to those found in Jaru and Ji-Paraná and chitosan with those found in Ji-Paraná. (table 3). Table 3: Frequency of Phytotherapics Prescribed in theMunicipality of Ouro Preto.

Phytotherapics	Frequency (%)
Senna	23.26
Kava-kava	19.10
Secred Cascara	12.02
Chitosan	9.94
Ginseng	9.55
Ginkgo biloba	9.09
Green tea	6.31
Valerian	4.15
Horse chestnut	2.51
Caseolamine	1.07
Other herbal medicines	3.00
Total: 3.681 prescriptions	100%

Source: Manipulation Pharmacy

In Ji-Paraná, 3.530 prescriptions were made during the study period. In the years 2015 and 2016, 1.434 were prescribed and in 2017 and 2018, 3.539 recipes were prescribed. The most prescribed phytotherapics by medical professionals were kava-kava (18.68%), sacred cáscara (16.94%), ginkgo biloba (13.66%), senna (12.48%) and chitosan (11.99%). (table 4).

The first five products account for more than 73% of the frequency of herbal medicines with a medical prescription. Ginkgo biloba and senna, phytotherapics with higher frequencies in Ariquemes also stand out in Ji-Paraná.

Table 4: Frequency of herbal medicines prescribed in thecity of Ji-Paraná.

Phytotherapics	Frequency (%)
Kava-kava	18.68
Sagred Cascara	16.94
Ginkgo biloba	13.66
Senna	12.48
Chitosan	11.99
Ginseng powder	8.43
Green tea	4.78
Valerian	4.88
Horse chestnut	3.52

Total: 3.530 prescriptions	100%
Other herbal medicines	2.00
Caseolamine	2.64

Source: Manipulation Pharmacy

In the municipalities of Ariquemes, Jaru, Ouro Preto do Oeste and Ji-Paraná, during the 4 years of research, herbal medicines with the highest average frequencies with medical prescription were senna (21.07%), ginkgo biloba (14.9%), kava-kava (14.20%) and, the sacred cascara (12.62%). (table 5). Similar to the finding by Silva [5], the sacred cascara component of the list of simplified registration of herbal medicines sold without medical prescriptions from ANVISA, in our study an average frequency of 12.62% was found in the four studied Municipalities, among all herbal medicines with prescription doctor.

 Table 5: Frequency of the Main Phytotherapics Prescribed in the Municipalities of Jaru, Ouro Preto do Oeste, Ji-Paraná

 and Ariquemes.

Phytotherapics	Jaru	Ouro Preto	Ji-Paraná	Ariquemes	Frequency
					Average %
Senna	17.71	23.26	12.48	30.84	21.07
Ginkgo biloba	15.75	9.09	13.66	21.10	14.90
Kava-kava	15.45	19.10	18.68	3.57	14.20
Sagred Cascara	18.31	12.02	16.94	3.24	12.62
Total	67.22%	63.47%	61.76%	58.75%	62.79%

Source: Manipulation Pharmacy

Senna, ginkgo biloba, kava-kava and sacred cáscara represent respectively 67.22% of all herbal medicines prescribed by doctors in the municipality of Jaru, 63.47% in Ouro Preto do Oeste, 61.76% in Ji-Paraná and 58.75% in Ariquemes. Sene was responsible for the highest average frequency of herbal medicine prescribed by a doctor with 21.07% of all revenues in the 4 municipalities, with emphasis on the municipalities of Ariquemes with 30.84%, Ouro Preto do Oeste 23.26% and Jaru 17.71%. Ginkgo biloba stands out at 21.10% in Ariquemes and 15.75% in Jaru. The kava-kava presented high frequency in Ouro Preto do Oeste (19.10), Ji-Paraná (18.68%) and Jaru (15.45%), while the sacred cascara was prescribed with high frequency in Jaru (18.31%) and Ji-Paraná (16.94%). These findings are similar to those found by Silva [5] referring to the cáscara-sagrada herbal remedies, senna, ginkgo biloba and kava-kava. Silva [5] also highlights the sacred cascara associated with other herbal medicines, especially senna. Paraguassú-Chaves, Batista, Silva Junior [12] confirm in a study on the use and notification of herbal medicines in Ariquemes, values similar to the findings in this study and those found by Silva [5].

In the study by Silva [5] it was found the association of phytotherapic with phytotherapic with an association of dry extract sene and dry extract extract; Senne dry extract, horse chestnut, kava-kava and ginseng; ginkgo biloba powder and horse chestnut; ginkgo biloba powder and sacred cascara; ginkgo biloba powder and witch hazel; ginkgo biloba 24% and ginseng; and, kava-kava dry extract, senna, valerian, 40% isoflavones and ginseng.

According to Batistuzzo [16] are examples of combinations of herbal and herbal medicines, which, in adequate dosages, have good effects: Ginseng (Panax ginseng) with ginkgo biloba (Ginkgo biloba) and valerian (Valeriana officinalis L) reduce anxiety; Chitosan (Chitosan) with artichoke (Cynara scolymus L) decrease cholesterol absorption; Senna (Senna alexandrina Mill) and sacred cascara (Rhamus purshiana D) are laxatives.

Although they are natural products, the ideal is that such combinations are made by a doctor, so that dosages and combinations are made according to the patient's needs.

In the same way, it warns of incompatible associations, such as horse chestnut (Aesculus hippocastanum) with anticoagulants: increased effects of anticoagulants; Hamamelis (Hamamelis virginiana) with horse chestnut: enhancing the effects of horse chestnut; kava-kava (Piper methysticum) with CNS depressants: increased effects of CNS depressants; chamomile (Matricaria recutita) with anticoagulants: increased effects of anticoagulants; ginkgo biloba (Ginkgo biloba) with anticoagulants: increased effects of anticoagulants; ginseng (Panax quinquefolius) associated with some hypoglycemic substances: increased effects of hypoglycemic agents; ACE inhibitors: production of toxic effects.

Alexandre [17] conducting a study on the frequency of herbal medicines found in Santa Catarina, the herbal

medicines ginkgo biloba, kava-kava, valerian, horse chestnut, hypericum, artichoke, ginseng and passion fruit, as the most frequent. Sparreboom et al [18] confirm that most commercialized herbal medicines are basically made with ginkgo biloba, kava-kava, horse chestnut, valerian, artichoke, hypericum, ginseng and passion fruit. For Alexandre [17] this prevalence does not depend on the region of the country.

Glucomannan-garcínia cambogia and horse chestnut of significant frequencies in the municipality of Ariquemes have not been prescribed prominently in other municipalities in this region of the Amazon, nor in previous studies. One of the hypotheses to clarify the significant frequency of glucomannan-garcinia cambogia in Ariquemes handling pharmacy is associated with the professional medical prescriber [12].

The glucomannan-garcínia cambogia composition demonstrates the demand for slimming product, since (Garcinia cambodia) has the action of naturally causing weight loss. According to Batistuzzo [16], its extract is a product based on Garcínia cambogia, a plant traditionally used by Indians to facilitate digestion after meals. It has as its active ingredient calcium hydroxycitrate (stable form of AHC), a substance chemically similar to citric acid found in oranges and other citrus fruits. Inhibits the formation of fat in the body. Also according to Batistuzzo [16], it controls the desire to eat sweets, if 500 mg is used, divided into three times a day. Its therapeutic indication is a potent slimming and natural hunger inhibitor, which has no action on the central nervous system. Therefore, there is a reduction in the formation of body fat, and the reduction is greater in the synthesis of cholesterol and triglycerides. Thus, garcinia extract helps the body to remove lowdensity lipoproteins from the blood (LDL).

Horse chestnut (Aesculus hippocastanum L.), which does not require a medical prescription, suggests the indication in our study in the treatment of varicose veins, microvarices, homoroids, venous stasis edema and in association in the indication of the treatment of capillary fragility [5]. According to Diehm et al [19], the species Aesculus hippocastanum in different clinical studies carried out with extracts of its seeds has demonstrated its venous anti-edema activity in patients with chronic venous insufficiency. Marliére et al [20] agree that in preparations with horse chestnut, their main indication is for the treatment of chronic venous insufficiency (such as varicose veins and hemorrhoids). Studies by Pittler, Ernst [21]; Siebert et al [22] has demonstrated the effectiveness of horse chestnut for the therapeutic indication of varicose veins and hemorrhoids.

Chitosan is an n-acetyl derivative of chitin. It has the action of reducing cholesteral and decreasing body mass. It is a natural slimming and cholesterol-lowering agent. Chitin is a polysaccharide found in the exoskeleton of seafood (such as shrimp and crabs). Because it is watersoluble, it dissolves in the stomach and turns into a gel, which involves the fat ingested and eliminates it through the intestine, resulting in weight loss, by not letting the fat be absorbed. In addition, it inhibits the absorption of harmful cholesterol (LDL) and stimulates HDL, a healthy cholesterol in the body. Helps control high blood pressure and reduces uric acid levels in the blood. It promotes the healing of ulcers and wounds, has antibacterial and anticandidiasis action and prevents irritation in the intestine.

Chitosan acts as an antacid, anti-constipant and increases calcium absorption. Anti-tumor properties have also been reported for him. Chitosan acts as an antacid, anti-constipant and increases calcium absorption. Antitumor properties have also been reported for him. The dosage is 250 mg / 4 six times a day. Some people allergic to crustaceans can have certain adverse effects, especially if they are taking high doses [16].

As described, the possibility of associating one herbal medicine with another is very large. In adequate doses and combinations, they bring satisfactory effects; in excess or mismatches, the reverse occurs.

3.2 Therapeutic indication of the most frequent herbal medicines prescribed by doctors

For Silva [5], among the most frequently prescribed phytotherapics, senna and cascara sagrada, indicate the search of the consumer population for weight loss products. Kava-kava is a very effective product against insomnia, nervous tension and agitation, problems of distress or everyday malaise. It is also common to consume products related to circulatory problems, depending on the presence of ginkgo biloba. Among the most indicated phytotherapics such as senna and cascara sagrada associated with senna, they indicate the users' search for a slimming product [5]. The significant frequency of ginkgo biloba is directly related to the search for the consumption of herbal products for circulatory problems. According to Cupp [23], ginkgo biloba is indicated for vertigo and tinnitus (tinnitus), resulting from general circulatory disorders and peripheral circulatory disorders (intermittent claudication) and cerebral vascular insufficiency.

According to WHO [24], Bristish [25], Escop [26], Senna has the therapeutic indication of treating occasional constipation. Ortiz [27] conducted a clinical study with 21 patients, aged between 19 and 85 years, with an average of 38 years. The follow-up time for constipation ranged from 3 to 80 months, with an average of 33 months. For this study, a standardized extract of Senna alexandrina was used. Most patients (81%) responded quickly to treatment with just one pill of the herbal medicine and, on average, less than one pill per day was needed during the 28-day observation period to ensure normal defecation rate.

Sá [28] conducted clinical research with 34 patients from a gynecological clinic, most of them pregnant, aged 18 to 62 years. The patients underwent oral treatment with jelly produced with Senna alexandrina leaves for three weeks, with the dose of a teaspoon at night, before sleeping. Patients were evaluated by comparing the evolution of variables such as time to defecate, number of bowel movements per week, presence of gases, quality of stools and feeling of total emptying of the rectum after evacuation, recorded before (one week of observation) and after treatment. All variables evolved significantly favorably. In the overall assessment of efficacy, the results were considered satisfactory in 88.2% of the cases in the opinion of the physician and in 82.3% of the cases in the opinion of the patients.

Leng-Peschlow [29] when carrying out non-clinical pharmacological tests with senna, states that "the effect of Senna alexandrina extract is related to anthraquinone derivatives, sinesides A and B. In a study carried out with sinesides A and B in animals, substances that are found in Senna alexandrina extract, it was concluded that after its administration (12.5 - 200 mg / kg) in rats, normal defecation was accelerated in 3-4h and the excretion of soft stools was evident from 4-5h, reaching its maximum peak after 5-7 hours. In addition, the transit time in the large intestine was dose and time dependent in the treatment with sinesides A and B. A big change was observed in the intestinal transit time. After two hours of substance administration, the transit time went from 6 hours in the control group to 90 minutes in the treated group. The maximum reduction was observed in the treated group after 4 hours, in which the transit time was reduced to 30 minutes with a dose of 50 mg / kg".

According to WHO [24], Escop [26], Alonso [30], Blumenthal [31], Vanaclocha [32], senna is contraindicated for children under 12, pregnant and lactating women and patients with a history of hypersensitivity and allergy to any one of the components of the herbal medicine.

It should not be used in cases of chronic intestinal constipation, according to WHO intestinal disorders, such as intestinal obstruction and stenosis, atony, inflammatory bowel diseases (Crohn's disease, ulcerative colitis, inflammatory colopathies) and abdominal pain, severe dehydration, hemorrhoids, appendicitis, hypokalemia, pelvic inflammatory disease, menstrual period, cystitis, liver, kidney or heart failure [24], [26], [30], [31]. It is also contraindicated for patients with nausea, vomiting or when an undiagnosed acute or chronic symptom is present [24].

Therapeutic indications for ginkgo biloba are the treatment of vertigo and tinnitus (tinitus) resulting from circulatory disorders, peripheral circulatory disorders, such as cramps [33], [34]. Blumenthal [35] in "The American Botanical Council - The ABC Clinical Guide to Herbs" carried out pharmacological clinical trials and 35 studies conducted with ginkgo biloba, including 3,541 participants, in 33 positive effects were found for use in the indications: Alzheimer's disease, dementia, tinnitus, peripheral vascular disease (intermittent claudication), asthma and depression. Van Dongen [36] in the survey "The efficacy of ginkgo for elderly people with dementia and age-associated memory impairment: new results of randomized clinical Trial" had a negative result in dementia and Drew, Davies [37] in "Effectiveness of Ginkgo biloba in treating tinnitus: double-blind, placebo controlled trial "had negative results for tinnitus.

Blumenthal [35] in research using ginkgo biloba to treat dementia due to cardiovascular failure or Alzheimer's found positive results when he focused on treating ginkgo biloba for intermittent claudication. According to Birks, Grimley [38] in "Ginkgo biloba for cognitive impairment and dementia", a meta-analysis study evaluated 33 papers on the effectiveness and tolerability of ginkgo biloba on cognitive impairment and dementia. According to these researchers in general, there were no statistically significant differences between ginkgo biloba and placebo in relation to adverse effects. As for efficacy, it was concluded that there are benefits associated with the use of ginkgo biloba with doses lower than 0.20 g / day for 12 weeks or doses higher than 0.20 g / day for 24 weeks. It was observed with the cognitive parameters, activities of daily living and mood that there is superiority of ginkgo biloba in relation to placebo in the two dosage ranges.

Ribeiro, Leite, Dantas-Barros [13] stratified 120 herbal medicines and observed that gingko biloba was the most sought after vegetable medicine, accounting for 23.4% of those sought and purchased. Ridney, Kimber, Hindmarch [39] point out that the use of ginkgo biloba has been widespread in several countries around the world. Schulz, Hansel, Tyler [40] claim that several clinical studies have shown that ginkgo biloba extract can be used as an effective nootropic agent in the symptomatic treatment of cognitive impairments. However, Birks, Grimlet [38] disagree with some therapeutic indications for ginkgo bilola. They claim that there is no strong scientific evidence for its effectiveness in treating dementia and cognitive decline.

Marliére et al [20] in the research "Herbal drug use by elderly people: results from a domiciliary survey in Belo Horizonte (MG), Brazil", found the three most frequent herbal medicines among the elderly. Ginkgo biloba, horse chestnut and soy isoflavones accounted for more than half of the products used, with a great discrepancy between the first and the others. According to the research, the higher frequency of use of ginkgo bilola corroborates the findings of studies conducted in other countries with the elderly population, such as the Brownie study [41]. For Suzuki [42], the greater use of this herbal medicine can be justified by the existence of a large number of scientific studies carried out with standardized extracts of this plant, which has been gaining more and more space in therapy.

WHO [24] in non-clinical trials, the standardized extract of Ginkgo biloba (100 µg / mL) potentiated the contractile effect of norepinephrine. Possibly, the contractile action induced by ginkgo biloba refers to the release of catecholamines from reserves of endogenous tissues, which would be involved with the therapeutic effects observed in humans (for example: improvement of peripheral and cerebral vascular insufficiency). Results suggest that ginkgo biloba has a musculotropic action similar to papaverine, and this activity has been described for the flavonoids quercetin, kaempferol and isorramnetina, isolated from leaves of this species. In vitro studies have demonstrated that ginkgo biloba extracts have free radical scavenging activity and reduce oxidative lipoperoxidation in microsomes of rats and human liver. The extract inhibited the generation of reactive oxygen species in human leukocytes and protected brain tissue from hypoxic damage. Oral administration of ginkgo biloba extract protected mice from cerebral ischemia. Intravenous perfusion of the extract prevented the development of multiple cerebral infarction in dogs containing fragments of clot in the carotid artery. Mice treated with standardized gingko extract (100 mg / kg, orally, 4-8 weeks) showed improvement in memory and learning. Substances present in ginkgo biloba extract are known antagonists of platelet activation factor [43].

Ginkgo biloba is contraindicated for children under 12, pregnant and lactating women and patients with a history of hypersensitivity and allergy to any of the components of the herbal medicine. Patients with coagulopathies or using anticoagulants and antiplatelet agents should be carefully monitored [43]. Studies by Emser, Bartylla [44] "Zur Wirkung von Kava-Extrakt WS 1490 auf das Schlafmuster bei Gesunden" and Warnecke [46] "Psychosomatische Dysfunktionen im weiblichen Klimakterium" conclude that kava-kava (Piper methysticum G. Forst) Indicated for the symptomatic treatment of mild to moderate stages of anxiety and insomnia, in the short term (1-8 weeks of treatment).

WHO [45] in "Guidelines for predicting dietary intake of pesticide residues" concludes through clinical trials that P. methysticum extract is devoid of hypnotic properties as shown in clinical trials accompanied by quantitative EEG. According to WHO [47] in clinical studies on the influence on sleep quality, it was observed that the amount of sleep spindles and the percentage of deep sleep increased, REM sleep did not change, stage 1 sleep and latency of sleep tended to decrease and subjective sleep time increased. The influence of P. methysticum-based herbal medicines on the quality of sleep is not accompanied by a restriction in the ability to react.

Pittler, Ernst [46] in the research "Efficacy of kava extract for treating anxiety: systematic review and metaanalysis" carried out a meta-analysis of three clinical trials using doses of 100 mg, administered three times a day, of the standardized extract of P methysticum WS 1490, corresponding to 210 mg / day of kavalactones, for four, eight and 24 weeks, involving 198 patients, 51% of which were diagnosed using the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (DSM) standard III-R). In the three trials, there were favorable results for the extract of P. methysticum (showing a 10-point reduction on the Hamilton anxiety scale) compared to the placebo, and the meta-analysis of these results showed a significant reduction in the total score of the Hamilton scale in favor of P. methysticum. Brazil [43] presents a meta-analysis study to demonstrate the therapeutic efficacy and safety of standardized kava extracts in the treatment of anxiety, involving 158 patients with non-psychotic anxiety, score 19 on the Hamilton anxiety scale, and who received 300 mg / day of P. methysticum extract (corresponding to 210 mg / day of kavalactones).

Pittler, Ernst [47] in "Kava for treating anxiety - a meta-analysis of randomized trials" carried out a metaanalysis that suggested a significant reduction in the total Hamilton scale score in patients treated with the standardized extract of P. methysticum in relation to those treated with placebo.

Johnson et al [48] in a double-blind, placebocontrolled study with 29 patients treated for four weeks with 100 mg of kava extract (standardized at 70% kavalactones) three times a day, compared with the placebo group, found the kava group was found to significantly decrease the anxiety symptoms measured on the Hamilton anxiety scale. Kinzler, Kromer, Lehmann [49] in a doubleblind, placebo-controlled study with two groups of 20 women, who used the same dosage as the study previously described, concluded that the kava group was effective in reducing anxiety associated with menopause. Lehmann et al [50] claim that kava extracts have been favorably compared to prescription medications, such as anxiolytics and tricyclic antidepressants (often used to treat anxiety disorders), and without the adverse effects commonly reported for these drugs. In studies by Siegers et al [51] the use of Kava did not decrease attention and seems to improve concentration. In two separate studies, oxazepam (anxiolytic medicine) decreased the reaction time, while kava boosted performance.

For the National Health Surveillance Agency of the Ministry of Health of Brazil, kava-kava (Piper methysticum forst) is indicated for anxiety, insomnia, nervous tension and agitation. Its markers are kavapironas and kavalactonas (daily dose of 60-120mg of kavapironas) [2], [3]. It has a tranquilizing and antidepressant action; it is an excellent indication in the treatment of stress and its consequences.

Seitz, Schule, Gleitz [52] in vitro studies (nonclinical trials) claim that there was no significant blocking of serotonin reuptake by kavalactones, however, there was a blockade for norepinephrine by three lactones, describing thus another possible mechanism of action. For WHO [53] in "Assessment of the risk of hepatotoxicity with kava products", in the case of animal models, kava is known to inhibit experimentally induced seizures.

For Brazil [43], kava-kava is contraindicated during pregnancy and lactation, and in patients with endogenous depression or liver disorders. Several cases of liver toxicity have been reported in Europe after using herbal products containing extracts of P. methysticum. It is contraindicated for patients with liver disorders (hepatitis, cirrhosis, jaundice and others) and / or who use drugs that can cause hepatotoxicity, such as acetaminophen, HMG-CoA reductase inhibitors, isoniazid, methotrexate, among others. This herbal medicine is contraindicated for children under 12 years old, and for lactating women.

According to Bedevian [55], the sacred cascara (Rhamnus purshiana DC), Bruneton [56] is indicated for short-term treatment of occasional intestinal constipation.

According to WHO [56] in "Monographs on Selected Medicinal Plants", sacred cascara is included in the pharmacotherapeutic group of stimulating or irritant (contact) laxatives. The 1,8-dihydroxyanthracene derivatives trigger laxative effect by two different mechanisms of action: I- stimulation of motility of the large intestine that results in the acceleration of transit in the colon; II - influence on the processes of concomitant secretion by two mechanisms: the inhibition of water and electrolyte absorption (Na +, Cl-) for the colon epithelial cells (anti-absorptive effect) and stimulation of water and electrolyte secretion for the colon lumen (secretagogue effect), resulting in an increase in the concentration of fluid and electrolytes in the colon lumen. Defecation will occur 6-12 hours after the administration of the sacred saccharide, due to the time required for transport to the colon and metabolism of the active substances.

In a study by Gyorgy, Azvedo, Manso [57] "Reactions of inorganic free radicals with liverprotecting drugs" it was demonstrated that the laxative effects of sacred cascara are mainly due to anthraquinone glycosides, cascarosides A-D. After oral administration of sacred saccharide, hydroxyanthracenic glycosides are not absorbed in the upper part of the intestine, but are hydrolyzed in the colon by intestinal bacteria to form pharmacologically active metabolites [43].

For Blumenthal [31] and De Witte [58] these metabolites are partially absorbed in the colon and act as a stimulant and irritant in the gastrointestinal tract. According to De Witte [58], the mechanism of action is twofold. First, there is stimulation of colon motility, resulting in increased propulsion and accelerated transit of feces through the colon (which reduces the absorption of fluid from the fecal mass). Second, there is an increase in paracellular permeability through the colon mucosa, probably due to inhibition of the sodium / potassium transporter adenosine triphosphatase or inhibition of chloride channels. With the increase in permeability there is an increase in the water content in the colon. The laxative effect of the sacred saccharin is generally not seen until 6-8 hours after oral administration. Anthracenic glycosides are predominantly excreted in the faeces, but are also excreted in the urine, producing an orange color; anthraxes and anthranois are excreted in breast milk.

For Brazil [43] the sacred cascara is contraindicated in the following situations: it should not be administered to patients with intestinal obstruction and stenosis, atony, inflammatory colon diseases (ulcerative colitis, irritable bowel syndrome, Crohn's disease), appendicitis, dehydration severe and electrolyte depletion or chronic constipation. According to Brazil [43], the sacred cascara is contraindicated in patients with pain, colic, hemorrhoids, nephritis or any symptoms of undiagnosed abdominal disorders, such as pain, nausea or vomiting. According to Blumenthal [31], sacred cascara is contraindicated for children under 10 years old, pregnant and lactating women, and even in cases of liver, kidney and heart failure and patients with a history of hypersensitivity and allergy, it is contraindicated to any of the components of the herbal medicine [44].

For all herbal medicines, adverse effects, drug interactions, precaution in use, time of use, overdose and information on safety and efficacy, such as toxicity, must be observed.

3.3 Medical Specialties and Herbal Medicine Prescriptions

During the study period, doctors prescribed 13,176 herbal remedies. The medical specialties that prescribed the most were the general practitioner with 36% of all medical prescriptions. Then, in descending order, gastroenterologist with 21%, obstetrician-gynecologist with 11%, urologist with 9.7%, angiologist and vascular surgeon with 9% and cardiologist with 5.8% (table 7).

Of the medical prescriptions by the general practitioner, the senna with the sacred cascara stands out with 35% of the prescriptions, followed by ginkgo biloba with approximately 20% and the dry extract senna with 17% of the prescriptions. For the medical specialty of gastroenterology, 21% of the total prescriptions in the period were prescribed and of these 77% correspond to glucomannan, garcinia cambogia. For medical professionals in the specialty of gynecology-obstetrics, 26% were 40% isoflavones, 20% senna, the combination of kava-kava, isoflavones and senene 17.6% and 14% ginkgo biloba. Of the medical specialty of urology, the dry extract senna stands out with 63% of medical referrals. In the specialty of angiology and vascular surgery, 57% of horse chestnut recipes and 42% of ginkgo biloba, respectively.

The cardiology specialty was also registered with 88% ginkgo biloba recipes out of the total recipes prepared by doctors specializing in this area. Other medical specialties that prescribed herbal medicines were the general surgeon, ophthalmology, medical clinic, endocrinology, neurology and other specialties.

In the specific case of the significant frequency of ginkgo biloba, the medical prescriptions of the medical specialty angiology and vascular surgery are directly related to the search for the consumption of herbal products for general circulatory disorders and peripheral circulatory disorders (intermittent claudication), treatment of varicose veins, deep vein thrombosis, vasculitis, treatment of arteries with strictures, dilated arteries and cerebral vascular insufficiency. In this medical specialty (angiology and vascular surgery) the prescriptions of horse chestnut predominated, which does not require the mandatory medical prescription and suggests the indication in the treatment of varicose veins, microvarices, homorroids, edema of venous stasis and in association in the indication of capillary fragility treatment. In this study there is no reference to findings related to cognitive problems.

From the prescriptions of the general practitioner the senna has therapeutic indication for the treatment of occasional intestinal constipation and the sacred cascara is indicated for short-term treatment of occasional intestinal constipation. The general practitioner has indicated ginkgo biloba for the treatment of general circulatory problems. The prescriptions of the composition glucomannan, garcinia cambogia made by the medical specialty of gastroenterology have a direct relationship with the demand for the product to generate weight loss naturally. In the medical specialty of gynecology-obstetrics, therapeutic indications for the treatment of relief of menopausal symptoms, mastalgia and pre-master's syndrome predominated. The prescriptions of kava-kava are more suitable for the symptomatic treatment of mild to moderate stages of anxiety.

The total number of prescriptions by medical professionals is equivalent to approximately 80% of all prescriptions manipulated in the period studied. Reports point to the moment of great impact on the health system, mainly in the municipalities of the interior of the State, with the insertion in the labor market of a large number of recently graduated doctors, which would probably have participation in these herbal prescriptions. Paraguassu-Chaves, Batista, Silva Junior [12] in the research "Use and Notification of Herbal Medicine: Medical Prescription in an Amazonian Subspace" had already called attention to the large number of herbal medicine prescribed by general practitioner.

In a study carried out in the Basic Health Care Units of the Family, in the State of Ceará, over a period of one year, according to Negreiros [59], there was a prevalence of 70% of herbal medicines prescribed by doctors. In the study by Silva, Sousa, Gondim [60] in another municipality in the state of Ceará, adherence and acceptance by health professionals to use herbal medicines was over 90%. In Niterói, Rio de Janeiro, according to Teixeira, Nogueira [61] just over 60% of the population studied used medicinal herbs prescribed by health professionals. A situation was evident in this study. In Rondônia, about 90% of the doctors who work as general practitioners are newly graduated doctors and do not yet have a medical specialty, not even a disciplinary or complementary training in phyto-therapy to prescribe herbal medicines safely and with scientific knowledge, because they not there is the discipline of phytotherapy in the curriculum of the 4 medical courses offered in Rondônia. According to Paraguassú-Chaves, Batista, Silva Junior [12] and according to information from professionals in the manipulation laboratories (pharmacies), these recipes are requested by the patients themselves (in addition to the prescription of synthetic and industrialized drugs).

The indicator of herbal medicine recipes should be infinitely lower than that of synthetic medicine recipes (in Porto Velho and in the interior of the state, in the popular saying, "there is a pharmacy on every corner"). The general population is consulted by the general practitioner when it is not a matter of referral or screening (which does not exist in health posts). This is a reality in the Amazon and in other regions of the Brazil. The biggest concern that draws attention concerns side effects and the consequences of drug interactions. Paraguassú-Chaves, Batista, Silva Junior [12], warns of incompatible indications and inadequate recipes.

Table 6: Medical Specialty that P	Prescribed Phytotherapics.
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Medical speciality	Frequency %
General clinic	36.03
Gastroenterology	21.10
Obstetrical Gynecology	11.03
Urology	9.74
Angiology and Vascular Surgery	9.09
Cardiology	5.84
Otorhinolaryngology	1.29
General surgeon	0.97
Neurology	0.97
Ophthalmology	0.97
Endocrinology	0.64
Medical clinic	0.32
Orher specialties	1.94
Total	100%

Source: Manipulation Pharmacy

IV. CONCLUSIONS

The consumption of herbal medicines has increased significantly in the last years of the research in the cities of Ariquemes, Jaru, Ouro Preto do Oeste and Ji-Paraná, in Rondônia, Western Amazon, Brazil. mong the possible reasons for the increase in the consumption of herbal medicines are the search to find an alternative to synthetic medicines, the advances in the scientific area that allowed the development of herbal medicines known to be safe and effective, and the trend of the population, for less aggressive therapies intended for care primary health care.

The phytotherapics with the highest average frequencies with a medical prescription were senna (21.07%), ginkgo biloba (14.9%), kava-kava (14.20%) and, the sacred jar (12.62%). In general, senna and sacred cask indicate the population's search for slimming products, kava-kava to combat insomnia, nervous tension, agitation, distress problems or everyday malaise, ginkgo biloba to combat general circulatory problems and peripheral circulatory disorders (intermittent claudication) and cerebral vascular insufficiency. The general practitioner (general practitioner) with 36%, gastroenterologist 21%, gynecologist-obstetrics 11%, urologist 9.7%, angiologist and vascular surgeon 9% and cardiologist with 5.8% were the professionals in the medical specialties who prescribed the most. Of the medical prescriptions of general practice, the senna with the sacred cascara (35%), ginkgo biloba (20%) and the senna dry extract (17%), of the gastroenterology 77% correspond to glucomannan, garcinia cambogia, gynecology -obstetrics, isoflavones 40% (26%), senna (20%), combination of kava-kava, isoflavones and senna (17.6%) and ginkgo biloba (14%), from urology, senna dry extract (63%), of the specialty angiology and vascular surgery 57% of horse chestnut and 42% of ginkgo biloba. Cardiology stands out with 88% ginkgo biloba recipes out of the total recipes prepared by doctors specializing in this area.

The sacred cascara deserves very special attention. In the two study periods, it was prescribed in association with other herbal medicines and in isolation. The association glucomannan-garcínia cambogia demonstrates the demand for weight loss product, since (Garcinia cambodia) has the action of generating weight loss naturally.

The municipalities studied have equivalent preferences for some herbal medicines that can be justified for several reasons and one of them concerns that due to the proximity of the municipalities, a single doctor can prescribe in more than one municipality. One thing was evident, in Rondônia, about 90% of doctors who work as general practitioners (general practitioners) are newly graduated doctors and do not yet have a medical specialty, which compromises the efficiency and effectiveness of the prescribed herbal medicines. An alert to possible incompatible indications and inappropriate recipes.

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Influence of plastic deformation over the natural frequency of steel structures

Ana C. C. Barbosa, Rodrigo R. F. Pinto, Janes Landre Jr.

Department of Mechanical Engineering, Pontifícia Universidade Católica de Minas Gerais, Belo Horizonte, Brazil

Abstract— The modal analysis is an important step during the project of structures. Throughout it, it is possible to know structural properties that may help when it is necessary to analyze the integrity of the system. Many studies and researches are being developed to understand more deeply the phenoms that involve mechanical vibrations, especially because of their importance. One of these phenoms, for example, crucial in aeroelasticity, is the flutter, that requires the coupling of two different natural frequencies, which may happen when the material is plastically deformed. In its turn, the coupling requires the variation of natural frequencies, which was experimentally observed by this work through traction tests and modal analysis.

Keywords— Modal analysis, Natural frequencies, Plastic deformation.

I. INTRODUCTION

The modal analysis aims to determine the dynamic parameters of a system. Through it, it is possible to know indispensable properties to analyze the integrity of structures and machines when exposed to a specific boundary condition, such as fluid-structure interaction. It also helps to design solutions that enhance the reliability and security of the structure when under critical operation conditions, such as alternating loads capable of inducing resonance conditions [1]. One of the most famous cases of resonance is the Tacoma Bridge, that exhibited big oscillations before collapsing on November 7th, 1940. Those displacements were caused by the interaction between the wind and the structure [2].

Another phenom capable of causing failures and breakage of structures in aeroelasticity is the flutter. In typical wings, it happens when the air condition induces a decrease of the equivalent damping factor of the system and the natural frequencies of bending and torsion are coupled, causing unstable oscillations. Thus, flutter in typical wings demands not only a specific atmosphere condition but a convergence of natural frequencies [3].

Therefore, natural frequencies and mode shapes are directly related and must be analyzed during the design process, especially when dynamic loads are imposed on the system. Depending on the nature of the boundary condition, such as the atmosphere, the material properties, and the geometry, a different dynamic response may be observed, and that must be predicted in the project phase.

II. NATURAL FREQUENCY AND DEFORMATION

The natural frequencies of a system with n degrees of freedom may be determined by the calculation of the eigenvalue of its motion equation that may be modeled through the Lagrange equation:

$$\frac{d}{dt}\left(\frac{\partial T}{\partial \dot{x}_i}\right) - \frac{\partial T}{\partial x_i} + \frac{\partial V}{\partial x_i} = F_i \tag{1}$$

in which F_i is a non-conservative force, T is the kinetic energy and V is the potential energy of the system.

In turn, the energies T and V may be written as:

$$T = \frac{1}{2}Mv^2$$
(2)
$$V = \frac{1}{2}Kx^2$$
(3)

in which \boldsymbol{v} is the velocity, \boldsymbol{x} is the displacement, \boldsymbol{M} is the mass and \boldsymbol{K} is the stiffness.

Using numerical methods, it is possible to write the result of the substitution of (i.e., (3) and (i.e., (4) into (i.e., (1) in the matrix form below:

$$[M]\ddot{\vec{x}} + [K]\vec{x} = \vec{F} \tag{4}$$

Assuming a conservative system, (i.e., (4) turns into a homogeneous differential equation which solution adopts the format:

$$T(t) = C_1 \cos(\omega t + \phi) \tag{5}$$

in which C_1 is the amplitude and ϕ is the phase of the movement. This solution shows that all the coordinates may move harmonically at the same frequency ω and in the same phase ϕ .

But the frequency $\boldsymbol{\omega}$ may not assume any arbitrary value. Since this equation may be written as a system of equations of *n* degrees of freedom, the trivial solution is zero. However, for the other solutions, the coefficient matrix must be zero, making this an eigenvalue problem and resulting in a polynomial equation which roots are *n* values of $\boldsymbol{\omega}^2$, where $\boldsymbol{\omega}^2$ is the eigenvalue and $\boldsymbol{\omega}$ is the natural frequency of the system. Thus, the natural frequency may be expressed as:

$$\omega_n^2[M]\vec{X}^{(n)} = [K]\vec{X}^{(n)} \tag{6}$$

As presented by (i.e., (6), the natural frequency $\boldsymbol{\omega}$ is a function of the stiffness matrix [K] and the mass matrix [M].

Similarly, it is possible to write the torsion natural frequency as:

$$\omega_{tn}^{2}[J]\vec{X}^{(n)} = [K_{t}]\vec{X}^{(n)}$$
(7)

in which $[K_t]$ is the torsional stiffness matrix and [J] is the polar mass moment of inertia matrix.

One of the most powerful methods to estimate natural frequencies is the Finite Element. It is based on the discretization of the analyzed system and provides great flexibility to understand the dynamic responses of a structure when submitted to different boundary conditions in a virtual environment. However, the preliminary results of a Finite Element analysis differ from the reality, and Experimental or Operational Modal Analysis are constantly required to adjust the virtual model to the reality. These distortions may have many causes, such as joint conditions, discrepancies in material geometry and nonlinearity [4].

Therefore, comprehending the mathematics behind the natural frequencies modes is important to investigate if any properties of the system are capable of leading to natural frequency variation. Since the mass is not likely to

properties of a material, and its main output is the Stress-Strain curve [5]. The Stress-Strain curve has two well-defined regions. The first one is the elastic region, where the strain and the

mathematically by the Hooke's Law:

$$\sigma = E\varepsilon \tag{8}$$

in which $\boldsymbol{\sigma}$ is the stress, $\boldsymbol{\varepsilon}$ is the deformation and \boldsymbol{E} is the Young modulus, which expresses the material resistance to deformation.

vary under standard operation conditions, the variation

must come from the resultant stiffness. The tensile test is

one of the procedures utilized to determine and study the

stress of the material presents a linear behavior expressed

The second is the plastic region, where the strain and the stress have a non-linear dependency. Many equations define this region, but one of the most commonly used is the Hollomon's Law:

$$\sigma = Y \varepsilon^n \tag{9}$$

in which \mathbf{Y} is the tensile strength coefficient and n is the strain hardening coefficient.

It is possible to transform the Strain-Stress curve in the elastic interval into a Force-Displacement curve applying the stiffness equation, which leads to the following form:

$$F = Kx$$
[10]

The (i.e., (10) reinforces from another perspective that the stiffness of the material is constant in all the elastic region, and so, it must not be a parameter capable of inducing a variation of the natural frequency. However, if the material enters the plastic deformation, the stiffness is likely to vary because of the non-linear behavior expressed by the (i.e., (9).

Since the material assumes a non-linear dependency in the plastic region, it is not possible to apply Classical Mechanics to input and study its impacts in the movement equation and consequently in the natural frequency of the system. However, the Lagrangian Mechanics presents tools to solve this issue.

In 1992, Nogueira and Loeffler [6] added the nonlinear properties model into Hamilton's Principle and studied the influence of multiple boundary conditions in the dynamic responses of beams via the Finite Elements Method (FEM). Hamilton's Principle consists of an integration in time and space that can be used to evaluate dynamic effects in structures when approached from the perspective of minimum potential energy. So, introducing the nonconservative effects of a system, it is possible to write the equation:

$$\int_{t_1}^{t_2} (\partial T + \partial W_e + \partial W_u + \partial W_a) dt = 0$$
(11)

in which ∂T is the variation of the kinetic energy of the structure; ∂W_e is the external virtual work; ∂W_u is the internal virtual work and ∂W_a is the virtual work of the dissipative forces.

After introducing the non-linear mathematic model of materials in each term of the (i.e., (11) and some simplifications, it is possible to write the global matrix equation of the movement:

$$[M]\vec{x} + [C]\vec{x} + \vec{R} = f$$
(12)

in which f is the external load, [M] is the mass matrix of the structure, [C] is the damping matrix of the structure and \vec{R} is the stiffness vector.

As presented by Nogueira and Loeffler in (i.e., (12), the addition of non-linear properties into Hamilton's Principle prevents the emergence of the constant stiffness matrix [K] as presented in (i.e., (4). In its place, however, appears the vector \vec{R} , which is a function of the stress and the deformation.

In one of the exercises, considering a beam subjected to followers loads, the authors identified that the plasticization of the material not only amplified the displacement but also increased the natural frequency. This survey is intended to go deeper into these observations, validate the prediction of natural frequencies variation in the simulated environment and verify this phenomenon through tensile tests.

III. TENSILE TEST AND MECHANICAL PROPERTIES

Since the main activity of the study was to perform an impact test during a tensile test, it was necessary to manufacture proof bodies specially designed for this application. For that, hot-rolled SAE 1020 steel was chosen because of the specifications and easy access.

The proof bodies were designed to attend the tensile test machine specifications and the standard ABNT NBR ISO 6892-1:2013. The rupture region had 10mm of diameter and 100mm of length, and the clamping region had 16mm of diameter. The total length was 302mm. One of the extremities was designed to be longer than the other, making it possible to mill an area and positioning the accelerometer. The manufacturing drawing is presented in Fig. 1.



Fig. 1: Drawing of the proof bodies.

After the manufacturing of the proof bodies, two initial tensile tests were performed to obtain the stressstrain curve and determine the mechanical properties of the material and the system. The tensile machine utilized was the Emic GR048. An extensometer was utilized to determine the mechanical properties of the material, as presented in Fig. 2.



Fig. 2: Configuration of the mechanical properties tensile test.

After the tests, the tensile test machine generated the stress-strain curves in Fig. 3 and calculated the Young module, the yield stress, and the maximum stress. The tensile strength and the strain hardening coefficient were calculated by the regression method adjusted to Hollomon's law as presented in Fig. 4.



Fig. 3: Strain-stress curve generated by the tensile stress machine.



Fig. 4: Nonlinear regression with power adjustment utilized to determine the tensile strength and the strain hardening coefficient in the plastic region.

Table 1 presents a summary of the mechanical properties of the material.

Property	PB01	PB02	PB03	Mean
Young Modulus [GPa]	199.5	219.1	220.4	213.0
Yield Stress [MPa]	343.1	325.0	329.5	332.5
Maximum Stress [MPa]	491.7	483.2	476.6	483.8
Tensile Strength Coef.	714.6	744.2	728.6	729.1
Strain Hardening Coef.	0.139	0.163	0.159	0.154

Table 1: Mechanical properties of the material.

After the determination of the mechanical properties of the material, the other three tensile tests were performed to observe the system behavior. In these tests, the extensioneter was not utilized, so the collected data refer to the system. The curves obtained are presented in Fig. 5.



Fig. 5: Displacement-stress curve of the system.

From these curves, it was possible to calculate the mechanical properties of the system. The report generated by the machine provided the yield and the maximum stress, so it is possible to define the boundary of the elastic and plastic regimes.

Since the test was performed without the extensometer, it's not possible to measure the strain of the material. However, it is possible to measure the displacement of the machine and calculate properties analogous to Hook and Hollomon's laws. Thus, the Young module becomes the Elastic Resistance, the Tensile Strength Coefficient becomes a Plastic Resistance Coefficient and the Strain Hardening Coefficient remains as a Strain Hardening Coefficient. Performing this mathematical arrangement, it is possible to determine the values of each variable by regression methods adjusted to Hook and Hollomon's law as presented in Fig. 6. Table 2 presents a summary of the mechanical properties of the system.



Fig. 6: Determination of the mechanical properties of the system.

Property	PB04	PB05	PB06	Mean
Elastic Resist. [MPa/mm]	105.6	108.7	105.2	106.5
Yield Stress [MPa]	330.7	336.7	339.4	335.6
Maximum Stress [MPa]	476.7	476.4	477.9	477.0
Plastic Resistance Coef.	254.0	257.8	265.3	259.0
Strain Hardening Coef.	0.220	0.213	0.205	0.213

Table 2: Mechanical properties of the material.

IV. FINITE ELEMENT MODELING

In order to validate the prediction of natural frequencies variation and define a range of frequencies to elaborate the Fast Impact Hammer Test (FIHT) presented in item 5, a modal analysis was performed using the free student software ANSYS Mechanical, which is a mechanical engineering software solution that uses finite element analysis (FEA) to solve structural engineering problems. A tension specimen was projected according to the standard ABNT NBR ISO 6892-1 and its geometry was modeled in ANSYS SpaceClaim interface, as presented in Fig. 7.

Since the subject of this survey is to study the natural frequency behavior of the system in both the elastic and plastic regions, linear analysis was not adequate for this simulation due to the non-linear properties of the material in the plastic region, so a non-linear analysis was required.

To elaborate a non-linear analysis in ANSYS Mechanical, the material Stress-Strain curve was obtained by a tensile test aiming approximate the material properties of the simulation to that used in the practice. The data was processed using (i.e., (8) and (i.e., (9) and imported to the software. Fig. 8 presents the curve imputed.



Fig. 7: Geometry of the tension specimen modeled in ANSYS SpaceClaim.



Fig. 8: Stress-Strain curve of the material imported to the software.

The modal analysis was elaborated considering a prestress condition based on a static structural analysis. The first test of mesh was performed considering a mesh of 1.5 mm, which led to an extremely refined model. For this reason, tests using other dimensions were performed and it was possible the attribution of a mesh ten times less refined with just 2% of variation in results. Since this magnitude of variation is not significant considering the purpose of the simulation, the default mesh was attributed.

Besides that, it was necessary to stipulate contour conditions to the static analysis to reproduce the behavior of a tensile test. Therefore, a fixed support was applied to the underside of the specimen's model, while a displacement was applied on the upper side.

The displacement condition has been configured to allow translation along the Y axis but restrict movement along the X and Z axes. Fig. 9 shows these configurations applied to the model.



Fig. 9: Contour conditions established to the tension specimen's model.

The static analysis was performed considering displacements from 0 to 9.5 mm. To each displacement applied, a modal analysis with pre-stress was elaborated and the first natural mode was noted in order to build a Frequency x Strain curve. The results obtained are presented in Table 3 and the curve constructed is shown in Fig. 10.



Fig. 10: Frequency x Strain curve elaborated considering the modal analysis performed.

Table 3: Modal analysis results by using	g the Finite
Element Method.	

Displacement [mm]	Frequency [Hz]
0.00	2,043.7
0.02	2,051.7
0.04	2,059.7
0.06	2,067.7
0.08	2,075.6

0.10	2,083.5
0.12	2,091.2
0.14	2,091.7
0.16	2,102.3
1.00	2,143.6
1.50	2,151.1
2.00	2,156.5
2.50	2,160.8
3.00	2,164.3
3.50	2,167.4
4.00	2,170.0
4.50	2,172.4
5.00	2,174.5
5.50	2,176.5
6.00	2,178.3
6.50	2,180.0
7.00	2,181.5
7.50	2,183.0
8.00	2,184.4
8.50	2,185.7
9.00	2,186.9
9.50	2,188.1

V. TENSILE AND IMPACT TESTING

After the simulations in virtual environment, the tensile test was performed along with the impact test. The accelerometer was set in the lower extremity of the proof body, in the milled area. The setting of the experiment is presented in Fig. 11. The strain-stress curve of the system was utilized to determine frequency measurement points, as presented in Fig. 12.



Fig. 11: Setting of the tensile-impact test.



Fig. 12: Natural frequency measurement points along the Stress-Strain curve of the system.

To attend the natural frequencies estimated by the simulation, the operating manual of the hammer was utilized to select the hard tip (80 lbf pk) to perform the impact test. The acceleration was measured by the accelerometer and the collection module. The software CatMan Easy was utilized to perform the Fast Fourier Transform and determine the natural frequency of the system. Fig. 13 presents examples of the data collected.



Fig. 13: FFT of the natural frequency measurement in a) 0.5mm; b) 4.0mm; and c) 23.0mm of displacement.

The natural frequencies obtained in function of the displacement are summarized in Table 4, and Fig. 14presents it graphically.

Table 4: Natural frequencies measurements by p	oroof body
and displacement of the system.	

Displacement	Natural Frequency	Natural Frequency	Natural Frequency
[mm]	PB01	PB02	PB03
	[Hz]	[Hz]	[Hz]
0.5	-	1,209	1,296
1.0	-	1,267	1,345
1.5	-	1,320	1,387
2.0	-	-	1,426
2.5	1,429	1,395	1,463
3.0	-	1,398	1,452
3.5	-	1,392	1,446
4.0	-	1,386	1,442
4.5	1,413	1,382	1,437
5.0	1,409	1,380	1,434
7.0	1,404	1,379	1,430
9.0	1,395	1,372	1,421
11.0	1,383	1,361	1,412
13.0	1,366	1,349	1,399
15.0	1,353	1,332	1,384

International Journal of Advanced Engineering Research and Science (IJAERS) <u>https://dx.doi.org/10.22161/ijaers.74.8</u>

17.0	1,337	1,321	1,371
19.0	1,322	1,300	1,358
21.0	1,305	1,284	1,344
23.0	1,290	1,273	1,332
24.0	1,281	-	1,332
25.0	-	1,262	1,320
26.0	1,271	-	1,320
27.0	-	1,250	1,320
28.0	1,259	-	1,320
29.0	1,246	1,239	1,293



Fig. 14: Experimental natural frequency and Stress vs System Displacement.

VI. CONCLUSION

Focusing on the experimental data collected, it was possible to construct the graphic Stress and Natural Frequency vs Strain presented in Fig. 15. From that, it was possible to observe that the natural frequency of a system varies according to the state of stress and deformation. In the elastic regime, a significant positive statistical correlation was obtained, validating the tendency of increasing frequency due to the increase in deformation. In addition, it was found that the variation of the natural frequency in this regime adopts a linear profile with an average variation of 89 Hz/mm displaced.

Similar behavior was observed in the plastic regime. In this case, it was possible to perceive a high negative statistical correlation, proving a tendency for the natural frequency to reduce due to the increase in deformation. In this regime, it was also possible to observe a linear behavior whose average variation is approximately -6 Hz/mm displaced.





Before analyzing the collected data, it was necessary to treat them mathematically so that they were on the same basis. Since the simulated natural frequencies in Table 3 is a function of the strain, it was necessary to transform it into a function of the system displacement. However, there is no mathematic function that transforms the displacement of the system into the deformation caused in the test region of the material, especially because of lots of phenoms such as slippings and the deformation of the clamping extremities happens during the tensile test. Despite that, it was possible to observe that the behavior of the curves from the simulation and the experimental tests are not similar.

From Fig. 10, it was possible to observe that the static simulation indicates a tendency of growth of the natural frequency of the system as it deforms, being the growth stronger during the elastic regime and weaker in the plastic regime. The same behavior was not observed in the experimental data collected and presented in Fig. 14, that shows a tendency of growth of the natural frequency in the elastic regime and a tendency of reduction in the plastic regime.

Such conclusions allow perceiving that a staticequivalent simulation similar to the one carried out in this work does not adequately the behavior of the material in the elaborated experiment. In addition, for greater assertiveness of results, it is necessary to use the data obtained empirically in the experiments to determine the main characteristics of the boundary condition of the system and, based on this, develop another simulation that is closer to the real condition of the test.

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The Composition of Minerals with Addition of Pectinase in young wines *cv. Isabel* produced both in Handmade and Full Production

Márcio Vinícius Ferreira de Sousa¹; Marcus Vinícius Sandoval Paixão¹; José Benício Paes Chaves²; Paulo César Stringheta²; Paulo Henrique Alves da Silva²

¹ Professor Doutor do IFES/*Campus* Santa Teresa 29660-000 Santa Teresa – ES

² Professor Doutor do DTA/Universidade Federal de Viçosa 36570-000 Viçosa – MG.

Abstract— Minerals are part of the wines' ashes, take part in the clarification and stabilization process and contribute to their characterization. This work aimed at describing the dry red wine (cv. Isabel) produced in two canteens (A: handmade one and B: industrial one), regarding the possible differences in their mineral composition by adding pectinase. The wine produced in the canteens had the following treatments: HCVwtE (handmade canteen vinified without enzyme), HCMwtE (handmade canteen microvinified with enzyme), ICVwtE (industrial canteen vinified without enzyme) iCMwtE (industrial canteen microvinified with enzyme). ICVwtE (industrial canteen microvinified with enzyme). The P content was assessed calorimetrically; the Ca, Mg, Mn, Fe, Cu and Zn contents were assessed by atomic absorption; and the K and Na contents were assessed by flame emission. The CRD in factorial 2 x 3 (canteen x enzyme) with four repetitions was used. Data were tested with ANOVA, Tukey's test and Principal Component Analysis (PCA). The canteen modified the contents of K and Zn, and the enzyme influenced the content of Mg. The contents of P, Mn and Cu of the wine produced in the canteens weren't altered by the process of vinification with pectinase. The PCA applied to the contents of Zn, Ca, Fe, P and K distinguished the wines of the ICMwtE from all the others. However, it was not possible to separate the wines produced in the canteens with pectinase.

Keywords— Canteens, Clarification, Industry, Artisan.

Composição de Minerais Com Adição de Enzima pectinase em Vinhos Jovens *cv. Isabel* Produzida em Escala Artesanal e Industrial

Resumo— Os minerais representam uma parte das cinzas dos vinhos, participa do processo de clarificação, estabilização e contribuem para sua caracterização. Objetivou-se caracterizar o vinho tinto seco de mesa (cv. Isabel) produzido em duas cantinas (A: artesanal e B: industrial) podendo se diferenciar em sua composição mineral com adição de pectinase. Os vinhos produzidos nas cantinas constituíram nos seguintes tratamentos: CAVsE (cantina artesanal vinificado sem enzima), CAMsE (cantina artesanal microvinificado sem enzima), CAMcE (cantina artesanal microvinificado com enzima), CIVsE (cantina industrial vinificado sem enzima), CIMsE (cantina industrial microvinificado sem enzima), e CIMcE (cantina industrial microvinificado com enzima). O teor de P foi determinado por calorimetria. Os teores de Ca, Mg, Mn, Fe, Cu e Zn foram feitas por absorção atômica, enquanto K e Na por emissão de chama. O delineamento utilizado foi DIC em fatorial 2 x 3 (cantina x enzima) com quatro repetições. Os dados foram submetidos à análise de variância, teste de Tukey e a Análise de Componentes Principais (ACP). A cantina modificou os teores de K e Zn, e a enzima influenciou no teor de Mg. Os teores de P, Mn e Cu dos vinhos produzidos nas cantinas não foram alterados pela introdução ao processo de vinificação de enzima pectinase. A ACP aplicada aos teores de Zn, Ca, Fe, P e K diferenciou os vinhos da cantina industrial microvinificado sem enzima e da cantina industrial microvinificado com enzima dos demais, no entanto, não foi capaz de separar os vinhos produzidos nas cantinas com a introdução de enzima pectinase.

Palavras-chave— Cantinas, Clarificação, Industria, Artesanal.

I. INTRODUCTION

The Vineyard area with 82.507 hectares produces 1.456 thousand tons of grapes annually. In 2012, approximately 43% of total production was commercialized for fresh consumption and 57% was processed into wine and grape juice (MELLO, 2013).

The Espírito Santo State produced 1.810 tons of grapes, and the city of Santa Teresa is the greatest producer, with 33,6% of the State's production (IBGE, 2012).

The preparation of wine begins with the vintage and the quality of the wine depends on the quality of the grape, essentially (variety, heath and proper maturation). Such quality is assessed by the physicochemical properties of the wine, which allows the visualization of the wine's balance, also either identifying or not the effective control of the winemaking process steps (GUERRA, 2009).

The use of specific enological technologies contributes to the increase or decrease of the content of minerals in wines. The maceration of red wines and the peculiar maceration of white wines contribute to the increase in contents of minerals in the wine. The mineral in greater concentration is K, followed by Ca and Mg. Among other cations found in smaller quantity are Na, Mn, Fe, Cu, Zn, Li and Rb (RIBÉREAU-GAYON et al., 2003).

The pectic enzymes can be used in the vinification process, since they have the advantage of facilitating the extraction of poliphenols, enhancing the flavor, favoring the pressing, increasing the yield in wine and favoring the clarification / filtration of the wine (Amorim *et al.*, 2006). The use of pectinase provide a greater extraction of the coloring matter and the chemicals in general (DUCRET; GLORIES, 2002).

Considering the importance of the wine sector for the city of Santa Teresa and the little access to information on wine, this work aimed at assessing the young wines *cv. Isabel* produced both in handmade and full production, aiming at identifying the differences in their mineral compositions with the addition of pectinase.

II. MATERIALS AND METHODS

Initially, the Grape and Wine Producers of Santa Teresa Assossiation (Associação dos Produtores de Uva e Vinho Teresense – APRUVIT) was contacted. Then, two designated canteens were selected: i) handmade canteen (HC): a premise with an adapted structure (facilities and equipment), producing 5000 L/ year of red wine, with vinification and microvinification held in polypropylene tanks; and ii) industrial canteen (IC): a premise with a technified structure (facilities and equipments), producing 27000 L / year of red wine, with vinification held in steel tanks and microvinification in polypropilene tanks.

The wine produced in two canteens, a handmade one and an industrial one, constitutes six treatments, with three repetitions each, adding up to 18 experimental units, with the following treatments (Painting 1).

Painting 1 – Description of the treatments applied	to!	the
experiment		

Treatments	Description
1	HCVwtE (handmade canteen vinified without enzyme)
2	HCMwtE (handmade canteen microvinified without enzyme)
3	HCMwE (handmade canteen microvinified with enzyme)
4	ICVwtE (industrial canteen vinified without enzyme)
5	ICMwtE (industrial canteen microvinified without enzyme)
6	ICMwE (industrial canteen microvinified with enzyme)

The dry red wine produced in both handmade canteen and industrial canteen comes from commercial plantation. (harvest: summer of 2012) of *Vitis labrusca* L.

(*cv. Isabel*) located in Santa Teresa/ES, coordinates 19° 59' 20" S and 40° 34' 44" W, altitude 155 m (INCAPER, 2011).

The vinification in red wine applied was the classic method, which was modified since the references Rosier (1995), Rizzon et al. (2003) (Figure 1). The grape was transported to the canteens (handmade and industrial) in polyethylene boxes with capacity of 20 kg. The grapes were weighed in platform scales branded 'Cauduro', model 118PL. The berries were separated from the rachis and smashed in an inox crusher-destemmer branded 'Japa', model DZ-35 (3000 kg h⁻¹) with coupled pump. A must sample was transferred to a 500 mL measuring cylinder and it was determined that, with mustmeter °Babo, the amount of sugar in grams in 100 g must.

In the vinification of the HCVwtE and ICVwtE treatments, polypropylene and stainless steel fermentation tanks (varying volumes) were used, respectively. In the microvinification of the HCMwtE, HCMwE, ICMwtE and ICMwE treatments, 50L propylene tanks were used. The period of maceration (fermentation: tumultuous phase) lasted from 5 days (industrial canteen) to 7 days (handmade canteen), with daily pumping. During this stage, 20g potassium metabisulfite per hL⁻¹ must. This was inoculated with active dry yeast (*Saccharomyces cerevisiae*) MaurivinTM – UCD 522, produced by *AB Mauri*, in quantity of 20 g.hL⁻¹ must, adding to the HCMwE and ICMwE the recommended dose of 3 ml hL⁻¹ must.

Following the removal of the cap and the pressing, the musts were chaptalized with crystal sugar (5.4 kg sugar per hL must). Afterward, the fermented musts were collected and transferred to six fermentation tanks of varying volumes, which three of them, made of polypropylene, held the HCVwtE treatments and the other three, made of stainless steel, held the ICVwtE treatment. In microvinification, the fermented musts of each treatment (HCMwtE, HCMwE, ICMwtE and ICMwE) were transferred to the three 30L polypropylene tanks, all of them with hydraulic bung.

The fermentation, in its slow phase, lasted 20 days with the first racking being realized 15 days by the end of the slow phase. The second racking was realized 30 days by the end of the first racking, and it was added to it 8g potassium metabisulfite per hL must. The third racking was realized 30 days by the end of the second one, and after each racking the casks were tapped and topped up.

The wine was bottled in the canteens by using semi automatic filling machines branded JAPA. The wines were poured into 750 ml new dark bottles, sealed with cork and labeled according to their respective treatments. The bottles were stored in horizontal position, in a dry, airy and light-protected place, under the temperature of $25\pm1^{\circ}$ C.

The experimental design applied was the Completely Randomized Design (CRD) with 2X3 factorial treatment combinations (canteen factor X enzyme factor) in 3 repetitions. The mineral results (P, Ca, Mg, K, Na, Mn, Fe, Cu, e Zn) were submitted to the Analysis of variance, the Tukey Test (enzyme) under 5% probability. Besides, the Principal Component Analysis (PCA) was also applied. Regarding the statistical analysis, procedures of the statistical program SAS (*Statistical Analysis System – SAS* Institute Inc., North Carolina, USA, 1992) version 9.2, licensed for the Universidade Federal de Viçosa/UFV – MG, were applied.

The minerals were determined at the Forest Soil Laboratory at Federal University of Viçosa - Minas Gerais State. The content of phosphorus (P) was determined through the Bel-1105 photocolorimeter, following the methodology proposed by Perkin-Elmer (2000). The contents of calcium (Ca), magnesium (Mg), manganese (Mn), iron (Fe), copper (Cu) and zinc (Zn) were analyzed through a Varian atomic absorption spectrophotometer, model Spectra 220-FS, following the methodology in Perkin-Elmer (2000). The determinations of potassium (K) and sodium (Na) were calculated using a Corning-400 flame photometer, according to Ough and Amerine's methodology (1988), and the results were expressed in mg L⁻¹.

Eight 750ml bottles of dry red wine were collected randomly from both handmade and industrial canteens and identified according to each treatment (HCVwtE, HCMwtE, HCMwE, ICVwtE, ICMwtE and ICMwE) in three repetitions, summing up 144 bottles. The bottles of wine were stored in the canteens in polypropylene boxes in the horizontal position and transported to their respectively laboratories in paper boxes with 12 bottles each, under 25±1 °C permanently until the beginning of the analysis in October 2012.

The Principal Components Analysis (PCA) was applied to the analytical characteristics of the actual alcohol content, total acidity, volatile acidity, pH, total dry extract, reduced dry extract, total sugars, total sulfur dioxide, total chlorides, ashes, alcohol in weight / reduced dry extract, methyl alcohol, anthocyanins, total polyphenols, color index and tonality.



Fig.1 - Operations that were carried out for the elaboration of dry red table wines (Source: modified from Rosier, 1995; Rizzon, Meneguzzo and Manfroi, 2003).

III. RESULTS AND DISCUSSION

The variance analysis of K, Na, Ca, Mg, Zn and Fe did not detect significant effect (p > 0.05) regarding the interaction canteen*enzyme. Significant effects were considered (p < 0,05) for K and Zn (canteens) and Mg (enzymes). The average contents of Na, Ca, Mg and Fe equaled (p > 0.05) in both handmade canteen (HC) and industrial canteen (IC) wines. Also the contents of K, Na, Ca, Zn and Fe equaled (p > 0.05) in wines either added or not enzymes to them (VwtE: vinified without enzyme; MwtE: microvinified without enzyme; and MwE: microvinified with enzyme). However, the average contents of K and Zn in the canteens were different (Table 1) and Mg in wines which either or not used enzymes (Table 2) were different (p < 0.05). The content of minerals in the wines depends on several factors, such as the presence of these elements in soil, enological practices, processing conditions, industrial development and contact with materials that may have such compounds during the wine production and conservation stages (RIBÉREAU-GAYON et al., 2003).

The average contents in the handmade and industrial canteens for K were, respectively, 1041.32 mg L⁻¹ and 1120.97 mg L⁻¹ (Table 1), such results are superior to the ones found in wines from Serra Gaúcha, by Rizzon, Miele and Meneguzzo (2000); Rizzon and Miele (2002; 2005; 2006; 2011); Rizzon, Salvador and Miele (2008). The content of K was greater compared to the composition of Serra Gaúcha wines, probabily due to the time of maceration applied to the vinification. Almost of of the potassium in the wine comes from the pellicle and the seed of the product, extracted from the maceration process (Rizzon, Salvador and Miele, 2008). The K is the most important mineral in musts and wines. Its presence is paramount for determining and stabilizing the Potassium bitartrate.

The average content of Zn (Table 1) found in the handmade canteen was 0.07 mg.L^{-1} and in the industrial canteen 0.13 mg L^{-1} , these numbers were inferior to the ones observed by Rizzon, Miele and Meneguzzo (2000); Rizzon and Miele (2002; 2005; 2006; 2011); Rizzon, Salvador and Miele (2008) for table red wine, and uncer the maximum limit established by Brasil (1965) and OIV (2012). According to Ribéreau-Gayon *et al.* (2003), wines from more prolonged macerations present a higher concentration of Zn. However, despite the greater time of maceration taken in the handmade canteen, it was observed in this work a greater concentration of Zn in the industrial canteen compared to the handmade one.

 Table 1 – Average contents and mineral standard deviation
 of dry red wines (cv. Isabel) of Santa

Teresa	-ES.

	Canteens		
Components	Handmade (HC)	Industrial (IC)	
Potassium (mg.L ⁻¹)	1041.32 ± 99.57	1120.97 ± 11.52	
Zinc (mg.L ⁻¹)	0.07 ± 0.07	0.13 ± 0.05	

The average Mg contents in the VwtE, MwtE and MwE treatments (Table 2) were, respectively, 56.98 mg L⁻ ¹, 65.78 mg L⁻¹, and 62.06 mg L⁻¹. The MwE and MwtE treatments did not differ (p < 0.05) from one another, but differed (p > 0.05) from the VwtE treatment; these MG contents were smaller than the ones found by Rizzon, Miele and Meneguzzo (2000); Rizzon and Miele (2005, 2006 and 2011); Rizzon, Salvador and Miele (2008). For Rizzon (2010) The Mg concentration found in wines varies between 50 and 90 mg.L⁻¹. The Mg average concentrations in microvinified wines (MwtE and MwE) were greater (Table 2), since, according to Daudt, Dal Piva and Rizzon (1992) these wines go through a differing maceration due to the relatin between the surface of the contact / volume of the wine. On the other hand, wines non microvinified show a smaller relation between the surface of contact and the volume during maceration.

Table 2 – Average contents and mineral standard deviations in dry red wines (cv. Isabel) of Santa Teresa – ES, submitted to different treatments

Components		Enzymes	
components	VwtE	MwtE	MwE
Magnesium	$56.98 \pm$	$65.78 \pm$	$62.06 \pm$
(mg.L ⁻¹)	3.66 B	0.27 A	5.09 AB

Averages followed by the same letter in the lines, for each characteristic, do not differ from one another according to the Tukey Test (p < 0.05).

VwtE (vinificated without enzyme); MwtE (microvinificated without enzyme); MwE (microvinificated with enzyme).

The average contents of phosphorus (P), manganese (Mn), and copper (Cu) were significantly (p > 0.05) affected by the interaction canteen*enzyme. The consequences of the interaction is represented on Table 3. The phosphorus (P) is naturally present in wines, both in mineral and organic forms. This element plays an important role (mainly when

the contents are elevated) in the composition of precipitated ferric phosphate, causing turbidity in wine (Rizzon, 2010). According to Table 3, the contents of P from the analyzed wines vary between 25.47 mg L^{-1} (HWMwE: handmade wine/microvinified with enzyme) and 63.59.05 mg L^{-1} (IWMwtE: industrial wine/microvinified without enzyme); the numbers are below the ones found by Rizzon and Miele (2005 and 2011); but approximate to the ones found by Rizzon and Miele (2006); Rizzon, Miele and Meneguzzo (2000).

The average contents of P in wines do not differ significantly (p < 0.05) between the ICVwtE (industrial canteen/vinified without enzyme), ICMwtE (industrial canteen/microvinified without enzyme) and ICMwE (industrial cantee/microvinified with enzyme) treatments (Table 3). Manfroi and Rizzon (1996) showed that the time of maceration is directly related to the amount of phosphorus extracted from the pellicle. In this study, however, the time of maceration resulted into fewer extractions of P from the pellicle in the HCVwtE, HCMwtE and HCMwE treatments when compared to the ICVwtE, ICMwtE and ICMwE, despite the handmade canteen wines being macerated for longer.

The average content of Mn was superior and differed significantly (p > 0,05) in the HCVwtE treatment when compared to all the other ones (Table 3). In red wine vinification the fermentation (tumultuous phase) is carried out with the berry (bark, pulp, seed) and, since in the handmade canteen the time and maceration are greater than in the industrial canteen, the seed will be in contact with the must for longer.

The red wines present greater contents of those minerals, since they are found in greater amount in the seeds. Some phytosanitary products used for disease control in vines can increase their concentration in wines. The content of Mn found in the wine varies between 0.5 and 3.5 mg. L⁻¹ (RIBÉREAU-GAYON et al., 2003; RIZZON, 2010). The concentration of this cation found by Rizzon, Miele and Meneguzzo (2000); Rizzon and Miele (2005; 2006 e 2011); Rizzon, Salvador and Miele (2008) were greater than the ones found in this work (Table 3).

		Enzymes		
Components	_	VwtE	MwtE	MwE
Dheamheans $(m \neq L^{-1})$	НС	$25.47\pm0.62~B$	$44.36\pm0.11A$	$44.37\pm0.26A$
Phosphorus (mg.L ⁻)	IC	$59.33\pm6.09A$	$63.59\pm6.42~A$	$55.72\pm0.09A$
Manganese (mg.L ⁻¹)	HC	$0.15\pm0.02A$	$0.11\pm0.01~B$	$0.05\pm0.02\;C$
	IC	$0.09\pm0.02A$	$0.11\pm0.01\ A$	$0.12\pm0.01\;A$
Copper (mg.L ⁻¹)	HC	$0.03\pm0.01~B$	$0.05\pm0.01A$	$0.02\pm0.01~B$
	IC	$0.02\pm0.00\:A$	$0.02\pm0.01\ A$	$0.02\pm0.00\;A$

Table 3 – Average contents and mineral standard deviation in dry red wines (cv. Isabel) of Santa Teresa – ES, submitted to different treatments

Averages followed by the same capital letter in lines, for each characteristic, do not differ from one another according to the Tukey Test (p < 0.05) in the HC, IC, VwtE, MwtE and MwE.

Table 3 presents the average contents of Cu (between 0.02 and 0,05 mg.L⁻¹) which were lower than the ones found by Rizzon, Miele and Meneguzzo (2000); Rizzon and Miele (2005; 2006); Rizzon, Salvador and Miele (2008), and lower than the limits established by Brasil (1965) and OIV (2012) regarding its toxicity. It was observed that (Table 3) the HCMwtE treatment presented a greater content of Cu, differing significantly (p > 0,05) from all the other treatments. Probably, the grape used in the handmade canteen (HC) vinification went through a greater pulverization (cupric treatment) for mildew control, what can result in a greater concentration of this cation in the wine. According to Rizzon (2010), Cu joins the processes of

turbidity and oxidation of the wines. Its concentration depends on the phytosanitary treatments carried out (mildew control) or the wine contact with other materials and containers which have Cu. The content of Cu found in wine varies between traces and 5 mg L^{-1} .

This way, it was applied the Principal Component Analysis (PCA) to the contents of the minerals in dry red wines of Santa Teresa – ES in order to verify whether the mineral characteristics could differ them under the following treatments: HCVwtE, HCMwtE, HCMwE, ICVwtE, ICMwtE and ICMwE (Figure 2).



Fig.2 – Disposition of the mineral characteristics and treatments in relation to the first two main components. Symbols: P – phosphorus; K – potassium; Ca – calcium; Mg – magnesium; Fe – iron; Cu – copper; Zn – zinc; Mn – manganese e Na – sodium.

Rizzon, Salvador and Miele (2008) applied the PCA aiming at determining the concentration of the main cations (K, Na, Ca, Mg, Mn, Fe, Cu, Zn, Rb, Li) of the Serra Gaúcha wines, so that they could describe their features. In this work, such multivariate analysis technique allowed to differentiate the wines according to their color – red, rosé, white – as well as their type – fine wine and table wine.

According to PCA, it was possible to verify that the first two main components (CP1 *versus* CP2) are responsible for 67,6% of the variability in data distribution: CP1 is responsible for 41,7% of the variation and CP2 justified 25,9% of the variation between the samples. The spatial separation of the six treatments (HCVwtE, HCMwtE, HCMwtE, ICVwtE, ICMwtE e ICMwE) indicates the formation of three different groups, each of them made of the following treatments: a) HCVwtE with ICVwtE; b) HCMwtE with HCMwE; c) ICMwtE with ICMwE (Figure 2).

The mineral contents are represented by vectors. The positive area of axis 1 (CP1: explains 41,7 % of the sample variability) is associated to the content of Fe, Zn, Ca, P, K, Na, Mn and Mg, while the negative area of axis 1 (CP1) is associated to the content of Cu. So, the further to the right of treatments (HCVwtE, HCMwtE, HCMwtE, HCMwtE, ICVwtE, ICMwtE and ICMwE) they are locate in this axis, the greater their contents of Fe, Zn, Ca, P, K, Na, Mn and Mg will be; and, the further to the left, the greater the content of Cu will be. The axis 2 (CP2) of the positive areas is

associated to the cations Mn, Fe, Zn, K, Ca and the negative area to the cations Mg, Na, Cu and P.

The discrimination of the treatments can be verified according to the size of the vector which represents the cation, that is, the larger the vector, the greater the importance of discriminating the treatments is. The proximity of all dry red wine treatments in relation to the vectors indicates the cation in greater content in the treatment.

Figure 2 suggests that the contents of Zn, Ca, Fe, P, and K (positive correlations with the first main component CP1) are present in greater concentration in the ICMwtE and ICMwE treatments, since these are located to the right (positive area of the horizontal axis). On the other hand, the HCVwtE, HCMwtE, HCMwE and ICVwtE treatments, located to the left area of the horizontal axis (negative area) have such contents in less concentration. The CP2, otherwise, can separate the ICMwtE and ICMwE treatments, mainly through the Mn (correlação positiva com CP2), Mg e Na (negative correlation with CP2).

The PCA, applied to the mineral contents was able to discriminate the ICMwtE and ICMwE treatments from the other ones. However, the PCA applied to the contents of Zn, Ca, Fe, P e K, despite the satisfactory discrimination of ICMwtE and ICMwE treatments from the other, it was not able to separate the dry red wines produced in the handmade canteens(HC) from the ones produced in the industrial canteens(IC) after the introduction of the vinification

process of the pectinolytic enzyme. Possibly, this is due to the fact that the concentrations of minerals in wines reflects not only the edaphoclimatic conditions, variety and the must composition, but it is also related to the use of phytosanitary products and enological techniques (RIZZON, 2010).

IV. CONCLUSION

The canteen modified the contents of K and Zn, and the enzyme influenced the contents of Mg. The contents of P, Mn and Cu of the wines produced in the canteens were not altered by the introduction of the process of vinification of the pectinase. The PCA applied to the contents of Zn, Ca, Fe, P and K differed the wines from the industrial/microvinified without enzyme treatment from the others, however, it was not able to separate the wines produced in the canteens with the introduction of the pectinase.

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Applications of satellite images and field databases to analyze agroforestry systems in Brazil

Édson Luis Bolfe

Brazilian Agricultural Research Corporation – Embrapa State University of Campinas – Unicamp

Abstract — Agroforestry systems (AFS) are part of a land use strategy aimed at maintaining environmental services in Brazilian Amazonia. Retention of ecosystem carbon stocks is an important environmental service considering the changing atmospheric composition and its effects on climate. We quantified the role of AFS on aboveground biomass (AGB) and carbon storage (CS) in the municipality of Tomé-Açu, Pará, Brazil. Satellite images information and multiscale databases were used to locate and analyze agroforestry. The different agroforestry plots were divided into four classes: AFS 1, AFS 2, AFS 3 and AFS 4. The indirect method, which is based on allometric equations for different species and diametric classes, was used to calculate the AGB (average was of 106 Mg ha⁻¹) and CS (average was of 48 Mg C ha⁻¹). The biomass storages in the AFS of Tomé-Açu indicate that these production systems accumulate important C amounts in their vegetation, and may contribute to the CO₂ sequestration process, indicating possibilities for environmental, economic and social sustainability.

Keywords— Geotechnology, Carbon Storage, Sustainable Agriculture.

I. INTRODUCTION

In the Amazon region of Brazil, the land conversion into agricultural systems and/or pastures provokes substantial releases of carbon dioxide [1]. Current research seeks efficient production systems to maintain carbon (C) sequestration and storage in biomass and in the soil agroforestry systems have high potential for C sequestration and for the reduction of greenhouse gases emissions [2, 3]. They also present possible of synergic interactions with sustainable adaptation and development, generating jobs and income and contributing to biodiversity and to the conservation of hydrological regimes [4].

In Brazil, especially in Amazonia, AFS have been broadly studied in the past years, with emphasis on family farms [5, 6, 7). The AFS in Amazonia have demonstrated comparative advantages in contrast to monocultures. Besides avoiding soil degradation and improving soil physical and chemical conditions through an increase in the amount of soil organic matter, they constitute an economically effective land use because the production per area unit is high. This is especially true when annual, semi-perennial, perennial, woody and non-woody species, along with livestock, are combined simultaneously in a way that is compatible with the standards of family farmers [8, 9]. That AFS with a selection of native fruit and wood trees restored abandoned or degraded areas in Amazonia, and recovered not only the land productive capacity, but several environmental services, such as C fixation by biomass, water cycling and biogeochemical regulation [10].

Agroforestry systems are diverse, and each system has different edaphoclimatic conditions and species composition. The biomass estimation in agroforestry systems is complicated by the high dispersion of the areas and to variation management systems. While some biomass studies have been carried in agroforestry systems using destructive methods, these are extremely labor intensive. For agroforestry systems with a forest structure indirect quantification of biomass using non-destructive measurements from field inventors, algometric equations and remote sensing generates valuable data for estimation of carbon storage in the AFS vegetation [4, 11, 12, 13].



Fig. 1 Study area showing property boundaries superimposed on a false color composition Landsat 5 images in Tomé-Açu, Pará – Brazil.

II. MATERIALS AND METHODS

This study was carried out in the Quatro Bocas district in the municipality of Tomé-Açu, located in the northeastern region of Pará state, Brazil (Figure 1).

In this study, the objective is to estimate aboveground biomass and carbon storage in agroforestry systems in Amazonia using satellite images information, databases and indirect methods based on sampling in established sites in Tomé-Açu, Para State in the Brazilian Amazon. Topography in the region is characterized by low flat plateaus, terraces, and lowlands with altitudes varying from 14 to 96 m. The soils are classified as Ferralsols, Plintosols and Fluvisols and has a humid mesothermal climate – Ami according to the Köppen classification – with high average annual temperatures (26° C) and relative air humidity rate of about 85%. The average annual rainfall is 2,300 mm. The original vegetation is that of lowland dense ombrophilous forest, which has been intensely altered [14].
A Landsat satellite image from the National Aeronautics and Space Administration (NASA) and database images from the Google Earth was used to identify the distribution of farm lots, where areas with potential for field surveys were selected. A total of 40 sampling plots were selected at random. In each sampling unit located using a Global Positioning System (GPS) receiver [15]. Information about land use and cover history, AFS ages, floristic arrangement, percentage of canopy cover, percentage of herbaceous plants, litter, and exposed soil were also collected.

The aboveground biomass estimation can be obtained by direct or indirect method [16]. The direct method is more accurate, but harder and more costly because of the need of cut and weigh all the trees in the sample area. The indirect method is quicker and has lower costs, but it is subject to measurement errors, which are not always mentioned [12]. This work used the indirect method for C and biomass estimation, with simple random sampling. Two factors were relevant for that choice: first, the wide scope of the sampling areas; and second, the impossibility of cutting the vegetable components of the studied agroforestry systems.

The aboveground biomass (AGB) equations developed in Pará State [17, 18], were used to estimate *Theobroma cacao* L., *Euterpe oleracea* Mart., *Theobroma grandiflorum* Schum. and other species in agroforestry systems (AFS). To estimate the carbon storage (CS) for the different systems classified, their AGB was multiplied by a factor of 0.45 aboveground C based [19]. The agroforestry classes (AFS 1, AFS 2, AFS 3 and AFS 4) were defined based on values for canopy cover (CC%), diameter at breast height (DBH), basal area (G), and total height (H) following [15].

III. RESULTS AND DISCUSSION

The results of satellite images information and multiscale databases analyzes show the landscape mosaic is dominated by pasture, agricultural fields, agroforestry systems, and secondary forests. Forest remnants are observed especially at the margins of streams. Tomé-Açu started its agricultural development in the 1920's, with the beginning of the Japanese immigration to the region. The immigrants implanted horticulture and, later, black pepper (*Piper nigrum* L.). They were provided with lands by the Brazilian government, which made technological development possible and turned Pará into the greatest black pepper cycle from the 1970's on, caused by fusarium blight, the farmers looked for new production alternatives.

The way out of this ecological crisis for the immigrants was to diversify their activities, with emphasis in native and exotic fruit trees that initiated a new economic cycle for the region [20]. Crop diversification was associated to a new production system, the agroforestry systems, developed from countless local experiments that generated different production arrangements with various species and promoted the products into new markets.

The current agroforestry systems (1 to 35 years old) have great variety of fruit and timber tree species. That the success of the region's agricultural development results from the great experience of the Japanese-Brazilian farmers, from their innovative thinking, their holistic view of future markets and their social-minded spirit, which made possible the creation of the Cooperativa Agrícola Mista de Tomé-Açu (Camta) in 1931, whose intention was to sell vegetables and nowadays commercializes the agroforestry products (fruit, pulp, juice and oil) in various countries [21, 22].

The data obtained in the studied agroforestry inventory were 5,697 individuals ha⁻¹ with DBH (Diameter at Breast Height) greater than 2.5 cm, belonging to 29 plant families and 54 distinct species, were inventoried in the studied AFS. These numbers are similar to those found observed 27 families and 61 species, and observed 26 families and 59 species, both during analyses of AFS in the municipality of Cametá, Pará State, Brazil [23, 24]. The values are somewhat lower than those found in studied the floristic composition of AFS in the Acre river valley and observed 94 species from 38 plant families [24] and greater than the 18 families and 28 species during analysis of AFS in the municipality of Igarapé-Açu, Pará State, Brazil [25].

Three species (*T. cacao* L., *E. oleracea* Mart., and *T. grandiflorum* Schum.) represent 51% of the relative frequency (F_r); 69.2% of the relative density (D_r); 51.1% of the relative dominance (Do_r), and 56.8% of the total importance value index ($IVI = F_r + D_r + Do_r$) of the 54 species observed in the AFS in Tomé-Açu. Also obtained greater IVI values for *T. grandiflorum* and *E. oleracea* in agroforestry in Pará State [23, 25].

The aboveground biomass (AGB) and carbon storage (CS) estimation per hectare were calculated individually for each sampling unit and averaged for the different AFS. The analysis of AGB and after CS estimation data shows increasing values for AFS 1 (6), AFS 2 (22), AFS 3 (42) and AFS 4 (120 Mg C ha⁻¹), which is also observed for species richness (Figure 2, 3, 4, 5 and 6). The ABG and CS values (106 Mg ha⁻¹ and 48 Mg C ha⁻¹) observed for AFS with ages between 1 and 35 years are within the averages

estimated and reported 50 Mg C ha⁻¹ of average CS in Amazonian AFS [2].

The biomass accumulation in a forest or agroforestry stand is affected both by environmental factors and by factors inherent to the species [26]. Besides the environmental factors, floristic factors influence the accumulated values of biomass and C. For example, the lower CS averages in comparison to AFS averages obtained in the present work at the Cametá region, Pará State, may be related to the high IVI of the *T. cacao* L, *E. oleracea* Mart., and *T. grandiflorum* Schum. trees, which corresponds to 167% of the total IVI value of the 19 species observed in AFS 3, and to 99% of the total IVI value of the 40 species observed in AFS 4.



Fig. 2 Carbon storage average in different agroforestry systems (AFS 1, 2, 3 and 4) in Tomé-Açu, Pará – Brazil.

International Journal of Advanced Engineering Research and Science (IJA	ERS)
https://dx.doi.org/10.22161/ijaers.74.10	



Fig. 3 Farm with agroforestry systems (AFS 2) in Tomé-Açu, Pará – Brazil.



Fig. 5 Farm with agroforestry systems (AFS 3) in Tomé-Açu, Pará – Brazil.



Fig. 4 Farm with agroforestry systems (AFS 2) in Tomé-Açu, Pará – Brazil.



Fig. 6 Farm with agroforestry systems (AFS 5) in Tomé-Açu, Pará – Brazil.

The occurrence of large-size trees in a small sample plot can lead to a bias to overestimate biomass [27]. This can be perceived by comparing AFS 4, which showed the greatest DBH and H averages and the greatest carbon storage estimation (120 Mg C ha⁻¹) with 1,457 individuals ha⁻¹, with AFS 3, which showed smaller CS estimation (42 Mg C ha⁻¹) even with greater abundance (1,723 individuals ha⁻¹).

The analysis of the carbon storage estimated for the agroforestry systems in Tomé-Açu shows that it represents 36% of the value reported for anthropic systems (228 Mg C ha⁻¹) [28], including the amount retained in the soil. In the potential analysis for C sequestration by these AFS, the greatest carbon storage value found for AFS 4 stands out (120 Mg C ha⁻¹).

It represents 80% of the average C stored in the analyzed upland forests (152 Mg C ha⁻¹), and 33 and 121% more than the average of the C stocked in the lowland forests (91 Mg C ha⁻¹) and in the secondary forests (55 Mg C ha⁻¹), respectively. In comparison to the work [28], the CS from AFS 4 represents 53% of the C observed for anthropic systems, including the amount retained in the soil, and thus constitutes an important alternative for C accumulation and fixation, along with the enriched secondary forests, the lowland forests or the upland forests in Brazilian Amazonia.

Together with reforestation and management of secondary forests, the AFS are viable alternatives from the environmental and economic perspectives, since they contribute to the absorption of CO_2 and to the reduction of the greenhouse effect [29]. Among the various land uses, the AFS are the ones that accumulate the greatest biomass [30]. The adoption of AFS by family farmers is a viable and relevant strategy for increasing the CS in their production systems [31].

Moreover, the biomass observed in the agroforestry systems of Tomé-Açu can easily be related to the food and fiber production capacity provided by these systems. Was already pointed out that the agroforestry systems in Tomé-Açu are a possible sustainable answer to the growing process of forest conversion into pasture in Amazonia; besides increasing the employment in the region, the income obtained by the Japanese-Brazilian farmers in their lands, whose areas range from 10 to 20 ha, is comparable to the income obtained by farmers who use 400 to 1,200 ha of land as pasture [32].

IV. FINAL CONSIDERATIONS

Satellite images information and multiscale databases expand the possibilities of agroforestry systems mapping and monitoring. Thus, spatial analyzes of agroforestry systems is strategic role in farm planning and to the benefit of more sustainable rural development.

Canopy cover, diameter at breast height, number of individuals per hectare, total height, and age are useful parameters to define the classification intervals for agroforestry systems AFS 1, AFS 2, AFS 3, and AFS 4 in Tomé-Açu. Data obtained by the structural and floristic analyses indicate, by means of the IVI, that the main species are cocoa (Theobroma cacao L.), açaí Mart.) (Euterpe oleracea and cupuaçu (Theobroma grandiflorum Schum.).

The agroforestry systems in Tomé-Açu indicate a viable and relevant strategy for increasing the carbon storage in Amazonian production systems, contributing significantly to the CO_2 sequestration process, pointing at possibilities for providing many economical, ecological and social benefits via its diversified products.

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Basic support teaching for Lay People using Realistic Simulation: Reporting Extensionist activities with High School Students in the Brazilian Amazon

Maicon de Araújo Nogueira¹; Bruno Mesquita Maia²; Lucimario Valente Ferreira³; Amanda Lorena de Araújo Silva⁴; Milk dos Santos Fernandes de Oliveira²; Keren Raissa Santos do Amaral²; Letícia Lôide Pereira Ribeiro²; Daniel de Sarges Rodrigues²; Simone Aguiar da Silva Figueira⁵; Eimar Neri de Oliveira Junior⁶; Renan de Souza Linard⁷; Thamyris Abreu Marinho⁸; Adriana Letícia dos Santos Gorayeb⁹; Elcilane Gomes Silva¹⁰; Alfredo Cardoso Costa¹¹; Samara da Silva Barbosa²; Joelia dos Santos Oliveira²; Rayssa Raquel Araújo Barbosa²; Luziane de Souza Soares²; Eliana Soares Coutinho¹²; Carmem Lúcia Pacheco de Sena¹²; Kethully Soares Vieira¹²; Gabriela Oliveira da Silva¹³; Tamara Catarino Fernandes¹⁴; Rudy Cleyton da Silva Oliveira¹⁵; Irlan Menezes da Paixão¹⁶; Sarah Lais Rocha¹⁷; Otávio Noura Teixeira¹⁹; Antonia Margareth Moita Sá²⁰

¹Nurse, Master in Health Education in the Amazon, PhD student, Stricto Sensu Graduate Program, Professional Doctorate in Health Education in the Amazon (ESA), Universidade do Estado do Pará (UEPA). Professor at the Universidade da Amazônia (UNAMA), Belém, Pará, Brazil. E-mail: profmaiconnogueira@gmail.com

²Nursing Student at the Universidade da Amazônia (UNAMA), Belém, Pará, Brazil.

³Nurse, Specialist in Surgical and Oncology Clinic. Universidade do Estado do Pará (UEPA), Hospital Ophir Loiola (HOL), Belém, Pará, Brazil.

⁴Nurse, Universidade da Amazônia (UNAMA), Belém, Pará, Brazil.

⁵Nurse, Master in Health Education in the Amazon, PhD student, Stricto Sensu Graduate Program, Professional Doctorate in Health Education in the Amazon (ESA), Universidade do Estado do Pará (UEPA). Professor at the Universidade do Estado do Pará (UEPA), Campus Santarém, Pará, Brazil.

⁶Nurse, Centro Universitário da Amazônia (UniFAMAZ), Belém, Pará, Brazil.

⁷Nurse, Lato Sensu Postgraduate Course in the Adult and Neonatal Therapy Unit, Faculdade Integrada da Amazônia (FINAMA), Belém, Pará, Brazil.

⁸Nurse, Post graduate. Stricto Sensu Graduate Program in Nursing, Universidade Federal do Pará (UFPA), Belém, Pará, Brazil.

⁹Nurse, Master in Health Education in the Amazon, PhD student, Professional Doctorate in Health Education in the Amazon (ESA), Universidade do Estado do Pará (UEPA). Dean of Centro Universitário da Amazônia (UniFAMAZ), Belém, Pará, Brazil.

¹⁰Doctor. PhD student, Stricto Sensu Graduate Program, Professional Doctorate in Health Education in the Amazon (ESA), Universidade do Estado do Pará (UEPA). Professor at the UEPA, Belém, Pará, Brazil.

¹¹Biologist. PhD student, Stricto Sensu Graduate Program, Professional Doctorate in Health Education in the Amazon (ESA), Universidade do Estado do Pará (UEPA). Professor at the UEPA, Belém, Pará, Brazil.

¹²Nursing Student. Universidade do Estado do Pará (UEPA), Belém, Pará, Brazil.

¹³Nurse. Resident in the Surgical Clinical Residency Program, Sírio Libanês, São Paulo, Brazil.

¹⁴Medical Student, Centro Universitário da Amazônia (UniFAMAZ), Belém, Pará, Brazil.

¹⁵Nurse, Faculdade Metropolitana de Manaus (FAMETRO), Brazil.

¹⁶Nursing Student, Faculdade Estácio Castanhal, Brazil.

¹⁷Nurse, Master in Health Education in the Amazon, PhD student, Stricto Sensu Graduate Program, Professional Doctorate in Health Education in the Amazon (ESA), Universidade do Estado do Pará (UEPA). Professor at the UEPA, Campus Marabá. Professor at the Faculdade Carajás, Pará, Brazil.

¹⁸Graduation in Computer Science and Technology in Data Processing. PhD in Electrical Engineering, Professor at Federal University of Pará (UFPA), Tucuruí, Pará, Brazil.

¹⁹Nurse, PhD in Nursing Universidade Federal do Rio de Janeiro (UFRJ). Permanent member of the faculty in the Stricto Sensu Graduate Program, Master and Professional Doctorate in Education and Health in the Amazon (ESA), Universidade do Estado do Pará (UEPA), Belém, Pará, Brazil.

Abstract— Objective: To report the experience of using realistic simulation as a teaching strategy for Basic Life Support for high school students. Method: I report the experience of extension activities, linked to the extension project "Realistic Simulation in Urgency and Emergency" of Universidade da Amazônia (UNAMA), held from April 5 to June 29, 2019, with middle school students from public and private schools in the metropolitan region of Belém, State of Pará, Brazil. Results: In total, ten educational interventions were carried out, using as a teaching strategy, the realistic simulation of the Basic Life Support maneuvers. 600 students from the 1st to the 3rd year of high school participated in the educational activities. These were taught to perform cardiopulmonary resuscitation maneuvers, with an emphasis on Basic Life Support for lay people according to the assumptions of resuscitation science proposed by the American Heart Association 2015. It was found that the participants expressed satisfaction and interest in the proposed and applied activity and methodology. Conclusion: It is concluded that there was significant interest on the part of the students, and the proposed and applied activities of this nature should be encouraged more vigorously in the various contexts of society, as it is believed that it is an educational action with significant potential to make individuals capable of providing care at the first level response to Cardiopulmonary Arrest, reduce mortality and preventable sequelae.

Keywords— Simulation Training. Cardiopulmonary Resuscitation. Training. Education, Primary and Secondary.

I. INTRODUCTION

Sudden cardiac arrest is the leading cause of death in Europe, the United States of America and Canada. Estimates show an incidence of Sudden Cardiac Death (SCD) in the United States, between 180.00 to 400.00 cases / year. However, it is considered that accurate data are not yet possible due to the different definitions of MSC used, studies based on retrospective analysis of death certificates or even the absence of a structured system to report cases in some regions (BRAGGION et al. 2015).

In Brazil according to data from the Ministry of Health (MS), diseases of the circulatory system are the main causes of death, and more than 30% of deaths (MARQUES et al. 2015). They are responsible for about 20% of all deaths in individuals over 30 years of age, reaching an

adult population in full productive phase (MANSUR et al. 2012).

Cardiorespiratory arrest (CRP) is characterized by the abrupt interruption of the mechanical function of the myocardium, leading to dysfunction of the other vital organs due to the absence of oxygenation, and the chance of survival depends fundamentally on the identification of the signs of CRP and the early start of care, which can also be initiated by a layman (FERREIRA et al. 2013). The signs of a cardiac arrest are loss of consciousness, apnea or agonized breathing (gasping, present in 40% of out-ofhospital cardiac arrest) and absence of central pulse (DALLACOSTA et al. 2017).

In this scenario, it is understood that the teaching of Basic Life Support (BLS) for the community is essential, especially for adolescents, who are able to perform Cardiopulmonary Resuscitation (CPR) maneuvers as effectively as adults, being school's basic education, an ideal laboratory to spread such knowledge (TAVARES et al. 2015).

The BLS consists of a set of steps and maneuvers performed sequentially, which include assessment and immediate intervention in each phase of CPR, identified by the acronym, C - circulation (assessment of signs of circulation and chest compressions), A - opening of pathways airways (assessment and correct positioning of the airways), B - breathing (assessment of respiratory movements and ventilation) and D - early defibrillation. These recommendations are based on the guidelines of the International Alliance of Resuscitation Committees (ILCOR) and the international scientific consensus of the American Heart Association - AHA (SILVA et al. 2015; NOGUEIRA et al. 2017).

The attendance at one (CPR) is always complex, however, the basic CPR maneuvers can be performed by any trained person, and, as long as well performed, may result in the maintenance of the circulation of vital organs until the arrival of a specialized service. In this context, considering the expressive number of CPRs that occur daily, the availability of Automatic External Defibrillators (AEDs) in public places of great circulation of people, the training of lay people is a dynamic strategy with the potential to reduce mortality and preventable sequelae (DALLACOSTA et al. 2017; NOGUEIRA et al. 2017).

Despite significant advances in the care of cardiac arrest victims, there is still considerable variability in survival rates that cannot be attributed exclusively to the patient's momentary clinic. In order to increase the chances of survival, allowing these individuals to receive high quality care, CPR training must use appropriate techniques and strategies, based on scientific knowledge, based on scientific evidence and reach the largest number of people (AMERICAN HEART ASSOCIATION, 2015; NOGUEIRA et al. 2017).

Despite the beneficial effects of CPR, it is already well established in the world scientific community, in every three victims of CPA, only one receives correct care performed by a layperson in the extra-hospital environment. Approximately 200,000 new cases of CPR are estimated in Brazil in a year, with half of the cases occurring in the extra-hospital environment, such as: homes, shopping centers, airports, stadiums, fairs, supermarkets, roads, among other scenarios (FERNANDES et al. 2014; NOGUEIRA et al. 2017).

CPR is characterized by chest compression and aims to maintain myocardial contraction, ensuring artificial

circulation with small but crucial oxygen supply to vital organs. For this prehospital care to be carried out effectively and as early as possible, it is necessary to train individuals not from health, with an interest in learning CPR maneuvers, and apply them above all (FERREIRA et al. 2013; DALLACOSTA et al. 2017; NOGUEIRA et al. 2017).

Resuscitation maneuvers should be performed by laymen only with chest compressions, as they are easy to perform and can simply be guided by a health professional, with knowledge based on emergency science. If the inexperienced rescuer is instructed and able to perform rescue breaths, the recommendation remains to apply 30 compressions for every 2 rescue breaths, and must use the Pocket Mask to protect both the victim and the rescuer (AMERICAN HEART ASSOCIATION, 2015).

For CPR to be of quality and effective, it is necessary to have minimal interruptions of chest compressions, which are performed with frequency and adequate depth to maintain cardiac and vital organ circulation. In adult patients it is recommended to keep the frequency at least 100, not exceeding 120 compressions per minute (GONZALEZ et al. 2013; AMERICAN HEART ASSOCIATION, 2015; NOGUEIRA et al. 2017).

Faced with this scenario, higher education institutions (HEIs) are currently investing and included in their extracurricular activities, learning methods that can add values both for the academic environment and for society; this approach, inserted within the extension activities, which permeate actions that facilitate learning and also corroborate to spread the knowledge, skills and competences to an audience not initially included in the academic environment, allowing direct contact of students with the society in which they will exercise in the future their functions and professional skills acquired within the university, thus allowing the realization of the axis, teaching-service integration and community (DALLACOSTA et al. 2017).

In the meantime, realistic simulation emerges as an active methodology aimed at prior training, in a controlled setting, which can be applied in BLS teaching in a very effective way as already described in several studies, in order to provide an appropriate training environment, both for society in general and for the undergraduate health student, favoring the development of their skills and abilities, adding the scientific knowledge acquired during the academic period, which linked to extension activities, bring together characteristics that allow to cross the walls of the university (BRANDÃO et al. 2014; NOGUEIRA et al. 2017).

In this conception, the study proposes to add relevant aspects of the experience of extension activities, linked to Undergraduate Nursing courses in the Brazilian Amazon, in the training for the realization of the BLS directed to lay people, using realistic simulation as a teaching strategy. Given the above, the study aimed to report the experience in using realistic simulation as a teaching strategy for Basic Life Support for high school students.

II. METHOD

This is an experience report with a qualitative approach and participatory method, elaborated from actions carried out in extension activities, linked to the extension project "Realistic Simulation in Urgency and Emergency", carried out by Nursing students from the 4th and 8th semester of Universidade da Amazônia (UNAMA).

In total, ten interactive educational interventions were carried out, using realistic simulation about BLS maneuvers, for 600 students from the 1st to the 3rd year of high school from different public and private schools in the metropolitan region of Belém, State of Pará, Brazil. It should be noted that the students were divided into a group of 60 participants per action.

The students were instructed to perform the resuscitation maneuvers according to the assumptions of resuscitation science proposed for the BLS by the American Heart Association 2015.

The educational intervention was carried out through the use of realistic simulation, which is a technique to stage real situations, reproducing a scenario that allows the previous training of the desired practice (ABREU et al. 2014).

High school students from public and private schools in the metropolitan region of Belém, State of Pará, Brazil, aged between 16 and 19 years old, participated in the study from April to June 2019, in a structured environment for the training, with practical scenarios organized within schools.

They were listed as material and methodological resources: media resource, TV, internet, banner, simulator mannequin (Resusci Anne - LAERDAL®) for cardiopulmonary arrest training and AED simulator. The execution and management of all simulation processes were carried out by Nursing students under the supervision and guidance of instructing teachers linked to the extension project.

The action was divided into two moments. The training program followed the recommendations for laypersons published in the American Heart Association Guidelines 2015. The training was carried out in the spaces destined for training, organized in practical stations. It started with a dialogical lecture, bringing basic concepts about PCR and CPR in addition to demonstrating the steps of the BLS for laypeople; this activity lasted 30 minutes.

There was a brief explanation about the links that make up the survival chain with a focus on the BLS in the care of extra-hospital PCR for laypeople, highlighting each stage, through demonstration and simulation on the doll / mannequin for CPR, followed by practical execution, based on which was explained initially.

Then, the instructors simulated the care for the victim of CPA. Then, each student performed the same simulation on the mannequin, under supervision.

So that the instructors / teachers could start the stage of practical activities, first there was an explanation (briefing) of how this step would take place, in order to guide them on how to proceed, that is, that there would be a systematic observation of the care provided by the student and registration by the instructor, but without intervention; that the instructors were only there to observe and offer some material if requested by the student. At this stage, it was reiterated that even if the student realized that he performed an incorrect action, he should follow the care as if he were in a real situation of CPR.

Each student was guided by a clinical case: "Male, 50 years old, obese, with chest pain suggestive of heart attack. Chest / chest discomfort, indigestion and feeling like you are going to faint. He becomes unconscious and falls to the ground! ", With the clinical case triggering the simulated practical activity.

The students were instructed to perform a safe approach on the scene, and to position themselves next to the simulator mannequin, kneeling on the floor, and instructed to follow the procedures listed in accordance with the American Heart Association 2015 protocol, namely: 1) Assess safety of the scenario, 2) Assess the victim's responsiveness, 3) Call SAMU 192, 4) Check breathing and pulse, if absent, initiate chest compressions, in this case by placing the hand (hypotenic edge / heel of the hand) at the bottom of the sternum bone (in the infra nipple line), simulating the victim's chest, without flexing the arms, at an angle of 90°, at a minimum frequency of 100, not exceeding 120 compressions per minute, at a depth of at least 5cm, not exceeding 6cm, always allowing the full return of the chest after each compression, among other important guidelines in this context.

At the end of each simulated service, the instructor performed the summary of the service individually, a succinct explanation of the critical points, errors and successes (debriefing) allowing feedback and feedback to the participants, in addition to a group evaluation focused on collective feedback.

III. RESULTS AND DISCUSSION

Most participants had no prior knowledge about the topic addressed, presenting initial difficulties in performing CPR and BLS stages. After the simulation, it was observed that these students were able to perform the technique correctly, but some still showed difficulties and doubts, which were clarified, commented and exemplified by the instructors, in order to remedy them.

The participants showed interest and curiosity from the beginning, regarding the proposed and applied methodology, due to the ease of possible applicability in the current context, making the didactic learning, meaningful and pleasurable. The observed results showed that ignorance about BLS among lay people is a relevant problem that deserves attention and is easy to solve, as people tend to show an interest in learning everything that becomes didactic and interesting, however there is a lack in the environment scientific and academic in the sense of conducting training aimed at society in general, hindering access to knowledge, which can have a negative impact on the sequelae and mortality rates preventable by out-ofhospital CPR.

The results found in the present study suggest that the realistic simulation methodology is an effective and relevant resource for teaching BLS to adolescents in a school environment, when carried out systematically, with an accessible language, providing an essential practice for breaking " myths " about PCR and CPR (TERASSI et al. 2015).

The ignorance of BLS on the part of lay people is a serious public health problem. A survey carried out in public and private schools in Manaus-AM, Brazil, showed that 8.7% of 665 students surveyed did not know the number of the Mobile Emergency Service (SAMU 192), a worrying fact, because without the activation emergency service and help request, there is a break in the chain of survival and consequently an unfavorable outcome in the individual's survival in PCR (ALVES et al. 2016).

A study carried out with 28 nursing students recommended that BLS training should be applied regularly, quarterly or semi-annually, with the justification that there is a significant decline in knowledge and skills after this period (NOGUEIRA et al. 2017).

In order to address the benefits of technological tools for teaching, SALVADOR et al. (2015), developed a study

based on the principles of andragogy and conceptualized different innovative technologies in the teaching-learning process, highlighting realistic simulation as a resource that offers the diffusion of knowledge through practice, allowing the student to learn without resulting from erroneous behaviors in real patients. On this subject, BARRETO et al. (2014) in an integrative literature review, showed that 76.9% of 26 articles analyzed did not present evidence of disadvantages in the use of realistic simulation.

In view of this, the actions carried out by extension activities, linked to the extension project "Realistic Simulation in Urgency and Emergency" were successful, since the academics were able to pass on the knowledge acquired during graduation to the participants, and they were willing and enthusiastic to pass it on. to your friends and family the knowledge acquired about CPR maneuvers.

IV. CONCLUSION

Considering that half of the PCRs occur in extrahospital environments and are generally seen by lay people, who are mostly unprepared to perform BLS, where simple attitudes like calling for help requesting emergency services (SAMU 192) in timely, start resuscitation maneuvers with quality chest compressions early and correctly, substantially increase the chances of a better prognosis, we understand that the role of nurses as educators in this context is fundamental, acting actively in the dissemination of knowledge about PCR and CPR.

In this sense, it is envisaged to encourage discussions about successful educational actions that value the practice aimed at lay people, strengthening the chain of survival and response in situations of CPA, through training with effective methodologies on BLS continuously. In the meantime, we strongly recommend that these strategies be carried out in the various contexts and segments of society, using dynamic and problematic resources such as realistic simulation as a methodological teaching strategy.

In this study, we found that the participants showed interest in the theme addressed, given that, it is possible to observe direct and motivated participation in the proposed and applied activities.

As a team, teachers and students, the experience made it possible to strengthen and relate theory and practice based on current scientific knowledge, through active methodological strategies, which provided the improvement of these skills in situations of cardiological emergencies and in teaching, strengthening the Teachingservice axis and community, through extension activities. We aim to contribute to the development of new studies, which can stimulate reflections about the teaching of BLS for students of basic education and society in general.

Furthermore, cooperate with the statement that the methodological strategy of realistic simulation favors the educational process, being a relevant strategy for the prevention of deaths by PCR and permanent sequelae in an extra-hospital environment.

We conclude that educational actions on BLS aimed at high school students emerge as possibilities for meaningful learning tools, contributing so that individuals can become able to intervene in their determinants of health and diseases effectively, and in this context improve the prognosis and reducing preventable sequelae and deaths from PCR.

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Development of a portable prototype: pH meter for prolonged esophageal pH monitoring with low cost materials

Aldo Marçal Guimarães¹, Adriane Wosny Guimarães², Amanda Wosny Guimarães³, Carla Maria Lima Olivi⁴, Clara Ozeny Lima Olivi⁵, Ana Paula Santos Oliveira Brito⁶, Rafael Oliveira Chaves⁷, Záyron Gregório Aguiar³, Júlia Helena dos Santos Ferreira⁸, Mariseth Carvalho de Andrade⁹, Lidiane Assunção de Vasconcelos¹⁰, Andrea dos Santos Mendes Gomes¹¹, Cibele Maria de Almeida¹², Adriana dos Santos Mendes Gomes¹³, Marcus Vinicius Henriques Brito¹⁴

- ¹Medical Digestive Tract Surgeon, Master of Experimental Surgery from the State University of Pará (CIPE/UEPA). Belém, Pará, Brazil. ² Medical Specialist in Pediatrics and Legal Medicine, Master's studentin Teaching and Health and Medical Teaching - Professional
- Master, University Center of Pará (CESUPA). Belém, Pará, Brazil.
- ³ Medical student at the University Center of Pará (CESUPA). Belém, Pará, Brazil.
- ⁴ Nurse Specialist in Urgency and Emergency, Master's student in Teaching and Health and Medical Teaching Professional Master,
- University Center of Pará (CESUPA). Belém, Pará, Brazil.
- ⁵ Nurse Specialist in Oncology and Intensive Care, Master's student in Teaching and Health and Medical Teaching Professional Master, University Center of Pará (CESUPA). Belém, Pará, Brazil.
- ⁶ Medical Specialist in Clinical Medicine and Gastroenterology. PhD student in Parasitic Biology At Amazonia, Pará State University and Evandro Chagas Institute (PPGBPA/UEPA/IEC). Belém, Pará, Brazil.
- ⁷Doctor, PhD in Electrical Engineering from the Federal University of Pará (UFPA). Belém, Pará, Brazil. Professor at the Federal
- University of Pará and the State University of Pará (UFPA/UEPA). Belém, Pará, Brazil.
- ⁸ Biomedical engineer, Federal University of Pará (UFPA). Belém, Pará, Brazil.
- ⁹ Statistics, Master in Experimental Surgery from the State University of Pará (CIPE/UEPA). Belém, Pará, Brazil.
- ¹⁰Master in Health, Environment and Society in the Amazon, Federal University of Pará (UFPA). Professor at University of State of Para (UEPA). Belém, Pará, Brazil.
- ¹¹Master in Collective Health, Federal University of Pará (UFPA). Belém, Pará, Brazil.
- ¹² Master's student in Health Education, University Center of Pará (CESUPA). Belém, Pará, Brazil.
- ¹³ Nurse Specialist in Audit and Health Systems. Belém, Pará, Brazil.
- ¹⁴Medical Doctor in Operative Techniques and Experimental Surgery by the Federal University of São Paulo (UNIFESP). Full Professor at the University of the State of Pará (UEPA). Belém, Pará, Brazil.
- Corresponding author: Aldo Marçal Guimarães

Abstract— Objective: to develop a prototype portable register for extended esophageal pHmetry examination with low cost materials. Materials and Methods: Preclinical research, pilot test with preliminal data to evaluate the effectiveness and accuracy of the prototype. From the product assembly and the software used for data reading and measurement. In this software are written the codes for reading the pH values and preparation of the Arduino plate for data transmission. The indicator for pH reading calculates the average value every 10 measurements and the result obtained is displayed as long as this process is necessary. In this same code, the display buttons are configured as well as the calibration mode for each buffer solution. After mounting and proper calibration of the Arduíno and Commercial instruments, both containing two channels were tested in 10 substances in cycles. First, the channels were immersed in a solution containing beer and the pH was read in the times 0 s, 30 s, 90 s, 120 s, 150 s and 180 s in both arduous and commercial for comparative purposes. At the end of the reading, the channels were immersed in water for 3 min for cleaning and then tested in a new solution. The same cycle was repeated for the other solutions, which are: orange juice, energy, mineral water, isotonic, vinegar, coca-cola, guava juice, grape juice and guarana. Results: The differences statistically: 180s of the energetic ($p = 0.0178^*$); 60s Mineral Water time ($p = 0.0178^*$); 150s and 180s of the Isotonic ($p = 0.0371^*$ and $p = 0.0330^*$ respectively); 0s Coca-Cola time ($p = 0.0246^*$); and 150s Grape juice time ($p = 0.0230^*$); 0s orange juice time ($p = 0.0371^*$); 0s energy time ($p = 0.0330^*$); 0s and 30s vinegar time ($p = 0.0075^*$ and $p = 0.0216^*$ respectively). Conclusion: The analysis, as to its performance regarding the precision in the recording of pH values (aqueous solutions) are satisfactory for presenting results very close to the measurements indicated by the commercial recorder, in simultaneous measurements during the testing phase.

Keywords— Gastroesophageal Reflux; Esophageal pH Monitoring; Technological Development; Evidence-Based Medicine.

I. INTRODUCTION

Gastroesophageal reflux disease (GERD) is a complex disease with high prevalence worldwide, which generates a high cost in its diagnostic investigation and treatment (Henry, 2014).

Population risk factors for GERD development are recognized: age, gender, gestation, obesity, genetic factors and presence of hiatal hernia. Although GERD occurs in all age groups, the prevalence of this clinical condition, as well as its complications such as stenosis and ulcers, is higher among elderly individuals (ALMEIDA et al., 2017).

Traditionally, reflux is considered to occur when the esophageal pH drops below 4. This threshold is clinically relevant, as pyrosis occurs with a pH below 4, and peptic activity decreases rapidly above this level. The end of a reflux episode is usually considered to be the point at which the esophageal pH rises above 4 (NASI, QUEIROZ, & MICHELSOHN, 2018).

It is important to mention that there are definitions of GERD that consider not only the acid content of the reflux, coming from the stomach, but also the non-acid content, coming from the duodenum (initial portion of the small intestine), thus, it is duodenogastric reflux. In addition to esophageal symptoms, there may be manifestations of extra-oesophageal symptoms such as asthma, recurrent non-coronary chest pain and pharyngitis, for example. The symptoms may or may not be associated with esophageal tissue lesions, depending on the clinical picture (Sifrim, 2013).

In the diagnosis and subsequent follow-up of the disease, it is also possible to find different consequences that GERD may trigger, depending on some factors. Therefore, there are variations on the endoscopic conditions in each patient, from the inexistence of lesions in the mucosa to major complications, in more severe cases. In addition, GERD is one of the most recurrent diseases in medical practice, a further justification for this

subject to be greatly investigated and consequently, the number of information and publications on the subject is growing (Gonçalves, Pimenta, & Neto, 2005).

As already seen, GERD has diverse clinical manifestations. The most common and unusual types of clinical manifestations may coexist, however, the inexistence of some of the most common symptoms is not a decisive factor in ruling out a positive diagnosis for GERD. The two typical clinical manifestations of GERD are heartburn and acid regurgitation: this is the burning sensation that reaches the region between the manubrium of the sternum bone to the base of the neck, and the reflux of acid or dietary content into the oral cavity, respectively(Ferreira et al., 2014; Sanchez-Lermen, Dick, Salas, & Fontes, 2007).

The anamnesis has great relevance for the diagnosis of typical GERD and is the first action of the diagnostic process. To this end, the patient is asked in detail about the characteristics of the symptoms presented, such as duration and frequency, factors that activate the symptoms and how much they influence their quality of life (Fraga & Martins, 2012).

Among the diagnostic methods presented below, High Digestive Endoscopy (HDA) and Extended Esophageal pHmetry are the methods that are effectively used for the diagnosis of GERD: it can be diagnosed by endoscopic changes suggestive of reflux, such as esophagitis and/or pathological reflux, identified by prolonged reflux monitoring (pHmetry). The other methods, although they do not perform a direct diagnosis of GERD, are present in this topic due to their importance in clinical practice, performing, for example, evaluations of specific clinical conditions of GERD carriers and identification of complications of the disease (Henry, 2014; Nasi, Moraes-Filho, & Cecconello, 2006).

In relation to the prolonged esophageal pHmetry examination, this method was introduced into clinical

practice in the mid-1970s and has since provided more knowledge about gastrosophageal reflux, quantification and counting of the number of episodes during the examination period. Before the inclusion of prolonged esophageal pHmetry as a method for monitoring and diagnosis, gastrosophageal reflux was perceived only through the resulting inflammation of the esophageal mucosa (esophagitis) in patients who presented it, detected by upper digestive endoscopy (NASI et al., 2018).

Extended esophageal pHmetry is a diagnostic method for GERD and performs a monitoring of gastrosophageal reflux over about 24 hours of examination. Intraesophageal pH monitoring allows determination: the intensity of acid reflux, but does not detect the presence of "non-acid" reflux; characterize the pattern of reflux; diagnose GERD in patients who do not have esophagitis (does not allow characterizing esophagitis or its consequences); displays supraoesophageal/laryngopharyngeal reflux if any (when acid reflux generates the atypical manifestations); in addition to acting to check the effectiveness of clinical and/or surgical treatment after it has been performed, if there are symptoms after either type of treatment (PONTE, 2015).

It was from the introduction of this prolonged monitoring method that the terms physiological reflux and pathological reflux were established: through pHmetry the reflux in healthy volunteers was quantified and this is considered normal, physiological reflux. Reflux that exceeds this limit in the quantification is said pathological reflux, therefore (NASI et al., 2018).

The exam consists of passing the pHmetry probe through the nose, which on average is two millimeters in diameter and has sensors that detect the acid pH. Probes with more than one sensor are usually used for this exam, in which the distal sensor is positioned five centimeters above the upper limit of the Lower Esophageal Sphincter (LES) (usually through esophageal manometry). The probe is connected to a portable recorder that records the pH values at each four-second interval (this period can be set on some recorder models) throughout the exam (between 18 and 24 hours in duration). The patient must record the beginning and end of his feeding, periods in which he is standing and lying down (supine), and the occurrence of symptoms (Nasi et al., 2008).

Prolonged esophageal pHmetry testing is indicated for:

• Evaluation of GERD, in cases of patients with functional dysphagia, non-cardiogenic chest pain, aerophagia and rumination, in addition to the characterization of the food esophageal transit disorder resulting from motor disorders;

• Pre and post antireflective surgery evaluation in which pathological acid reflux is suspected to persist;

• Detection of GERD in patients with chest pain of non-cardiac origin, after cardiac evaluation using a scheme (index) of symptom association;

• For study of supra-oesophageal or pharyngeal reflux, when the main symptom of the individual is a respiratory manifestation (asthma, chronic cough, microaspiration recurrent pneumonia), otorhinolaryngological (posterior laryngitis, hoarseness, burning in the oropharynx, globes, chronic hawking and pharyngeal mucus) or oral (halitosis) (Machado, Cardoso, Ribeiro, Zamin Júnior, & Eilers, 2008).

The esophageal pH monitoring is a direct in vivo measure of esophageal acid over time and generally has some recommendations to indicate monitoring, such as when in the presence of symptoms suggestive of GERD, when you want to establish the relationship between GERD and extradigestive symptoms and as a way to control the effectiveness of treatment, which can be clinical or surgical (Guimarães, Marguet, & Camargos, 2006; SBMDN, 2017).

Currently, two systems are used: catheter-based or wireless. Catheter monitoring requires the intranasal insertion of the catheter, with its measuring electrode located 5 cm above the upper edge of the LES. While the wireless is inserted 6 cm above the scamocolumnar junction (SJ) or in Barrett's esophagus above the top of the gastric folds, the data is transmitted to a radio frequency recorder and then transferred to a software (Han & Peters, 2014). Thus, due to the large apparatus required, the wireless pH sensor costs approximately 3 to 5 times more than the catheter-based pH monitor, which should be taken into consideration when choosing the type of monitoring (Carlson & Pandolfino, 2014).

Although catheter monitoring is relatively inexpensive, most patients feel that they cannot work during the test period, which somewhat raises the cost for the patient (Gawron, French, Pandolfino, & Howden, 2014). Thus, the search for a low cost and efficient pHmeter is an important ally in the diagnosis of GERD. To achieve this, catheter monitoring, which is the least expensive compared to wireless, should be improved, seeking to reduce costs as a way to optimize the diagnosis or follow-up of the disease.

We note the scarcity of information in the literature and transparency portals of the Single Health System about the financial costs of the GERD diagnosis method in question. However, it is empirically known that private clinics that perform the diagnostic examination charge high prices, which makes access to current diagnostic methods difficult. Therefore, there is a need for greater disclosure of these costs in future works in order to provide a basis for comparison between new low-cost diagnostic methods and the current ones.

In this context, the objective of this study was to develop a prototype portable recorder for prolonged esophageal pHmetry examination with low-cost materials.

II. METHOD

Type of study

Preclinical research, pilot testing with preeliminate data to evaluate the effectiveness and accuracy of the prototype.

Place and period of study

The study was carried out in two Higher Education Institutions (HEIs): Universidade do Estado do Pará (UEPA) located at Tv. Perebebuí, 2623 - Marco, Belém -PA, 66087-662 and Universidade Federal do Pará (UFPA) located at Rua Augusto Corrêa, 01, Guamá, Belém - PA, 66075-010, from May 2018 to July 2019.

Study/project phases

First, there was the stage of research and studies in scientific articles, books, content available on websites and in collaborative programming environments on the fundamental concepts for the development of this monograph, the theoretical basis concerning the assembly of the product and software used for reading and measuring data. List of project components and materials used for testing:

Arduino Mega 2560;

- LCD display with buttons;
- Protoboard;
- Jumpers;
- pH sensor module;
- Probes for 1 and 2 channel pHmetry;
- Module Bluetooth HC-05;
- BNC to RJ45 output adapter;
- Source DC 12v 1A;
- USB cable for computer connection.

Programming

• Arduino IDE (1.8.5)

This software writes the codes for reading the pH values and preparation of the Arduino plate for data transmission.

The code for pH reading calculates the average value every 10 measurements and the result obtained is displayed as long as this process is necessary. In this same code, the display buttons are configured as well as the calibration mode for each buffer solution.

Assembly and Calibration

The schematic of the equipment assembly is shown below:



Image 3 - Schematic model of pH meter assembly. **Source** - Author of research.

For calibration of the probe, which must be carried out before each examination, a glass vessel must be provided to receive the pH 4 buffer solution, a second one to receive water and a third one for pH 7 buffer solution, in which case the calibration uses the buffer solutions.

Ready the containers and assemble the equipment, the equipment calibration mode must be selected from the display buttons. Then the probe for pHmetry must be connected to the adapter and inserted in a container containing the pH 4 buffer solution, so that all the channels of the probe are submerged in the solution if it is a probe with more than one channel. Wait about 2 minutes until the display indicates that the calibration for that pH has been completed. Then the probe should be dried with paper and placed in a container of water so that there is no interference with the calibration with buffer solution pH 7 (same procedure as pH 4).

After calibration in the two buffer solutions, the equipment is ready for examination.



Image 4 - Nox buffer solutions pH 7.00 and pH 4.00 Source - Nox Lab Solutions



Image 5 - Two-channel pHmetry probe. **Source**- Alacer Biomédica Ltda, 2019.



Image 6 - Assembled Arduino pHmeter (left) compared with commercial pHmeter (right) Source - Author of research.

Data Collection

After assembly and proper calibration of the Arduino and Commercial devices, both containing two channels were tested on 10 substances in cycles. First, the channels were immersed in a solution containing beer and the pH was read in the times 0 s, 30 s, 90 s, 120 s, 150 s and 180 s, both in Arduino and Commercial for comparative purposes. At the end of the reading, the channels were immersed in water for 3 min for cleaning and then tested in a new solution. The same cycle was repeated for the other solutions, which are: orange juice, energy, mineral water, isotonic, vinegar, coca-cola, guava juice, grape juice and guarana (Image 15).

1 CERVEJA						Água			2.5	UCO DE	LARANJA	6		Água			
EXPERIN	ENTO 7	0 seg	30 seg	60 seg	90 seg	120 seg	150 seg	180 seg	3 min	0 seg	30 seg	60 seg	90 seg	120 seg	150 seg	180 seg	3 min
and the second	CANAL 1	5.1	5.1	5.1	5.0	5.1	5.2	5.1	5.9	5.1	5.0	4.9	4.9	4.8	4.6	5.0	5.8
ARDUINO	CANAL 2	5.2	5.3	5.2	5.1	5.1	5.2	5.1	5.8	5.2	5.0	5.0	4.9	4.9	4.9	4.9	4.7
az marsar i	CANAL 1	5.3	5.2	5.1	5.1	5.1	5.1	5.1	6.7	5.5	5.3	5.2	5.1	5.1	5.1	5.1	6.3
COMERCIAL	CANAL 2	5.4	5.4	5.4	5.3	5.3	5.3	5.3	6.6	5.4	5.2	5.2	5.2	5.1	5.1	5.1	6.4
			3 ENE	RGÉTIC	D C	8111-2			Água			4	ÁGUA N	INERAL			Água
EXPERIN	IENTO 7	0 seg	30 seg	60 seg	90 seg	120 seg	150 seg	180 seg	3 min	0 seg	30 seg	60 seg	90 seg	120 seg	150 seg	180 seg	3 min
10000	CANAL 1	5.8	5.6	5.5	5.4	5.6	5.4	5.5	5.6	6.2	5.7	5.9	6.9	5.8	5.9	6.1	6.0
ARDUINO	CANAL 2	5.9	5.7	5.7	5.6	5.7	5.7	5.7	5.6	6.3	5.7	5.8	6.3	6.9	6.3	6.5	5.7
	CANAL 1	6.3	6.2	6.2	6.2	6.3	6.2	6.2	6.6	6.8	6.8	6.8	6.8	6.8	6.8	6.9	7.0
COMERCIAL	CANAL 2	6.4	6.3	6.3	6.3	6.4	6.4	6.4	6.6	6.8	6.9	6.9	6.9	6.9	6.9	6.9	7.0
5 ISOTÔNICO					Água			1	6 VINA	GRE			Água				
EXPERIN	MENTO 7	0 seg	30 seg	60 seg	90 seg	120 seg	150 seg	180 seg	3 min	0 seg	30 seg	60 seg	90 seg	120 seg	150 seg	180 seg	3 min
ARDUNO	CANAL 1	4.2	4.3	4.1	4.1	4.1	4.2	4.2	6.3	4.7	4.3	4.2	4.1	4.1	4.4	4.2	5.3
	CANAL 2	4.4	4.3	4.3	4.2	4.3	4.3	4.2	5.5	4.7	4.6	4.4	4.3	4.4	4.4	4.4	5.4
000	CANAL 1	4.3	4.2	4.2	4.2	4.2	4.2	4.2	6.7	4.8	4.7	4.7	4.6	4.6	4.6	4.6	6.2
COMERCIAL	CANAL 2	4.3	4.2	4.2	4.2	4.2	4.2	4.2	6.6	4.8	4.7	4.7	4,7	4.7	4.7	4.7	6.2
			7 COC	A- COL	1				Água			85	UCO DE	GOIABA	1		Água
EXPERIM	IENTO 7	0 seg	30 seg	60 seg	90 seg	120 seg	150 seg	180 seg	3 min	0 seg	30 seg	60 seg	90 seg	120 seg	150 seg	180 seg	3 min
	CANAL 1	4.4	4.4	4.4	4.5	4.4	4.5	4.4	5.2	5.2	5.1	5.2	5.2	5.0	5.2	5.2	5.8
ARDUNO	CANAL 2	4.7	4.3	4.3	4.6	4.4	4.4	4.4	5.0	5.3	5.3	5.4	5.1	5.2	5.1	5.2	5.7
	CANAL 1	4.7	4.7	4.7	4.7	4.7	4.7	4.7	6.6	5.8	5.7	5.7	5.6	5.6	5.6	5.6	6.4
COMERCIAL	CANAL 2	4.9	4.7	4.7	4.7	4.7	4.7	4.7	6.6	5.7	5.6	5.5	5.5	5.5	5.5	5.5	6.4
() () () () () () () () () ()			9 5000	DE UV	A				Água			1	10 GUA	RANÁ			Água
EXPERIN	ENTO 7	0 seg	30 seg	60 seg	90 seg	120 seg	150 seg	180 seg	3 min	0 seg	30 seg	60 seg	90 seg	120 seg	150 seg	180 seg	3 min
100100	CANAL 1	6.0	5.9	5.7	5.8	5.7	5.7	5.8	6.0	5.1	5.4	5.3	5.2	5.0	5.3	5.3	5.8
ARDUINO	CANAL 2	6.1	6.1	6.0	6.0	6.0	6.0	6.0	6.1	5.3	5.3	5.6	5.5	5.1	5.7	5.2	5.9
	CANAL 1	6.5	6.1	6.1	6.1	6.1	6.1	6.1	6.2	5.7	5.6	5.6	5.6	5.6	5.6	5.6	6.8
COMERCIAL	CANAL 2	6.4	6.3	6.2	6.2	6.2	6.2	6.2	6.2	5.8	5.6	5.6	5.6	5.5	5.5	5.6	6.9

Image 15 - Schematic of the pH check cycles through Arduino x Commercial channels per solution.

Source - Author of research.

Data Presentation and Analysis

The sample characterization information was computed in a database developed in *Microsoft*® *Office Excel*® 2016 software.

In the application of the Descriptive Statistics, calculations were performed to identify the pairing constant, when necessary, of the results with Arduino in relation to the Commercial device. Tables and graphs were constructed to present the results and position measurements were calculated as arithmetic mean and standard deviation.

Foi realizado o teste de Normalidade de Shapiro-Wilk, onde se identificou que as amostras eram heterocedásticas, não obedecendo uma Distribuição Normal. A estatística analítica foi aplicada através do teste de Mann-Whitney para duas amostras independentes.

The descriptive and analytical statistics were performed in *BioEstat*® 5.4 *software*. For decision making, the significance level was adopted $\alpha = 0.05$ or 5%, signaling with an asterisk (*) the significant values. **Budget**

The choice of components for the assembly of the recorder for pHmetry has undergone some modifications during the development of the Project, in order to make the hardware simpler. Therefore, the components listed above are the ones that are part of the final component selection for the prototype. In Table 1, the costs for composing the hardware of the recorder are presented.

Componente	Custo
Arduino UNO Rev3	R\$ 54,90
Módulo sensor de pH líquido para Arduino PH-4502C (2 unidades)	R\$ 129,80
Display LCD 16 x 2 shield com teclado	R\$ 29,90
Módulo Bluetooth RS232 HC-05	R\$ 34,90
Módulo micro SDCard	R\$ 9,90
Micro SDCard 8 GB	R\$ 17,83
Módulo Tiny RTC DS1307	R\$ 15,90
Acelerômetro e Giroscópio Módulo GY-521 MPU-6050	R\$ 16,90
Módulo Serial I2C para Display LCD	R\$ 9,90
Bateria de 9V	R\$ 25,02
Caixa para montagem Patola	R\$ 34,11
TOTAL	R\$ 379,06

Table 1 - Arduino Inexpensive Prototype Hardware Costs.

Source - Author of research.

III. RESULTS AND DISCUSSION

It is essential to make a comparison between the performance of the Arduino pHmeter prototype and the commercial device adopted as a model for the development of this prototype, in order to prove that it is performing measurements correctly, so that its reading of pH values generates results close to those of the reading performed by the commercial device.

The results of the evaluations carried out on the two devices, Arduino and commercial, when using a

channel, were statistically similar. The comparisons proved no statistically significant difference (p-value <0.5) in 64 (91.4%) of the 70 performed in Table 2.

The statistically significant differences were present only in the following times and substances: in 180s of the energetic ($p = 0.0178^*$); 60s of the Mineral Water ($p = 0.0178^*$); 150s and 180s of the Isotonic ($p = 0.0371^*$ and $p = 0.0330^*$ respectively); 0s of the Coke ($p = 0.0246^*$); and 150s of the Grape Juice ($p = 0.0230^*$).

Substance	Rated times - Channel 1						
Appliance	0 s	30 s	60 s	90 s	120 s	150 s	180 s
Beer							
Arduino	5.18	5.21	5.24	5.20	5.19	5.38	5.25
Commercial	5.25	5.24	5.21	5.21	5.21	5.20	5.20
p-value	0.1723	0.1351	0.1592	0.4168	0.3683	0.0748	0.1963
Orange juice							
Arduino	5.48	5.40	5.19	5.14	5.10	5.06	5.25
Commercial	5.39	5.25	5.16	5.14	5.13	5.13	5.13
p-value	0.1038	0.1038	0.3566		0.2998	0.0371	0.3746

 Table 2 - Comparative data of the substances tested by Arduino pHmeter and Commercial pHmeter in 1 channel, organized

 by evaluation period.

International Journal of Advanced Engineering Research and Science (IJAERS) <u>https://dx.doi.org/10.22161/ijaers.74.12</u>

[Vol-7, Issue-4, Apr- 2020] ISSN: 2349-6495(P) | 2456-1908(O)

Substance	Rated times - Channel 1	Substan ce	Rated times - Channel 1	Substan ce	Rated times - Channel 1	Substance	Rated times - Channel 1
Energy							
Arduino	6.48	6.34	6.31	6.24	6.26	6.21	6.18
Commercial	6.45	6.36	6.34	6.30	6.33	6.31	6.30
p-value	0.3372	0.4582	0.3778	0.1436	0.1403	0.0812	0.0178*
Mineral water							
Arduino	6.70	6.59	6.44	6.51	6.55	6.61	6.59
Commercial	6.746.796	5.806.816.8	16.806.83				
p-value	0.2311	0.1240	0.0178*	0.0781	0.0946	0.0781	0.0707
Isotonic Arduino	4.25	4.19	4.15	4.15	4.14	4.11	4.13
Commercial	4.26	4.21	4.21	4.21	4.19	4.19	4.21
p-value	0.2643	0.2474	0.0707	0.0707	0.0707	0.0371*	0.0330*
Vinegar							
Arduino	4.95	4.79	4.69	4.68	4.68	4.70	4.68
Commercial	4.76	4.71	4.69	4.68	4.66	4.74	4.54
p-value	0.0781	0.0869			0.4087	0.3540	0.1055
Coca-Cola							
Arduino	5.20	4.86	4.83	4.86	4.85	4.80	4.81
Commercial	4.85	4.80	4.80	4.83	4.84	4.85	4.84
p-value	0.0246*	0.1671	0.3183	0.3308	0.4407	0.3236	0.3983
Guava juice							
Arduino	5.93	5.58	5.61	5.59	5.55	5.60	5.56
Commercial	5.81	5.63	5.58	5.56	5.53	5.53	5.50
p-value	0.1874	0.2139	0.2474	0.2818	0.2768	0.1122	0.1300
Grape juice							
Arduino	6.28	6.06	6.09	6.06	6.00	5.99	5.99
Commercial	6.26	6.08	6.08	6.08	6.08	6.08	6.08
p-value	0.4582	0.3764	0.4582	0.3372	0.0564	0.0230*	0.0564
Guarana							
Arduino	5.65	5.61	5.53	5.51	5.51	5.59	5.58
Commercial	5.63	5.58	5.53	5.53	5.49	5.51	5.50
p-value	0.3372	0.2154		0.0564	0.2311	0.2311	0.2643

Source - Author of research.

*Teste U Mann-Whitney

The measurement of the pH in beer sample in this test shows that the commercial recorder performed equal reading of the pH values for both channels at all times

agreed for such value annotation during three minutes (instants 0 seconds, 30 seconds, 60 seconds, 90 seconds, 120 seconds, 150 seconds and 180 seconds).

In general, the readings taken by the commercial recorder and prototype were of pH values very close to each other and during the three minutes of measurement. These values tended to get closer and closer, until in the instant 150 seconds there was a distance from the results - pH variation of 0.18 more in the arduous prototype, returning to the initial standard of approach at 180 seconds.

About measuring the pH in Industrialized Orange Juice. The pH values read by the commercial recorder channels have been reducing over time, but have remained close to the values recorded by the prototype. The prototype also presented decreasing values, but between 150s and 180s, there was an increase in the pH value of 0.12. When compared, the instants of 0 seconds, 30 seconds and 180 seconds showed the highest different values between the two models, in these cases, always the Arduino pHmeter presenting a higher value than the commercial one.

In the Energetic analysis, the readings from the commercial recorder showed satisfactory proximity to the prototype readings, with the greatest difference being that it is statistically relevant at the moment 180 seconds with a pH of the commercial pHmeter 0.12 (p=0.0178) greater than the Arduino pHmeter.

The test in mineral water showed that the pH values read by the channels of the commercial recorder remained similar to each other during almost the entire three-minute period, with its highest pH difference at the time 60 seconds with a variation of 0.44 more for the Commercial pHmeter.

The values obtained from the isotonic analysis, the readings from the commercial recorder showed satisfactory proximity to the prototype readings, with the greatest difference in pH being 150 seconds and 180 seconds with a pH of the commercial pHmeter 0.8 greater than the Arduino pHmeter.

Regarding the measurement of the pH of the Vinegar, it conferred a lot of stability in the reading of both the commercial register and the Arduino register. It is observed that despite the small oscillations in the channel

readings, only the instants 0 seconds and 180 seconds ran with pH values respectively higher by 0.19 and 0.14 in the measurement of Arduino pHmeter.

For the records of the Coca-cola soft drink, there is statistical variation between the data obtained by the commercial recorder and the arduino recorder in the period of 0 seconds, where its pH variation was 0.35 more in the arduino recorder. The other measurements were made with low variation, in which the 30-second period was the one with the highest pH variation (0.06) when compared to the initial variation.

Regarding the values obtained from the analysis of Guava Juice, the readings from the commercial recorder showed satisfactory proximity to the prototype readings, with the greatest difference in pH being 0 seconds with a pH of the arduous pHmeter 0.12 greater than the commercial pHmeter.

In the Grape Juice analysis, he studied with statistical equity throughout the analysis, except only the instant of 150 seconds, where the pH variation was 0.08 plus pro commercial model.

Already in the analysis of Guaraná performed in 1 channel. Statistically speaking there is no expressive difference between the values obtained in both models. The moment of greatest difference was 150 and 180 seconds, where in both, the pH variation was 0.08 more in the Arduino model.

On the other hand, the general results of the evaluations carried out on the two devices, Arduino and commercial, when using two channels, were also statistically similar. Comparisons proved no statistically significant difference (p-value < 0.5) in 66 (94.3%) of the 70 performed, all presented in Table 3 and graphically represented by the Graphs 11 to 20.

The statistically significant differences were only present in the following times and substances: in 0s of orange juice ($p = 0.0371^*$); 0s time of energy ($p = 0.0330^*$); 0s and 30s time of vinegar ($p = 0.0075^*$ and $p = 0.0216^*$ respectively).

 Table 3 - Comparative data of the substances tested by Arduino pHmeter and commercial pHmeter in 2 channels, organized

 by evaluation period.

Substance	Tempos avaliados - Canal 2						
Appliance	0 s	30 s	60 s	90 s	120 s	150 s	180 s
Beer							
Arduino	5.20	5.20	5.21	5.23	5.16	5.21	5.23
Commercial	5.23	5.28	5.24	5.23	5.20	5.21	5.20
p-value	0.2311	0.3346	0.4319		0.3915		0.2474
Orange juice							
Arduino	5.55	5.44	5.31	5.24	5.19	5.18	5.33
Commercial	5.40	5.23	5.21	5.21	5.18	5.18	5.18
Substance			Rated ti	mes - Chan	nel 1		
Appliance	0 s	30 s	60 s	90 s	120 s	150 s	180 s
p-value	0.0371*	0.0911	0.0605	0.3307	0.2998		0.1240
Energy							
Arduino	6.59	6.41	6.40	6.34	6.35	6.23	6.30
Commercial	6.45	6.36	6.35	6.34	6.34	6.35	6.35
p-value	0.0330*	0.0946	0.0781		0.2154	0.1468	0.2818
Mineral water							
Arduino	6.78	6.63	6.63	6.46	6.66	6.76	6.66
Commercial	6.75	6.81	6.84	6.81	6.84	6.81	6.84
p-value	0.4658	0.2573	0.2208	0.1075	0.2825	0.4369	0.2956
Isotonic							
Arduino	4.30	4.26	4.24	4.20	4.19	4.18	4.18
Commercial	4.29	4.24	4.21	4.19	4.19	4.18	4.19
p-value	0.3764	0.2004	0.2311	0.3391			0.3756
Vinegar							
Arduino	5.08	4.86	4.81	4.78	4.80	4.80	4.75
Commercial	4.76	4.71	4.71	4.71	4.71	4.66	4.59
p-value	0.0075*	0.0216*	0.1189	0.1428	0.0974	0.0539	0.0522
Coca-cola							
Arduino	5.25	4.89	4.88	4.89	4.85	4.84	4.84
Commercial	5.01	4.81	4.83	4.83	4.83	4.81	4.81
p-value	0.1084	0.1752	0.2793	0.2255	0.3822	0.3841	0.4054
Guava juice							
Arduino	5.82	5.54	5.50	5.40	5.45	5.39	5.41
Commercial	5.73	5.51	5.48	5.46	5.46	5.46	5.43
p-value	0.2175	0.4168	0.4374	0.0545	0.2311	0.0929	0.2311

Substance	Rated times - Channel 1	Substance	Rated times - Channel 1	Substanc e	Rated times - Channel 1	Substanc e	Rated times - Channel 1
Grape juice							
Arduino	6.38	6.15	6.13	6.11	6.10	6.10	6.10
Commercial	6.23	6.09	6.08	6.08	6.08	6.06	6.06
p-value	0.0587	0.1860	0.2643	0.2998	0.4168	0.2998	0.3764
Guarana							
Arduino	5.79	5.59	5.64	5.60	5.65	5.68	5.64
Commercial	5.73	5.65	5.70	5.63	5.63	5.64	5.65
p-value	0.3671	0.1038	0.3641	0.3183	0.4483	0.4194	0.4722

Source - Author of research.

*Teste U Mann-Whitney

For the measurement of the pH in beer, the pH values read by the channels of the commercial recorder and Arduino prototype were statistically similar, and there was no major disagreement between them. The longest distance period was 30 seconds, where the pH variation was 0.08 more in the commercial prototype.

On the other hand, in the analysis of the orange juice it obtained significant statistical variation only in the instant of 30 seconds, which the pH variation was 0.21 (p=0.0911) plus prototype Arduino. The other values were reduced between the variation in time, equalizing in the instant of 150 seconds and distancing again in 180 seconds with a pH variation of 0.15, although statistically not important.

The analysis of the pH obtained in the Energetic solution by the commercial pHmeter and the arduous prototype showed statistically relevant pH variation of 0.14 (p=0.0330) more for the arduous prototype in the instant of 0 seconds. The other times and measurements had quite similarity in their data.

In the values obtained from the Mineral Water analysis, and the Isotonic solution analysis. In both, both the commercial pHmeter and the arduous prototype were made with similar data, not showing important variations to the statistics.

On the other hand, in Vinegar analysis, it is performed with two statistically different moments, represented in 0 seconds with a pH variation of 0.32(p=0.0075) and 30 seconds with a pH variation of 0.27 (p=0.0216), both with higher data in the arduous pHmeter. The other times and values of both pHmeters showed no statistically relevant divergence, being considered similar.

In the presentation of Coca-Cola pH analysis, even with the pH difference of 0.24 plus in the arduous prototype, this, as well as the other results, does not present significant statistical variation.

In relation to the analysis of guava juice, it presents statistical similarity at all analyzed moments, and no significant inconstancy or divergence is evidenced. The interval of greater distance between the data obtained by the Commercial pHmeter and Arduino pHmeter was the instant of 0 seconds, with pH variation of 0.09 more for the prototype Arduino.

For the analyses of Grape Juice and Guarana respectively, they present stability in the data collected in both with pHmeters, being noticed statistical similarity in all the analyzed moments, not being evidenced any inconstancy. Its moments of greater variation between the obtained data, were 0 seconds in Graph 19 with variation of pH of 0.15 more for the prototype Arduino, and 30 and 60 seconds in Graph 20, with variation of pH of 0.06 more for the Commercial pHmeter.

IV. CONCLUSION

The portable Arduino pHmeter was built at a low financial cost for better accessibility to pHmetry examination. Daily substances (Beer, Energetic, Mineral Water, Orange Juice, Grape Juice, Guava Juice, Isotonic, Guarana, Coca-cola and Vinegar) were tested, having their readings done and saved in SD memory card, where they were recorded for later access. The analysis, its performance in terms of accuracy in recording pH values (aqueous solutions) is satisfactory because it presents results very close to the measurements indicated by the commercial recorder, in simultaneous measurements during the testing phase.

The calibration with the buffer solutions of pH 4.00 and 7.00 values purchased corresponded to the actual pH values of each solution, so the portable recorder showed satisfactory results with respect to the calibration procedure also.

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Potentials Insect Pests of Yacon *Smallanthus Sonchifolius* (Poeppig & Endlicher) H. Robinson in Brazil

Fábio Luiz de Oliveira¹, Leandro Pin Dalvi¹, Dirceu Pratissoli¹, Gilberto S. Andrade², Julielson Oliveira Ataide¹

¹Department of Agronomy, Center of Agrarian Sciences and Engineering, Espírito Santo Federal University, Brazil. ²Department of Agronomy, Federal Technological University of Paraná, Brazil,

Abstract— The recent exploration of yacon demands scientific information for improving the crop production technology. A important demand is about Plant health. In this sense, the aim of this study was know insects that promote injuries in yacon crops. The study was developed in Brazil. The planting on a field site began in May 2014. Sampling for injuries and insect display was performed weekly for a period of six months which corresponds to the interval between the emergence of the crop to harvest. Using traversal switchback, detailed surveys were conducted in the shoot 5% of plants aimed at locating injuries and their cause insects. The insects were collected, packed in appropriate enclosures, cataloged and sent to the Entomology Section of Universidade Federal do Espírito Santo for identification standard procedures. The species Myzus persicae (green peach aphid) and Macrosiphum euphorbiae (Potato aphid), Edessa meditabunda (known the black wings stinkbug in Brazil) and Dysmicoccus brevipes, commonly called the pineapple mealybug, were recorded causing injuries in yacon during the cultivation.

Keywords— Hemiptera, Plant health, Polymnia eduli, Polymnia sonchifolia.

I. INTRODUCTION

The yacon is a Andean tuberous root, that is been consumed in various parts of the world such as North America, Asia and Europe (Maldonado et al., 2008). Economic interest on yacon (*Smallanthus sonchifollius*) has growing due to its nutraceutical properties as reduction of body weight, insulin index modulator, intestinal regulator, improving LDL level (Genta et al., 2010; Tostes et al., 2014) and inhibition of carcinogenic processes (Moura et al., 2012).

Because this is a relatively recente commercial exploitation plant, yacon has no detailed growing system. Regarding to pest attack, for example, very little information can be found. In small yacon-growing areas in Peru, Seminário et al. (2003) observed some insects which feed themselves by eating the aboveground part, including leaves, sprouts and flowers: *Liriomyza* sp. (Diptera: Agromyzidae); *Diabrotica undecimpunctata* and *D. speciosa* (Coleoptera: Chrysomelidae); *Agrotis ípsilon* and *Copitarsia turbata* (Lepidoptera: Noctuidae); *Schistocerca* sp (Orthoptera: Acrididae), and other two insects of Acrididae and Trydactydae families. The authors also

observed slug attack (*Agriolimax* sp.: Limacidae). Attacking the underground parts, *Golofa aegeon* (Coleoptera: Scarabaeidae) and *Passalus* sp. (Coleoptera: Passalidae) were observed. The sucking insects like green leafhopper (*Empoasca* sp.), showed lower occurrence (Hemiptera: Cicadellidae), and aphids, *Aphis* sp. And *Myzus persicae* (Hemiptera: Aphididae).

In Brazil, the only report was made by Silva et al. (2015) found three species from the Coleoptera order: *Lagria villosa* (Coleoptera: Lagriidae); *Cerotoma arcuata* and *Diabrotica speciosa* (Coleoptera: Chrysomelidae) and two species from the Lepidoptera order: *Spodoptera eridania* (Lepidoptera: Noctuidae) and *Chlosyne lacinia saundersii* (Lepidoptera: Nymphalidae) were observed causing damage to the yacon crop. The caterpillar *C. lacinia saundersii*, known as sunflower caterpillar, was the most important species, being observed throughout the yacon cycle.

However, number of insects species increases naturally when crop plants are introduced in a new area (Gullan and Craston, 2008). Thus, the aim of this study was to assess insect and their damage on yacon in order to predict future scenarios of plant health challenges and to adapt sustainable tactics and control strategies in the future.

II. MATERIALS AND METHODS

This work was carried out in an experimental field of Universidade Federal do Espírito Santo, Brazil. After soil chemical analysis, the authors concluded that no correction would be needed; however, planting fertilization using cattle manure equivalent to 50 kg of nitrogen per hectare was performed.

The experimental field was composed of 1000 plants spacing of 1.0 m between lines and 0.5 m between plants, in na area of 500 m². Cultivation began in April 2014 and emergence of the shoots was 30 days after planting (DAP) of the rhizophores. Plants reached the maximum height of 90 cm after five months (150 DAP) and the harvest was carried out in November (180 DAP). The authors highlight that organic management was adopted, so no insecticides or fungicides were applied during cultivation.

Sampling for injuries and insect display was performed weekly for a period of six months which corresponds to the interval between the emergence of the crop to harvest. Using traversal switchback, detailed surveys were conducted in the shoot 5% of plants aimed at locating injuries and their cause insects. The insects were collected, packed in appropriate enclosures, cataloged and sent to the Entomology Section of Universidade Federal do Espírito Santo for identification standard procedures. At harvest the roots of all plants were also inspected. No damage was found in roots, which were observed at harvest time.

III. RESULTS AND DISCUSSION

Only in the aboveground part, the authors observed aboveground feeding insects; neither presence of insects underground nor symptoms of root attack were detected. *Myzus persicae*, *Macrosiphum euphorbiae* (Hemiptera: Aphididae), *Edessa meditatabunda* (F.) (Hemiptera: Pentatomidae) and *Dysmicoccus brevipes* (Hemiptera: Pseudococcidae) were found in yacon plantation. These species occurred from 120 days until the end of the crop cycle.

M. persicae and *M. euphorbiae* were found underside of leaves in the middle third of the plants, they were grouped near the ribs of leaves. The feeding of this insets cause leaf chlorosis, which relates to the reduction in photosynthetic rate. On the other hand, *M. persicae* is reported as secondary insect-pest for yacon in crops in Peru (Seminario et al., 2003), which is can be due to secondary compounds in this plant that can affects this aphid, what issuggested by mortality of this aphid by extracts plant (Yun et al., 2012).

Edessa meditabunda was collected close to apical meristem of plants causing small necrotic lesions. These feeding points decreased the length of internodes of the plant. However, *D. brevipes* was the most important insect due to acute depletion of plants at full growth. Their presence was around the stem, leaf axils and petiole, causing reduction of leaf area, leaf atrophy and chlorosis. *D. brevipes* is an insect pest causing huge damage to pineapple around world, mainly because it is closely related to pineapple wilt and they can survive in over 30 different host plants (Lacerda et al., 2009). It should stress that the area of yacon cultivation was close to a 0.5 hectares of pineapple plantation which may have favored dispersion of insets to yacon.

Is worth mentioning this plant is traditionally grown in polycultures as additional option of income for producers. Changes in the production system, such as monocultures, may increase likelihood that other insects adapt in this crop plant.

IV. CONCLUSION

During the cultivation of yacon, the species *Myzus* persicae were recorded (green peach aphid) and *Macrosiphum euphorbiae* (Potato aphid), *Edessa* meditabunda (known the black wings stinkbug in Brazil) and *Dysmicoccus brevipes*, commonly called the pineapple mealybug, were recorded causing injuries in yacon

ACKNOWLEDGEMENTS

FAPES (Foundation for Research Support and Innovation of Espírito Santo) and CNPq (The National Council for Scientific and Technological Development) for their financial support and granting scholarships of research.

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Evaluation of the waste of medicines through the irrational use of medicines in the residences registered in the Health Unit of the Family Hugo Naves Cansado belonging to the Vila Íris neighborhood located in the municipality of Gurupi — Tocantins

Sara Falcão de Sousa^{1,*}, Fabrício de Souza Santos², Erika Carolina Vieira Almeida³, Eros Silva Claúdio¹, Jaqueline Cibene Moreira Borges¹, Larlla Veruska Arrates Pires¹, Millena Pereira Xavier², Natallia Moreira Lopes Leão², Saulo José de Lima Júnior¹, Vanderson Ramos Mafra¹, Yara Silveira⁴, Aline Matos de Carvalho Berto¹

¹Professor at the University of Gurupi, Unirg, Av. Rio de Janeiro, N° 1585 - St. Central, 77403-090 - Gurupi, Tocantins, Brazil ²Pharmaceutical, Unirg, Av. Rio de Janeiro, N° 1585 - St. Central, 77403-090 - Gurupi, Tocantins, Brazil

³Pharmaceutical and Professor at the University of Gurupi, Unirg, Av. Rio de Janeiro, Nº 1585 - St. Central, 77403-090 - Gurupi, Tocantins, Brazil

⁴Clinical Pharmacy and Intensive Care, Professor at the University of Gurupi, Unirg, Av. Rio de Janeiro, Nº 1585 - St. Central - 77403-090, Gurupi, Tocantins, Brazil

*Corresponding Author: Sara Falcão de Sousa de Sousa

Abstract—Irrational use of medicines is understood as the process that includes the prescription, dispensing and use of medicines incorrectly. A pharmacy homemade is characterized as a clear example of this practice, cooperating through the storage of medicines in homes for the waste of them, either by a certain amount stored or by drugs with an expired shelf life. Thus, this study aimed to investigate whether there was a waste of medicines from their irrational use in the community living in the Vila Iris neighborhood of Gurupi-TO. This research was characterized as a descriptive exploratory field with qualitative and quantitative analysis. It was carried out with residents living in the Vila Íris neighborhood of Gurupi-TO, registered at the Family Health Unit (FHU) Hugo Naves Cansado, data collection took place from home visits with questionnaire application during July and August 2011. 142 legal guardians of the residences were interviewed, of this 70.42 % were female, in 90.52% of the households participating in the research there was drug storage and the average was 2.41 drugs per household, according to the results from this research it was possible to notice that in the community of neighborhood Vila Iris, Gurupi-TO, there was a waste of medicines. Although most of the drugs present in the researched houses were acquired by medical indication, the possibility of irrational use of medications is not ruled out mainly due to a lack of adequate guidance.

Keywords—Home Pharmacy, Irrational use of medicines, Pharmaceutical product.

I. INTRODUCTION

It is defined by medicine, pharmaceutical product

technically obtained or prepared for prophylactic, curative, palliative, or diagnostic purposes [1, 2].

It is believed that with the development of the pharmaceutical industries, along with advertising policies that encourage the use of medicines, the lack of supervision of organs, high rates of pathologies that has been affecting as well as society overcrowding the Unified Health System (UHS), contribute to society acquiring drugs improperly, making it susceptible to the irrational use of medicines.

The homemade pharmacy is a clear example of the irrational use of the drug, society acquires more and more drugs, store in their homes and use when they want, that is, make up the medical diagnosis, due to the omission of information on the use of some medication, causing incorrect storage of drugs, which are conducive to physicochemical changes, loss of their therapeutic efficacy and even becoming toxic to health, not to mention providing significant purchasing impairment individuals and the three spheres of government [2, 3].

Thus, this research aimed to investigate whether there was a waste of medicines from their irrational use in the community living in the Vila Iris neighborhood of Gurupi-TO.

II. MATERIALS AND METHODS

This work was characterized as descriptive exploratory field research, containing quantitative and qualitative analysis, which was carried out with residents registered at the Hugo Naves Cansado Family Health Unit in the Vila Íris neighborhood in the municipality of Gurupi, state of Tocantins, data collection took place in July and August 2011. Data were obtained from home visits. The study was conducted in 10% of these households, totaling approximately 202 households that were surveyed. But only 142 legal guardians of the residences were included in this study. Residences registered in the Family Health Unit (FHU) belonging to the Vila Íris neighborhood located in the municipality of Gurupi ----Tocantins, whose legal guardians for the households were between 18 and 60 years old and who agreed to participate in the research by signing the Free and Informed Consent Form were included in the research. All households that were registered in FHU of the Vila Íris neighborhood during the period of data collection, all households whose legal guardians were under the age of 18 years or older than 60 years, all legal guardians of the households that refused to participate in the study were excluded, and all residences where legal guardians were not found and/or found closed

until the end of the research, and the researcher returned as many times as necessary. In this research, an interview was conducted using a questionnaire with closed questions, where the following subjects were addressed. The project was evaluated and approved by the Research Ethics Committee of the UNIRG -University Center Gurupi under the number through the process no. 0029/2011 and, by the Municipal Health Department of Gurupi — Tocantins, both allowed its approval to start data collection, obeying resolution 196/96 of the National Health Council (NHC). The final result of the data collection was informed to the Municipal Health Department that is responsible for the FHU Hugo Naves Cansado. This research did not imply compensation or compensation from both parties (researchers and interviewees). The information was analyzed and processed through graphs and tables by descriptive statistical analysis.

III. RESULTS AND DISCUSSION

In this context, we seek to present the compilation of the data obtained during the research carried out in the Vila Íris neighborhood, Gurupi-TO municipality. It is noteworthy that 202 households were used as sampling. Of these 142 participated actively in the research, and 60 were excluded from the research, and 25 responsible for the residences were over 60 years old, 5 were under 18 years old, 22 did not agree to participate in the interview without signing the free and informed consent form and 8 residences were closed until the end of the research. The study was approved by the Research Ethics Committee of the University Center of Gurupi through process Nº. 0029/2011. Through the critical analysis of the data obtained in this study, the social characteristics of the people interviewed were verified, that is, with regard to gender, level of education, age of the interviewees, and the number of people per residence (Table 1). Thus, it was found that the majority of the respondents were female, in which in the universe of 142 people, 100 were women (70.42%), and 42 (29.58%) were men. (Table 1).

According to the description of Gouvêa (2008) [4], the consumption of medications is related to the sex of the individual. It is that women self-medicate more than men, which is also affirmed by the World Health Organization (WHO) in drugstores in the country. This result according to the same author is due to several

factors, among them the social role of women in wanting to provide family health. As far as education is

related, 25.35% (36) of the sample surveyed had incomplete 1st degree, 23.94% (34) complete 2nd degree, 18.31% (26) 1st complete degree, 11.27% (16) incomplete 2nd degree, 10.56% (15) complete 3rd degree,

4.93% (7) 3rd degree incomplete, and 5.63% (8) were incomplete, and 5.63% (8) were illiterate (Table 1). Because of these data, it can be perceived that the majority of the population surveyed is not functionally illiterate, that is, it has more than four years of complete studies presenting a reasonable level of education, that is, on average, and the majority has schooling between

 1° complete degree and 3rd degree complete. According to site Educação Brasil (2011) [5] and IBGE (2002) [6] it should be considered that functional lye, every person who is over 20 years of age and has not completed 4 years of formal study, as well as, does not know how to write his name, or simple sentences, does not know how to perform basic mathematical calculations, and yet, cannot interpret what he reads, or use this knowledge in his experience [7].

Brazil in 2002 had a percentage of 26% of functionally illiterate, while in 2009 this rate was for 9.7% of illiterate. This result can be considered good, taking into account data from previous years that showed a rate of 36% of functionalities [5, 6].

Regarding the age of the person responsible for the residence, more than half of the respondents were aged between 51 - 60 years, reaching a percentage of 36.62% (52), 23.94% (34) were in the age group of 29 - 39 years, already 18 - 28 years and 40 - 50 years had the same percentage, 19.72% (28) (Table 1).

Table 1: Social characteristics of the interviewees registered in the Family Health Unit (FHU) Hugo Naves Cansado and
residents in the Vila Íris neighborhood of Gurupi - TO.

Variable	Interviewed (N°)	Percentage (%)
Sex		
Male	42	29.58
Female	100	70.42
Total	142	100
Level of education of the legal guardian		
No schooling	8	5.63
Incomplete 1st grade	36	25.35
Complete 1st grade	26	18.31
Incomplete 2nd degree	16	11.27
Complete 2nd grade	34	23.94
Incomplete 3rd degree	7	4.93
Complete 3rd degree	15	10.56
Total	142	100
Age of the responsible		
18 to 28	28	19.72
29 to 39	34	23.94
40 to 50	28	19.72
51 to 60	52	36.62
Total	142	100
Number of people living in the household		
One	10	7.04
Two	19	13.38
Three	31	21.83
Four	40	28.17
More than four	42	29.58
Total	242	100

According to IBGE data 'b' (2010) [8], show that in the country there was a considerable growth of people aged 65 years or more, going from a percentage of 4.8% in 1991, to 7.4% in 2010. In this sense, it was noticed that the data from the research conducted in the Vila Iris neighborhood, Gurupi municipality

— state Tocantins, have a certain consonance concerning the data of the rest of the country, regarding the number of people over 50 years of age, an index higher than the other ages.

Regarding the number of people living in the households visited, it was found that 42 households (29.58%) there were more than 4 individuals in 40 households (28.17%) there were 4 individuals in 31

households (21.83%) 3 individuals, 19 households (13.38%) 2 individuals, and 10 households (7.04%) only

1 individual. (Table 1)

When analyzing these data, it was noticed that in the Vila Íris neighborhood most of the family groups

were composed of 4 or more members, thus reaching a percentage of 57.75% (82) of respondents who answered between 4 and more than 4 people per residence (Table 1).

These data differ from those indicated by IBGE, concerning the general index of the country, which is an approximate number of 3 people per family [9].

During the interview, it was questioned whether there was the storage of medicines in the homes surveyed, and 90.85% (129) of the interviewees said yes, while 9.15% (13) answered no. This research is in line with the work carried out by Schenkel (2004) [10], which shows that of 101 respondents, 98 people were found medicines in their homes.

Graph 1: Percentage of storage of medicines in homes by the interviewees registered at the Family Health Unit (FHU) Hugo Naves Cansado and domiciled in the Vila Íris neighborhood of Gurupi - TO.



Yes According to Tourinho (2008) [2], storing

According to Tourinho (2008) [2], storing medicines in homes is common practice, however, this practice may represent a health risk, since people do not know the correct way to store the drugs.

Still, in this same line of thinking, Margonato (2008) [11], also, the accumulation of medicines stored in homes may be related to the shortage of medicines in the Public Health System, causing the patient to acquire an unnecessary amount of medicines before they are missing in public health units or even acquiring through self-medication in pharmacies and/or drugstores, preventing the lack of drugs in the future.

According to Lima (2010) [12], families keep a large number of medicines considered indispensable, and this can increase the risks of intoxication due to improper ingestion, drug exchange, error with the therapeutic indication, among others.

Also, the considerations described by Brandão

(2010) [13], when he points out that 25% to 30% of medicines stored at home is wasted, due to their loss of validity.

Also, concerning the data showing that most of the respondent's stored medicines at home as shown in Graph 1, Costa (2007) [14] states that among the factors that contribute to the indiscriminate consumption of medicines in Brazil, is the low-level education of the Brazilian population. However, the description made by Costa (2007) [14] is in disagreement with the results found in this research, which shows that approximately 50.70% of the interviewees had more than 4 years of complete studies (Table 1).

On the other hand, the line of thought of Villarino et al., (2005) [15] should be considered when he states that the higher incidence of medication consumption is intrinsically related to the higher level of education of people since in the view of this author, people with a

You store medicines in your home

higher degree of knowledge are more confident to selfmedicare. Thus, it is believed that this last explanation is more in line with the data of this research because those with higher education are the ones who store drugs in their homes the most (Table 1, Graph 1).

When questioning which medications, the interviewees kept in their homes, it was found that the drugs used for pain and fever reached higher rates than those destined for other pathologies. Thus, 41.35%

(110 people), fever 18.80% (50 people), hypertension 15.41% (41 people), diabetes 5.64% (15 people), cholesterol 5.64% (15 people), allergy 3.01% (8 people), and for other diseases reached a percentage of 10.15% (27 people). These values are data from a universe of 129 people who claimed to have medicines at home. Also, these 129 people had the option of multiple choice giving the right to inform all medicines used in their homes (Graph 2).

Graph 2: Percentage of which drugs were stored in the residences by the interviewees registered at the Family Health Unit (FHU) Hugo Naves Cansado and domiciled in the Vila Íris neighborhood of Gurupi - TO.



As described by Rocha (2009) [16] the presence of analgesics and antipyretics in homes is common because these serve as first aid for rapid treatments of everyday diseases such as headaches, and fever, since these remedies are only used when there is a need. Another point that can influence the growth of these drugs in homes is the free sale in pharmacies and drugstores.

Concerning the high rates of hypertensive patients, this reality is not unique in the Vila Iris neighborhood, but the rest of the country. According to the site Portal da Saúde (2004) [17], the rate of hypertensive patients in Brazil is 35% of the population over 40 years of age. This information is in line with the research conducted because, in this, it was perceived that most of the interviewees are aged between 40 and 60 years, and still 15.41% (41) make use of antihypertensives drugs, an amount considered significant.

Still, in this bias, it was found that recent studies confirm that the rate of hypertensive patients in Brazil has grown, because according to the Brazilian Society of Hypertensive Patients, this pathology affects about 25% of the Brazilian population, reaching 50% in the third [18].

It should be taken into account that part of these medicines stored at home was of continuous use as the case of antihypertensives and, antidiabetics, that these may be being used correctly or not.

According to data provided by Tourinho (2008) [2], 50% of all drugs used in the world are prescribed, sold, dispensed, or used incorrectly.

Also, in this keynote, who can contribute is Fazio (2011) [19], when he emphasizes that the main causes for the self-index of drug intake throughout Brazil may be the lack of knowledge of users, the wide access to medicines in drugstores and the self-medication. The idea of this author can confirm the result obtained in the research, thus justifying the large number of medicines stored in the visited homes.

According to research conducted in Porto Velho

(RO) on indiscriminate use of medications practically all medications used in the context of self-medication belong to the groups of antibiotics, analgesics, vitamins, and contraceptives [20].

Of the 90.85% (129) individuals interviewed, when asked about the number of medicines stored in the households surveyed, 29.46% (38 people) reported having only one drug stored in their home, 28.68% (37 people) only two, 12.40% (16 people) only three, and 29.46% (38 people) from four. It can be seen that in all households they had at least one medication and that most of them had more than three stored medicines (Graph 3).

Also in the context of the information related to Graph 3, when compiling the data, it can be observed that 38 people kept 38 drugs, 37 people kept 74 medicines, 16 people kept 48 medicines, and when they answered that they stored the from four drugs (only 4 drugs were taken into account), 38 people kept 152 drugs, reaching a total of 312 drugs in the 129 households surveyed, an average of 2.41 drugs per household. The presence of the high number of drugs in the homes of the people surveyed can be supported by Lyra (2003) [21] when he states that the Brazilian population has easy accessibility to medicines.

Others that can also contribute to this same assertion are the WHO and the ministry of health when they inform data that the Brazilian drug trade provides more than 32,000 medicines, one of the reasons for classifying Brazil in the sixth position among the countries that lead the ranking of drug consumption [3].

According to Brandão (2010) [13], Brazil consumed in 2009 the equivalent of 2000 kilos of the type of appetite suppressant sibutramine. This indicator corresponds to that of every thousand inhabitants in the country, one consumed three doses of drugs per day.

Most Brazilians have drugs in their homes, and the amount is accumulated in such a way as to constitute a homemade pharmacy [22].

Margonato (2008) [11], stresses that the percentage of medicines stored in homes can be attributed to dependence on the health service as well as in the shortage of medication in the public health system, as previously mentioned.





Regarding the way of storing medicines in the researched homes, it was possible to verify that the majority of the interviewees stated that their medications came from medical indication, reaching a percentage of 56.59% (73 people). Those who said that the drugs were not indicated by the doctor reached a percentage of 43.41% (56 people) of the interviewees (Table 2).

Also, about medicines stored in homes, that is, those indicated by physicians, the following order could

be observed: 41.10% (30) of the people stored only 1 drug, 19.18% (14 people) two types of medications, 24.66% (18 people) three types of drugs, 15.07% (11 people) from four drugs (Table 2).

The research conducted by Bueno (2009) [22] shows that most of its respondents practice selfmedication, which differs from this research since the majority of people interviewed 56.59% (73) used prescription drugs. However, Aquino (2008) [23] reports in his research that 35% of the drugs sold in Brazil are the fruits of self-medication, which is in some ways in line with this study because it exposes that less than half of the interviewees did not use a medical prescription to acquire some kind of drug. Carmeli (2001) [24], emphasizes in his article that self-medication is a very

common practice in Brazil, as well as in other countries, also argues that, this is a means that the patient uses to find immediate relief to his pathologies. However, this can mask the diagnosis, thus making it difficult to elucidate the true disease.

Table 2: Data on the storage of medicines by the interviewees registered in the Family Health Unit (FHU) Hugo Naves
Cansado and domiciled in the Vila Íris neighborhood of Gurupi – TO.

Variable	Interviewed (N°)	Percentage (%)
Have the medicines stored in your residence been indicated		
by the doctor?		
Yes	79	56.59
No	56	46.41
Total	129	100
How many medicines stored in your home have been indicted by the doctor?		
Only one	30	41.10
Only two	14	19.18
Only three	18	24.66
From four	11	15.07
Total	73	100
Do you know how to use the medicines stored in your home?		
Yes	121	93.80
No	8	6.20
Total	129	100
How many medicines are being stored in your home that you know how to use?		
Only one	50	41.32
Only two	26	21.49
Only three	23	19.01
From four	22	18.18
Total	121	100
Are the medicines in your home being stored correctly?		
Yes	109	84.50
No	20	15.50
Total	129	100

According to Costa (2007) [14], the data presented in his research state that, among the majority of respondents, some obtained prescription drugs, data that, although they were made in another region of the

country, are in line with the data of this research, because it also presents a higher rate of medicines acquired through a prescription.

It is important to add in this line of thought that the use of medications in a rational way, that is, respecting the medical prescription is of great importance, because patients, in addition to receiving medications appropriate to their clinical needs, are the right dose, and the time of use of each drug [23].

Regarding the medicines stored in the homes, of the 129 interviewees who stored medicines in their homes, 121 (93.80%) reported knowing how to use them, and only 8 (6.20%) said they didn't know how to use it. When the number of drugs that stressed knowing how to use the drugs was questioned, the vast majority, a percentage of 41.32% (50 people) stated that they know how to use only one, secondly, were those who said they knew how to use only 2, representing a percentage of 21.49% (26 people); in sequence, 19.01% (23 people) only three medications, and 18.18% (22 people) from four medications (Table2).

Although the above-mentioned information presented a data in which it shows that the majority of respondents know how to use medicines, this is not a reality in global terms, because, in this sphere, the absence of information about medicines is one of the causes that the individual does not adequately comply with his treatment [3].

In the opinion described by Salviano (2008) [25], the patient's knowledge about the use of medications plays an important role in the efficacy of its treatment, as it reduces the risks of drug-related problems and potentiates the best therapy.

Regarding the location of the storage of medicines in the households, it can be verified in this research, according to the opinion of the majority of the interviewees, that the drugs were stored in correct places, reaching a percentage of 84.50% (109), on the other hand, on the other hand, the view of 15.50% (20) of the respondents stated that they did not know how to store the drugs correctly (Table 2).

In this bias, it was verified that the drugs were stored in different locations of the residences visited. In the kitchen cabinet was the place where 48% (62 of the people) reported storing, 25% (32 people) said they kept in the room inside the wardrobe, 10% (13 people) said they kept it on the refrigerator, 9% (11 people)

said they kept it in the room on the table, 8% (10 people) said they kept medication in another unidentified place,

already in the room on a table, only one person and in the bathroom, no person kept medication (Table 3).

According to Seraphim (2007) [26], all medicines should be stored in places protected from light, moisture, heat, and radiation. Among the places that should not be stored are the sinks, bathrooms, cabinets near the windows, stoves, as well as, should not stay together with food.

According to Lima (2010) [12], the data from his research state that the drugs were found in places exposed to light, heat, and humidity, and 50% of the interviewees said they kept the drugs in the closet and 37% exposed in places such as walls, the balcony of the sink of the kitchen, on the fridge and the table. These data, which are in line with part of the data presented in the research conducted in the neighborhood Vila Iris municipality of Gurupi — TO, when referring to the places of storage of medicines such as, on the refrigerator, on the table, and the kitchen cabinet, once that these locations may be exposed to high temperatures.

Another scholar who can corroborate this understanding is Tourinho (2008) [2] when in his considerations points out that the home pharmacy is deposited in inappropriate environments, for him, this may favor the possibility of irrational consumption, waste, and risk of toxic exposures.

Regarding the usefulness of each drug stored in the researched households, 113 (87.60%) respondents answered that they knew its purpose and only 16 people (12.40%) didn't know. And to better clarify the level of knowledge of the interviewees regarding the drugs stored in the homes, we were also asked about the number of medications they knew about their service. In this keynote, it was found that 39 people (34.51%) stated that they knew only 01.30 people (26.55%) said they knew only two, 15 people (13.27%) said they knew only three, and 29 people (25.66%) stated that they knew the usefulness of four or more medicines in their homes (Table 3).

It is believed that the interviewees knew the drugs because they stated as can be seen in Table 2 that most of the drugs stored in their homes were obtained by medical indication. However, the interviewees' answers as to what the drug is for does not mean that they will use the drugs correctly since basic guidance on dosage, time of use, interactions are necessary. How to follow the treatment to the end and in most cases the diagnosis of a doctor. Another point that deserves to be highlighted is that the care provided by the doctor or other health professional in some cases does not mean that the patient has received the necessary and correct guidance for the

rational use of medications, since research many unprepared health professionals [25].

Table 3: Data on the storage of medicines by the interviewees registered at the Family Health Unit (FHU) Hugo NavesCansado and domiciled in the Vila Íris neighborhood of Gurupi-TO.

Variable	Interviewed (N°)	Percentage (%)
Do you know what each drug is being stored in your home?		
Yes	113	87.60
No	16	14.40
Total	129	100
Of the medicines stored in your home, how many do you know what it's for?		
Only one	39	34.51
Only two	30	26.55
Only three	15	13.27
From four	29	22.48
Total	113	100
Why do you store medicines in your home?		
Lack of knowledge about the dangers of use	1	0.78
For prevention of an unexpected disease	66	51.16
Leftover drugs due to treatment abandonment	5	4
Leftover medicine dispensed too much	16	12.40
You have a disease and need to use medication	29	22.48
Other	12	9
Total	129	100
How do you store medicines in your home?		
In the litchen achieve	62	49
On top of the fridge	12	40
	15	10
In the room on the table	11	9
In the room inside the wardrobe	32	25
In the bathroom	0	0
In the room on a table	1	l
Elsewhere	10	8
Total	129	100
According to Saez (2004) [27], the pharmacist has the role of correctly guiding the consumer on the rational use of medicines and thus avoiding the incorrect and excessive use of medicines. It is also the responsibility of this professional to make sure that the patient has received the necessary information on how to use the drug, and advise him to always seek medical help when the symptoms are unclear or the pathology persists.

According to a survey conducted by Serafim (2007) [26], its interviewees responded by using the medical prescription, and the package leaflet as an instruction for the use of medications. Vieira (2011) [28] supports the same idea that some people seek leaflets to acquire knowledge about the use of medications.

According to Aquino (2008) [23], some people ignore the health risk when mixing various medications, thus failing to inform the doctor under the use of some other drug. Continuing with the results obtained in the research, it is important to point out that the reasons that the interviewees kept medicines at home, in increasing order were the following. One person (0.78%) answered storing medicines at home due to lack of knowledge about the dangers of incorrect use of the same, 66 people (51.16%) reported storing medicines in their homes for prevention, 5 people (4%) reported leftover drugs due to treatment abandonment, 16 people (12.40%) leftover medicines by dispensing above the necessary. Already 29 people (22.48%) answered to store medicines because they were continuously using drugs for hypertension, diabetes and/or cholesterol and thus kept medicines at home, and 12 people (9%) answered that they had another reason to store medicines at home (Table 3).

Although the results of the research show that only one person stores medicines at home due to lack of knowledge, Fanhani (2006) [3] describes in his work that the lack of information about medications is one of the most significant causes for the abandonment of medical therapy. And it is known that abandoning medical treatment most often can result in the storage of drugs in homes.

According to Carmeli et al., (2001) [24], people in search of a cure, treatment, prevention, and other

factors, driven by the ease and speed of access to drugs, make this need and supposed knowledge the practice of self-medication. This item denotes the results of the research where it showed that the majority of people 51.16% (66) used prevention as a factor to store medicines at home.

Following the results obtained in research, it can still be observed in Table 3, about the storage of drugs, it was perceived that in the item leftover from medications due to treatment abandonment, only 5 people (4%) reported having medicines for this reason. This result was considered insignificant by the researcher, equating with the results obtained for other reasons of the leftover. However, attention was focused on this subject due to national information described by Aquino (2008) [23], where it reports that 50% of the prescribed drugs are performed incorrectly. It may be a factor for treatment abandonment.

Regarding the item leftover from medicines, due to the same dispensed above the amount necessary for the treatment of the patient expressed in table 3, it can be verified that there was an expressive index, totaling 16 people (12.40%). In this sense, it was noticed that these data reinforce the real objective of one of the measures that the federal government adopted to solve the problem of prescription of medicines over dispensed. This measure, which edits law no. 5348 of January 20, 2005 on the sale of fractional drugs, thus preventing the leftover of drugs, and dispensation in the exact amount prescribed by the doctor [29].

The results of this research showed that 29 people (22.49%) (table 3) that kept medicines at home were because they made continuous use of them. On the other hand, when asked about which drugs stored at home, adding antihypertensives and, antidiabetics (graph 3) a percentage of 26.69% of respondents were obtained. This small observed difference in values of continuous use medications can be attributed to several reasons, among these, the lack of truthfulness or omission in the information presented by people when answering the questionnaire, or even being able to forget their pathology or their dependents and thus not report the correct information.

Graph 4: Index of people interviewed and domiciled in the Vila Íris neighborhood registered with the Family Health Unit (FHU) Hugo Naves Cansado when asked about how they acquired the drugs that were being stored in their homes.



How were these drugs acquired

If we look at graph 4, we can appreciate how the interviewees acquired the drugs stored in their homes, thus, we observed that 55.04% (71) reported acquiring in the pharmacy, 40.31%, (52) at the health center, 1.55% (02) by indication of a friend and/or a pharmacy clerk (reached the same percentage), 0.78% (1) by indication of a person who used the drug and/or obtained medications influenced by another reason (the same percentage achieved) and no person reported that he obtained alcohol sway due to advertisements.

Most respondents reported purchasing drugs in the pharmacy (Graph 4) and said they store drugs to prevent diseases (Table 3) however it can be assumed that part of these acquisitions may be the result of self-medication. Jacome (2011) [30] reports that 50% of the sales of traditional medicines in the Brazilian market are selfmedication and/or the shortage of farms in the public health system, providing the demand for pharmacies and/or drugstores.

This information shows us how important the presence of the pharmacist in pharmacies and drugstores, both to avoid the indiscriminate sale, as well as to provide a responsible dispensing, ensuring the health of the client, avoiding waste of medicines through the storage of home pharmacies, the famous "homemade pharmacy" and also reducing expenses for both the use of medicine and public coffers [13].

The second place that the interviewees of the Vila Íris neighborhood reported acquiring their medicines was in the health posts, these data may probably be related to the social class of the population in question, where it appeared to be a class of low purchasing power, and thus would justify making use of the public health system.

The percentage of people who purchased their medications by indication of a friend, indication of a pharmacy clerk, and another person who used medication, is small, however, it is relevant to address this issue, because it was perceived that there were still people without information, lay for the dangers of selfmedication, and who needed conscientization by the competent government authorities. Also, in this Brandão theme (2010) [13], it states that the practice of pharmaceutical care because it is not widespread and consequently not fully enjoyed by the Brazilian population, possibly by the culture of the country and the lack of the professional contribution to the waste of medicines.

Regarding the influence that advertisements

provided in the acquisition of medicines, the people interviewed did not consider this option valid, however, this information contrasts with the data described by Jesus (2009) [31], which shows that one of the main causes of drug use in Brazil is the influence that drug advertisements have on the population, causing people to buy medicines without consulting a health professional. In consonance Fanhani (2006) [3] reports that drug advertisements are one of the factors that contribute to the use of drugs without a prescription.

IV. CONCLUSION

Through the results of this research, it was possible to notice that in the community of Vila Iris neighborhood, Gurupi municipality - TO, there is, yes, waste of medicines. Although most of the drugs present in the researched houses were acquired by medical indication, the possibility of irrational use of medications is not ruled out, mainly due to a lack of adequate guidance. At the heart of this work, it was understood that the full-time presence of a pharmaceutical professional in the health center of the region in question is of great relevance, as it will provide the local community with quality care concerning dispensing medicines. In summary, the presence of a pharmaceutical professional at the health center will provide effective pharmacotherapy to the patient.

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Selenium as a Free Tool to Test for Java Web Application

João Paulo Renovato dos Santos¹, Katia Petrolina da Silva², Bruno Pereira Gonçalves³, Jaqueline Silva de Souza Pinheiro⁴, Jean Mark Lobo de Oliveira⁵, David Barbosa de Alencar⁶

^{1,2,3,4,5}Academic department, University Center FAMETRO, Manaus-AM, Brazil
 ⁶Research department, Institute of Technology and Education Galileo of Amazon – ITEGAM, Manaus-AM, Brazil

Abstract— The objective of this article was to present the Selenium tool in conjunction with the Java Web program language and the need to use automated tests to ensure a system (software) of quality and reliability, thereby preventing occasional failures, extra expenses, loss of reputation commercial, among other annoying. Nowadays it is still very common for companies to carry out the testing of their systems manually and this can cause numerous problems for companies and customers, who may come to deposit personal information on the website, especially e-commerce systems that in addition of personal information, they also tend to take advantage of addresses and the various forms of online financial transactions. The tests performed in an automated way are faster than manual tests and this tends to decrease the delivery delay of the projects, besides making it easier for the tests to be carried out during the development of the system, thereby reducing the problems that may occur before version which will be made available to the customer or end user.

Keywords— Selenium; Java Web; Software; Tests; Automated Tests; Manual Tests.

I. INTRODUCTION

Software is part of our routine, basically everything today needs a system, from a simple algorithm to a complex system. With all this growth, the user tends to be more careful with the software used. If a system or app lacks quality, it can generate financial losses, time and can even hurt the business reputation. They need to provide the correct data, maintaining its stability, robustness and usability. This becomes complicated when companies need to create complex and interconnected systems in a short time and at a low cost. The tests often do not occur in the correct way, which can cause failures, bugs in the production environment, or even fail to meet the expectations of stakeholders in the project. Thus, bringing a long delay in the final delivery of the project.

There are several mistakes in software development, one of which is just to run the software and look for errors, although it is not only that, it involves other activities such as: planning, analysis, modeling and implementation in a test environment. Following the strategy of being involved since the beginning of the project and development and of knowing the right moment to carry out a manual or automated test, there will be several benefits in terms of saving time and money, regarding gains in the quality of the project.

If a user accesses a shopping website and it is not secure, the customer will be frustrated and may withdraw from the purchase or buy from a competitor. The solution is to show the steps for the developer to follow and produce the system that meets the design quality standards and user requirements. Making the site fluid, without errors or flaws and making a site safe and easy to make purchases..

II. BIBLIOGRAPHIC REFERENCE

2.1 Java market on the web

With regard to the current market, there is no doubt that Java WEB is the one that contains the greatest possibilities of performance. And it is not for nothing that Java has this fame, the projects developed in it bring greater independence, thereby avoiding the need for another supplier, that is, vendor lock-in. Better said, the company becomes more autonomous from other software, such as: the database, the developer of its virtual machine (Virtual Machine) and the servlet container. In addition, Java allows development to be done on one operating system and implementation (deploy) to be performed on another operating system.

Even though it is popular in the WEB area, for the development of Java software it is also essential to have a certain knowledge of servlet APIs and JSP, regardless of whether the development team wants to make use of: VRaptor, JSF, Struts, in addition to other Frameworks. In addition, in order to understand the problems that may occur in your application, knowledge of session, cookies and HTTP is essential.

2.2 Software tests

Software tests are methods associated with the development of a project (software), which has the function of locating errors in the software, reporting errors and analyzing whether they have already been solved, with that the final product will have a higher quality.

2.2.1 The importance

The importance of software testing is in preserving the quality of the software. Ensuring that the software has all the requirements requested by the customer. However, quality control is only one of a number of areas that software testing covers.

They are utilities that help to reduce financial expenses and bring greater reliability to customers, so it is common for companies to use software testing to safeguard reputation, as companies that develop low quality systems tend to be frowned upon in the Marketplace. With software testing, future expenses can be avoided by analyzing Croatian errors in the system. Because when a defect is found in the test phase, it can be up to 100 times cheaper to correct compared to the same error in the production phase.

2.3 Selenium

Selenium is a framework made available for free that focuses on testing web applications by the browser (browser) automatically, compressing tests for web purposes and its compliance with browsers allows it to work on different systems. It operates with a kit of resources and libraries used in the automation of browsers for the purpose of administrative repetition actions on websites and for testing actions. The set of tools that Selenium makes it possible to follow numerous tests focusing on various types of utilities in WEB applications, in this way versatile actions such as the location of elements of the customer interface and the comparison of these elements with the expected results. possible to have real conjectures of the application procedures. Selenium has support for other programming languages besides Java, such as: CSharp, JavaScript, Php, Perl, Python and Ruby. In addition to supporting your actions for different browsers on different platforms.

III. MATERIALS AND METHODS

In this article we use the Selenium test tool for Java Web, to do the acceptance tests of the application. In each update launched of a web application there is a range of features that need to be tested numerous times. These tests take a lot of time and generate a lot of rework. That is why it is necessary to use a testing tool like Selenium, to streamline the testing process.



Fig. 1: Selenium logo.

Source: Selenium dev official website

Selenium is a free and open source tool that performs automated testing of an application. No longer has necessary to perform repetitive tested done by humans, this exhaustive work will be done by Selenium.



Fig. 2: Process of using Seleium with the Navigator. Source: own authorship.

Selenium simulates user behavior using a browser. When we use it, we need two tools: Selenium IDE and Selenium WebDriver.

The Selenium IDE allows a quick creation of test scripts, it allows to record the user's behavior in the application, we can know the page accessed, texts typed in the inputs, click on buttons and etc.

Selenium WebDriver provides the API to perform tests with greater productivity in an agile way. This is the natural choice when we want to do automated tests for web development.

It makes calls directly in the browser using each browser's native engine. That is why the tests with it are quite realistic, because instead of using a JavaScript engine itself, it is used by the browser itself. It supports most browsers on the market, such as: Opera, Mozilla, Chrome, Safari, among others. Use Selenium Web Driver

We will see use in a Java Web application.

3.1 Initial setting

To perform tests on Selenium, first of all it is necessary to add the dependency of the Selenium Web Driver to your application. Using Maven, which is a dependency manager most used in Java applications, just add the artifact to your pom.xm. As in the image below:

<depender< th=""><th>cy></th></depender<>	cy>
<grou< td=""><td>pId>org.seleniumhq.selenium</td></grou<>	pId>org.seleniumhq.selenium
<arti< td=""><td><pre>factId>selenium-java</pre></td></arti<>	<pre>factId>selenium-java</pre>
<vers< td=""><td>ion>3.4.0</td></vers<>	ion>3.4.0
<scop< td=""><td>e>test</td></scop<>	e>test
<td>ncy></td>	ncy>

Fig. 3: Added dependency on the application using Maven.

Source: Authors, 2020.

By placing this library in your project, Selenium is ready for use. There are several implementations of interfaces for use, we can use one of them for our applications and start the tests.

A common use of Selenium is to fill out a form and submit it on a web page. Let's take an example to understand it better.



Fig. 4: Form where the test will be performed.

Source: post office website.

We will need to fill three fields, the UF, Localities and Bairro. After that click on the search button.

3.2 How to fill data with Selenium

First of all, we need to know the HTML codes, because we are conducting tests for WEB. And before getting to know Selenium, you have to have a web development base, because we need to know the TAGS of a web document.

We want to fill a select, our UF. Two text fields, which are our Locality and Neighborhood inputs. After that click on submit to submit the form. UF: tag select (creates a combo with options) with the name = "UF" attribute

Locality: input tag with name = "Locality attribute

Neighborhood: input tag with name = "Neighborhood" attribute

"Search" button: input tag with the attribute type = "Submit" (Creates a button to submit the form).

3.3 We will perform the following steps:

1. Enter the post office page; 2. Fill in the fields; 3. Click the search button; 4. View the search result

<pre>BTest public void preencheFormularioCorreiosBuscaLogradcuroPorBairro() {</pre>
<pre>// Escolhe o valor de UF Select selectUF = new Select(driver.findElement(By.name("UF"))); selectUF.selectByVisible(ext("K""); // Preeache a Localidade com o valor "Rio de Janeiro" WebElement inputOcalidade = driver.findElement(By.name("Localidade")); inputLocalidade.sendKeys("Mio de Janeiro"); // Preeache o campo Bairro com o valor "Copacabana" // Preeache o campo Bairro com o valor "Copacabana" WebElement inputBairro = driver.findElement(By.name("Bairro")); inputBairro.sendKeys("Copacabana");</pre>
<pre>// clica no botão Buscar WebElement buttonBuscar = driver.findElement(By.cssSelector("input[type='submit'")); buttonBuscar.click(); }</pre>

Fig. 5: Test script to fill out fields on the post office website.

Source: The Authors, 2020.

When running the test, the Browser is automatically opened, the fields are filled and the search is performed.

With automated tests it is not necessary to keep filling fields and submitting forms manually. Just create an automated script to do all of that. The test case we performed was a basic test. But more advanced scripts can be created, to perform performance tests and systems invasion.



Fig. 6: Selenium test cycle.

Source: selenium. dev official website.

This is the test cycle of Selenium; it is possible to perform complete tests of your application. It is not just used to test interfaces. Tests of business rule, usability, database, system functionalities etc. can be performed.

With it is possible to carry out tests on applications written in other programming languages, in addition to Java. It is a complete tool for performing automated software testing.

IV. RESULTS AND DISCUSSION

An exploratory research was carried out to identify what users think of the software they work with on a daily basis, and together with this research, we visited the UEA development pole, where we interviewed some developers about the tests carried out at the pole of its developed programs.



Fig. 7: There is no Software tester. Source: The Authors, 2020.

We see that 80% of companies do not have a software tester. This means that many companies do not bother to test their company.



Fig. 8: Software tested in Development. Source: The Authors, 2020.

We see that 83.3% test the software in the course of development. This generates tests during the entire development process, but it is necessary to make a final test to evaluate the possible errors that may be present in the software.





Source: The Authors, 2020.

We see that 80% think that the software must be tested rigorously. Tests are essential to ensure the quality of the software, and to ensure that the user does not suffer from possible system failures.



Fig. 10: Software standardization.

Source: The Authors, 2020.

We see that 80% standardize the tests depending on the characteristic of the system. Depending on the system the test will be done in a way, you need to evaluate the language, the framework you are using to perform your tests.



Fig. 11: How the Software test is done.

Source: The Authors, 2020.

We see that 60% perform the tests manually. This is the old way of doing tests, today the tests are automated, avoiding the repetitive work of the tester, who can miss countless failures.



Fig. 12: Identifying faults. Source: The Authors, 2020.

Most users of the survey, accounting for 80%, said they can identify flaws in the websites they access.



Fig. 13: Software purchase.

Source: The Authors, 2020.

If there was a failure on the site 40% of users answered that they would buy on a competitor site. This is worrying for those who have an e-commerce, with possible failures will result in the loss of future customers.

V. CONCLUSION

It can be concluded from this article that there is an increase in the quality of software, due to the users who are becoming more careful. The lack of quality and stability of a system can result in great losses. With this, the need arises to guarantee that the final user experience is satisfactory and for that, it is necessary tools that can cover the project.

Java for Web is one of the best options for the current market, as its structure allows the system not to depend on third parties, thereby avoiding the vendor lock-in, however the entire project is, regardless of the facilities that the programming language offers, is subject to failures that affect the final product. With that said tools that can identify these errors are also necessary for the quality of the software, in this situation comes the Selenium framework. The saying whose objective is both tests and repetition tasks on sites with support for different platforms.

ACKNOWLEDGEMENTS

I thank God first for keeping me on the right track during this research project with health and strength to reach the end.

We are grateful to our family for the support they have always given us throughout our lives.

We would like to thank our advisor for the encouragement and dedication of his limited time to my research project.

We also thank the University Center FAMETRO and all the teachers of the course for the high quality of the education offered.

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Outlook of Renewable Energy (Wind Energy) in China

Waled Yahya¹, Kou Ziming², Wu Juan³

¹College of Mechanical and Vehicle Engineering, Taiyuan of University of Technology, Taiyuan, China ^{2,3}Shanxi Province Engineering Technology Research Center for Mine Fluid Control, Taiyuan, China

Abstract— China's rapidly growing economy, population, and energy consumption are all threatening its future environmental sustainability. China faces many ecological challenges, and its reliance on coal is at the heart of most of the country's ecological troubles. Most of China's air pollution emissions come from the industrial and electricity sectors, and the human health costs of China's air pollution are very high. China is the largest global polluter, with more than 25 per cent of total global carbon dioxide (CO2) emissions, green development could help mitigate climate change and enhance global welfare. Over the past decades, the demand for energy sources has increased by 150% in China, which has made China among the most energy-consuming countries. Most of China's energy consumption comes from coal energy, which accounts for about 78% of all energy sources in China in 2011. China is one of the world's largest wind energy sources, according to data released by the World Wind Energy Association (WWEA), with about 34% of the world's wind energy sources. According to the road map implemented by the Chinese government by exploiting and generating wind energy sources and benefiting from the rapid economic development that China witnessed late, according to this plan by 2020, China is expected to produce about 250 gigawatts (GW). By 2030, production may reach 400 GW of electrical energy generated from wind energy, and by 2050, production may reach 1,000 GW.

Keywords— Energy consumption, carbon dioxide (CO2), wind energy, World Wind Energy Association (WWEA).

I. INTRODUCTION

China's science and technology priorities in the energy sector have changed over time with evolving domestic energy needs. The decade that preceded period between (2000-2010) brought new challenges to the relationship between energy consumption, emissions, and economic growth in China. By 2007, China was the most significant national emitter of CO2 in the world, and by 2010, China became the world's largest energy consumer and producer. Over the past years, China has witnessed significant economic development, with an average annual rate of about 10% of GDP, which has increased the demand for access to new energy sources[1]. Recently, fossil fuels are the primary source of energy consumption in China, and this affects the strategy that China adopts by exploiting renewable energy sources, as well as from environmental pollution while extracting coal from the ground. The pollution problem in China is one of the most important challenges facing the Chinese government, which seeks to reduce environmental pollution of all kinds, such as air pollution, or water and soil pollution. The pollution problem in China is one of the most critical challenges facing the Chinese government, which seeks to reduce the environmental pollution of all kinds, such as air pollution, or water and soil pollution, and caused by several factors, the most important of which are carbon dioxide pollution from factories and pollution resulting from congestion, traffic and transportation [2,3].

China is the world leader in wind power generation, with the largest installed capacity of any country [4]. And the rapid growth in new wind facilities [5]. With its vast land area and long coast, China possesses exceptional wind energy resources [6]. Some estimates indicate that China has about1000 GW of electrical energy that wind turbines can produce onshore and 200 GW of electrical power offshore[7].In 2016, China produced about 149 watts of electrical energy created by wind power, 4% of total electricity consumption throughout China[8].In 2015, China was the second-largest market for the production of electric energy generated from wind energy after the

United States with a production capacity of about 7404 GW[9]. By 2020, China's wind power production is expected to reach 250 GW, an increase of about 15% of the total electricity consumed in China[10]. The Chinese government has developed a roadmap for wind energy until 2050. Wind energy targets reach 400 GW by 2030 and 1,000 GW by 2050 [11]. China has identified wind energy as a significant component of growth in the country's economy [12].

RENEWABLE ENERGY IN CHINA.

Recently, the Chinese government has taken several measures to reduce pollution from traditional energy sources such as fossil fuels, as well as the cost resulting from the production of these energy sources and the search for a new, inexpensive, environmentally friendly source. Therefore, the Chinese government must take many measures to advance and develop in this field to provide and produce alternative energy. China ranks first in the rankings of the most available countries for renewable energy, so the government should take advantage of these potentials available in China and take advantage of them. China produced about 728 GW of renewable energy for both wind energy and hydro-power by the end of 2018. Compared to fossil fuel production and nuclear power capacity, renewable energy is growing faster in China. Although vast amounts of renewable energy are available such as solar energy, wind energy and water, the total renewable energy produced in China in 2015 was 24%, and the rest is electrical energy produced is produced by coal power plants [13]. By 2017, hydro-power production reached about 36.6% of the total renewable energy and 26.4% of the total electric energy in China [14]. By 2013, the Chinese government has developed a plan to increase the work of electrical energy production by renewable energy to reduce carbon dioxide emissions and environmental pollution that adversely affects the healthy life of the country and the citizen [15,16]. China currently aims to install 250 (GW) of wind and 50GW of solar photovoltaic by 2020 (see Table 1). In addition, it appears likely that China will implement renewable power quotas for major generators and grid companies, formulated as the percentage of total generation coming from nonhydropower renewable energy [17].

Table.1: China's targets for renewable energy development
through 2020. Sources: REN21 (2012), NEA (2012),
NDRC (2012), State Council (2013).

The capacity of Renewable energy targets (G.W.)	2012	2015	2020
WIND (G.W.)	6.2	104	250
Solar Pv (GW)	13.1	35	50
Biomass (GW)	4.4	13	30



The Pie chart. 1: shows the percentage of total renewable energy in China, according to the China Electricity Council in 2014 [18].

THE HISTORY OF WIND ENERGY IN CHINA.

In 1994, one of the first specific wind energy was introduced to the sources of energy in China, according to the decisions of the Ministry of Electrical Energy (MOEP). Where the estimated rate of increase is one hundred times, where the proportion of wind energy in 1993 was about 10 M.W. to 1000 MW in 2000. With the passage of days, wind power witnessed an unprecedented development, and at the beginning of 2005 the accumulated wind energy production exceeded only 769 MW. In the same year, China ranked 10th in the world in wind power production. China's wind power industry has grown rapidly over the past decade. Since the first renewable energy law was passed in 2006, the cumulative installed capacity of wind energy has reached 44.7 GW by the end of 2010 [19]. The newly installed capacity in 2010 reached 18.9 GW which made up about 49.5% of new windmills around the world. China's wind potential is excellent, although estimates vary from different sources. According to him and others [20].

WIND ENERGY IN CHINA

Wind power is one of the renewable energy which becomes popular because of its availability in huge access. It can be used both small and large scale and also environmentally friendly power [21]. A wind turbine is classified into Horizontal Wind Turbine and Vertical Wind Turbine. wind power is renewable and very flexible. It can be used for various purposes including generating power, lighting in residential buildings, and water pumping for irrigation. Wind energy can be used or constructed everywhere, both in the rural areas, mountains, and plateaus or even in the sea and is also low-cost and environmentally friendly energy sources for communities in rural areas as shown in figure 1.



Fig. 1: shows wind turbines to urban areas.

Due to the safety of the network and the lack of available transmission lines By national standards between 2010 and 2016, the overall wind energy rejection rate in China exceeded 10%. In mid-2016, the problem of rejecting wind energy became more acute in China [22].

The total wind energy in the world is around 343,586 GW, as shown in the following graph that shows the top ten wind power countries according to data issued by the World Wind Energy Association (WWE) until the end of 2015, where China ranks first among These are the ten countries, where China can produce wind energy around

148 GW of total wind power by up to 34.03% of the total wind energy in the world.



Pie chart . 2: shows the ten countries with the most significant wind energy in the world, according to the World Wind Energy Association (WWEA) at the end of 2015[23].



Fig. 2: Wind Power Capacity and Additions, Top 10 Countries, 2018 Source: See endnote 22 for this section [24].

From the bar chart that show the top ten countries for wind power capacity and additions. China in 2018 became the first country to exceed 200 GW of wind power capacity and saw an increase in new installations (up 7.5%) following two years of decline.23 Approximately 21.1 GW was added (19.5 GW onshore and nearly 1.7 GW offshore), bringing total installed capacity to approximately 210 GW [24].



The pie chart . 3: shows the ratio of the total capacity of wind energy in various provinces of China, according to the National Administration of China [25]

From the pie chart that shows the ratio of the total capacity of wind energy in various provinces of China. For the full size of wind energy, the first rank is Xinjiang, that has 12.46 %, and the second rank is West Inner Mongolia, that has 11.74%. the third rank is Gansu, that has 9.68%, from the information . the Xinjiang that have the most of the total capacity of wind energy in China.



Fig. 3: Wind farm in Xinjiang, China OFFSHORE WIND TURBINE IN CHINA

China set an ambitious goal of 5 G.W. of installed offshore wind capacity by 2015 and 30 G.W. by 2020. However, the development of offshore wind power did not come as fast as expected. Construction of Donghai Bridge Wind Farm, the first offshore wind farm in China started in April 2009, In May 2014, the total capacity of offshore wind power in China was 565 MW, which raised to about 900 MW in 2015, less than a fifth of the expected target.

Installations increased substantially in 2016, with 592 MW of offshore wind power capacity deployed, ranking third in the world behind Germany and the Netherlands. By the end of 2016, the total cumulative offshore wind power capacity in the country was 1.9 GW.

Offshore wind development slower pace in China is mainly due to the lack of experience of domestic turbine manufacturers in the sector. This forces local development to use different products, resulting in Siemens being the largest supplier of offshore wind turbines in China. Another problem is the considerable investment needed and associated risks of offshore development, which discourage private companies.



Fig. 4: Dong Hai Bridge Wind Farm.

II. CONCLUSION

China is one of the countries with the most common air pollution problems that affect life in China. Because of global warming, environmental issue, and reducing fossil energy resources, the use of environmentally friendly energy resources, such as solar and wind power, becomes even more urgent and attractive.Wind energy is one of the most important renewable energy that can be utilized in China, as China is one of the largest countries in the capacity of wind energy, with a rate of about 34% of the total wind energy capacity. According to the road map implemented by the Chinese government by exploiting and generating wind energy sources and taking advantage of the rapid economic development that China experienced late, according to this plan by 2020, China is expected to produce about 250 GW. By 2030, production may reach 400 GW of electrical energy generated from wind energy, and by 2050, production may reach 1,000 GW.

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Co-occurrence of Economic, Political and Environmental Factors in the Perception of Social Groups in the Municipality of Uberlândia (Minas Gerais, Brazil) About Notified Cases of Dengue

Fabrício Pelizer Almeida¹, Rogério Gonçalves Lacerda de Gouveia², Moisés Keniel Guilherme de Lima³, Flávia Alice Borges Soares Ribeiro³, Jaínne Pereira Mendonça⁴, Jéssica do Nascimento Oliveira⁵

²Master in Agronomic Engineering. Professor of Environmental Engineering. Institute of Technology, University of Uberaba (Uniube), Brazil

³Master in Civil Engineering. Professor of Environmental Engineering. Institute of Technology, University of Uberaba (Uniube), Brazil ⁴Undergraduate in Environmental Engineering. University of Uberaba, Brazil

⁵Undergraduate in Production Engineering. University of Uberaba, Brazil

Abstract— The present study evaluated the perception of the urban population of Uberlândia/MG regarding the occurrence of notified dengue cases. A script of questions was developed that combined social, environmental, political and economic variables, which could explain, in the perception of the research participants, the current dengue scenario in the municipality. 384 randomized individuals living in the municipality were interviewed, from may to august 2019, through the survey of qualitative and quantitative data. The data obtained could compose a qualitative and quantitative model of NLR (Nominal Logistic Regression) that relates a set of predictors and a nominal response, and a set of co-occurrence maps of qualitative variables. The quantitative results showed that the female group correlates highly, significantly the set of variables determined in the research. In the outputs of maps of the qualitative models, the opposite decision of the preference preference groups (weak, moderate, good and high) was evident. Individuals who reported weak correlation of the proposed variables in determining the occurrence of notified cases of dengue showed a greater correlation between the codes "society" and "policies and local economy", attributing greater responsibility to the role of municipal public management in this scenario. The high and good correlation groups showed greater concern with environmental aspects, mainly regarding the issue of waste and urban pollutants. Therefore, it is concluded that in the quantitative model, there was a different pattern of responses, significantly among individuals declared in the research. And in relation to the quantitative data, the opposite decision of the preference response groups was evident. The role of the municipal public manager must consider the need for extension, inclusion and permanence of strategic actions in the areas most vulnerable to dengue in the municipality, given the fragility of health services and the scope of policies involving quality of life and environmental education.

Keywords— environmental health. qualitative modeling. social research.

I. INTRODUCTION

Global climate issues have been the scope of

coincident reflections on the quality of life of urban and rural populations, sustainable development and socio-

¹PhD in Environmental Planning and Management. Professor of Environmental Engineering Course. Institute of Technology, University of Uberaba (Uniube).

environmental vulnerability of communities. Despite being treated on divergent spatial scales, there is an almost unanimous understanding that global climate change due to anthropogenic causes precede profound changes in the dynamics of mobility and space organization of large cities and in the current model of food production and runoff(CONFALONIERI et al, 2007; EBI, 2011).

Almost irreversible effects on society are related to the prevalence of serious diseases and epidemics and difficult to manage and control by municipal public agents, especially when associated with the challenges posed by deteriorating conditions access to clean water and basic sanitation(McMICHAEL et al, 2004; EBI, 2011).

The works of Patz et al. (2007); Costello et al. (2011); Ebi (2011) associate the challenges related to people's health and quality of life, as opposed to the expansion of industrial activities and growth of urban conglomerates. In common, they associate the excessive and distorted model of consumption of urban space by local society, as part responsible for the increase in the activity of greenhouse gases and atmospheric thermal stress in urban areas, resulting in the worsening in the seasonal pattern and worsening of the pathogenicity of diseases.

For Shuman (2011), the burden of adverse effects on public health in vulnerable communities in developing countries is precisely due to the fragility of basic sanitation programs, drinking water services and better environmental conditions for proliferation of vector insects. McMichael et al., (2006); Patz et al. (2007), state that frequent changes in natural ecosystems can increase the prevalence of reservoir vectors and hosts, which when combined with decreased resistance of the human host, promote the occurrence of epidemics such as dengue. These effects related to sudden climate change are evident in conditions of social vulnerability, when they promote the overload of local health systems, and highlight the lack of a public governance model for the climate management of cities.

In Frumkin et al. (2008) give relative importance to monitoring integrity status to identify and solve local community health problems, the ability to inform, educate and empower people about health problems and assessment of the effectiveness, accessibility and quality of health services as important pillars to ensure minimum public health conditions in response to severe climate setbacks.

In the sense, Woodcock et al., (2009); Haines, (2012); Bouzid et al., (2013) there are relevant contributions from the low-carbon economy translated into promoting the environmental health of cities, focusing on the maintenance of urban green areas, combined with

efficient mobility and public transport programs are coherent responses to the constant deterioration of urban microclimate and people's quality of life.

Therefore, multidisciplinary vector control programs and a set of community interventions aimed at dengue control are needed, appropriate to the wide variety of ecological and social environments, including: communication campaigns, educational initiatives, behavior change, biological control efforts and integrated control projects (STEWART-IBARRA et al, 2019).

Behavioral changes can help reduce infestation of household containers if individual community practices are properly targeted. For Kabir et al. (2016) the best experiences based on the perception of local communities in tropical regions regarding the worsening epidemiological risks associated with climate events are aligned with the mobilization networks and social organizations, efficiency in the implementation of public policies aimed at educating and reaching families. It is necessary to establish a new paradigm of relationship between government institutions and individuals, and that epidemiological programs be developed based on the local sanitation structure. In short, programs should incorporate epidemiological surveillance, community participation, environmental management and basic public services, permanent case monitoring, education and control, and effective vector training.

Ebi (2011) proposes stakeholder engagement as one of the bases for adaptive management of public health risks by referring to climate change. Stakeholders, according to the author, include local, regional and national policymakers, as well as representatives of relevant public health programs and organizations aware of climate change and its effects on current and projected health risks. Preventive social perception of climate change by affected communities is essential for governments and society to build effective strategies and policies that minimize the consequences of associated epidemiological risks (LIM et al, 2004).

In fact, Stewart-Ibarra et al. (2019) rightly highlights the importance of considering the ways of perception and association of climate events and alteration of the urban environment by the local community as an active response to behavior change and engagement in strategic actions for epidemic control and monitoring, specifically in urban centers of tropical climate regions. Guiding clear and objective information on how climate can influence dengue cases would increase public acceptability and improve community response in a climate-based alert monitoring program (ZAKI et al, 2019).

Therefore, it is essential to understand how socially vulnerable populations understand and act as part of the dynamics of the social fabric in the environment in which they live (BOLLYKY et al, 2015). It should also reflect its interlocution between health, society and the environment, recognizing local environmental risks and problems, as well as their notions of self-care and socioenvironmental impact. For Lermen and Fisher (2010), these premises are met, attitudes can be taken that effectively improve the quality of life of these people, because public health should be seen and discussed horizontally, recognizing the particularities of each population and adapting to them.

In this sense, and in a contributory way, this work aims to evaluate the qualitative and quantitative aspects about the perception of urban social groups in the city of Uberlândia/MG, about the occurrence of notified cases of dengue, based on a combinatorial model of social, environmental, political and economic variables.

II. METHODOLOGY

1. Characterization of the Study Area

The municipality of Uberlândia (Figure 1) is located in the Mesoregion of triângulo mineiro and alto paranaíba, State of Minas Gerais, in the Southeastern Region of Brazil. The geographic coordinates, referenced in the water box tower of block II of the Virgilio Galassi administrative center, are of latitude 18°54'41,09582"S and longitude 48°15'21,63093"W, and altitude 864.80 meters. The municipality is included in the territory covered by the hydrographic basins of the Araguari and Tijuco rivers, and the predominant climate is the semihumid tropical, with the occurrence of dry winters and hot and humid summers (UBERLÂNDIA, 2016).



Fig.1: Location of the Triângulo Mineiro (I), the Municipality of Uberlândia (II) and the Headquarters District in the Municipality of Uberlândia (III) in the State of Minas Gerais.

Source: Lima (2017).

According to IBGEDATA (2010), between 2000 and 2010, the total population of the municipality of Uberlândia grew 20.5%, while in the same period, there was a population growth of 2232.8 hab*km⁻², to 2706.2 habitant*km⁻² in 2010.

2. Planning and Data Modeling

The study is supported by a qualitative and quantitative spatial survey, structured from an interview form, applied to individuals living in the city of Uberlândia, Minas Gerais, aged over 18 years old. The sample of volunteer participants was estimated using a generic function described in Gil (2009), according to equation 1:

$$n = \frac{(N*1/e^2)}{(N+1/e^2)}$$
 (eq. 1)

where *n* is the sample size; *N* is the population size and e^2 is the maximum error (5%). In the research, 384 possible questionnaires were considered and sent at random by electronic mail in a form template, during the period from may to august 2019, using random contact lists and data from residents in the municipality.

The form was divided into four sections, with

limited quantitative data being obtained in the first, second and third sections, while qualitative data were tabulated in the fourth section. The first section consists of 5 questions of socioeconomic characterization of the individual *–sex*, *age group, monthly family income* (in number of minimum wages), *education level* (regardless of whether completed or not) and *neighborhood in which he lives in the urban area of the municipality of Uberlândia* (spontaneously described and later organized by residential area) – asdescribed in Table1.

 Table 1:Terminologies used for each item of socioeconomic characterization of the individuals participating in the research regarding the socio-environmental perception about the occurrence of dengue in the city of Uberlândia/MG.

Section	Interview of Variables	Grades		
	Sex	1 (female); 2 (male);		
		1 (young people, 18-25 years old);		
	Age ¹	2 (young adults, 26-40 years old);		
		3 (adults, 41-60 years old);		
		4 (elderly, > 60 years old).		
^a Section	Family Monthly Income ²	1 (\leq 2 minimum wages);		
		2 (from 3 to 4 minimum wages);		
		3 (from 5 to 10 minimum wages);		
		4 (from 11 to 20 minimum wages);		
		5 $(\geq 21 \text{ minimum wages})^4$.		
	Schooling ²	1 (elementary school); 2 (high school); 3		
	g	(graduate); 4 (postgraduate).		
	Residential Zone ³	1 (Central Z.); 2 (East Z.); 3 (North Z.); 4 (West Z.); 5 (South Z.).		

¹According to Botti (2010). ² According to IBGE methodology (2010). ³The smallest numerical value is the most central zone or neighborhood of the municipality and increases east-north and west-south, due to the greater connection and urban road mobility. ⁴ No interviewee indicated in the alternative ≥ 20 m.w. in survey.

The second section, consisting of 11 multiplechoice questions, addressed environmental perceptions, addressing the relationships and associations between the growth in the number of properties, industrial activity, basic sanitation service, management of green areas and current climatic conditions, in the case record dengue fever, according to the individual's perception. A discrete scale of "0" (when the participant does not recognize the relationship between the variables described in the question) was assigned up to the limit of "3" (when the participant recognizes a high relationship between the variables proposed in the question), as described in Table 2.

A table of the sum of the discrete responses per participant was proposed, obtaining a score between "3" (lowest possible combination between responses per participant) and "33" (highest possible combination between responses per participant). For the purpose of analyzing the scores, 4 groups were established - week, moderate, good, high - using the minimum, maximum, first and third quartiles limits and the median of continuous data (Table 2). The scores are described in Table 3.

Table 2:Descriptive statistics of the sum of discrete responses (N = 384 forms) regarding the socio-environmental perceptionof individuals participating in the research about the occurrence of dengue in the city of Uberlândia / MG.

Variable	Ν	Average	Minimum	1st Q	Median	3rd Q	Maximum
Scores	384	23,622	3,000	20,000	25,000	29,000	33,000

Table 3: Questions and scores adopted in the research and associated with aspects of social and environmental perception	on
related to the occurrence of dengue in the city of Uberlândia/MG.	

Section	Questions about aspects of social and environmental perception	Grades
	1. The growth in the number of properties, shopping centers and urban infrastructure in Uberlândia affects variations in temperature, humidity, and in the periods and volume of rainfall recorded in the city.	
	2. The industrial activity in Uberlândia affects the variations in temperature, air humidity and in the periods and volume of rainfall recorded in the city.	
	3. The water harvesting service for supply of the population of Uberlândia affects variations in temperature, air humidity and periods and volume of rains recorded in the city.	
	4. Treatment given to urban sewage affects variations in temperature, air humidity and periods and volume of rains recorded in the city.	0 (does not affect);
	5. The amount and current circulation of the fleet of vehicles in Uberlândia affect the variations in temperature, air humidity and periods and volume of rainfall recorded in the city itself.	1 (affects a little);
	6. The current management of parks, squares and urban green areas in Uberlândia affects variations in temperature, air humidity and periods and volume of rainfall recorded in the city.	2 (affect);
tion	7. Industrial activity in Uberlândia affects air quality in the city.	3 (greatly affects)
2ª Sect	8. The current quantity and circulation of the vehicle fleet in Uberlândia affects air quality in the city.	
	9. The type, volume and treatment given to urban solid waste generated in Uberlândia affect the environmental quality of the city.	
	10. The growth in the number of properties, shopping centers and urban infrastructure in Uberlândia affect the number of dengue cases registered in the city.	
	11. Variations in temperature, air humidity and rainfall periods in the city of Uberlândia are related to reported dengue case records.	
		1 (<i>weak</i> correlation, of scores from 3 to 20);
	Link on	2 (<i>moderate</i> correlation, of scores from 21 to 25);
	ілік-ир	3 (<i>good</i> correlation, of scores from 26 to 28);
		4 (<i>high</i> correlation, of scores from 29 to 33).

In the third section, the profile of the individuals' choice was drawn as to the correlation capacity between the social, economic and environmental factors addressed in the 11 research questions, with the response variable being the term "*link-up*". In this phase of the research, the use of the Nominal Logistic Regression (NLR) model allows the development of a model that relates a set of

predictors and a nominal response (HOSMER et al., 2013). Thus, the probabilities tested in the logit model are described for the first response group, as described in equation 2:

$$P_r(y_i = 1 | x_i) = P_{i1} = \frac{1}{1 + \exp(x_i'\beta_2) + \exp(x_i'\beta_3) + \exp(x_i'\beta_4)}$$
(eq.
2)

and assumes generic notation for the other groups, where k = 4 (number of response categories), as described in equation 3:

$$P_r(y_i = k | x_i) = P_{in} = \frac{\exp(x'_i \beta_n)}{1 + \exp(x'_i \beta_k) + \exp(x'_i \beta_{k+1}) + \exp(x'_i \beta_{k+2})} (eq.3)$$

Therefore, two logit functions with k response categories are obtained, being (k = 4, weak, moderate, good, high), corresponding to three logit models of estimated differences in chances (*high-weak; high-moderate; high-good*), described in equation 4.

$$g_k(\mathbf{x}) = em\left(\frac{\pi_k(\mathbf{x})}{\pi_k(\mathbf{x})}\right) = \theta_k + \mathbf{x}\mathbf{b}_k \text{ (eq. 4)}$$

where, $g_k(\mathbf{x})$ is the logit link function, θ_k , the constant associated with the kth different response category, \mathbf{x}_k the

vector of the predictor variables, and \boldsymbol{b}_k the vector of the coefficients associated with the kth logit function (HOSMER et al., 2013). To obtain the data output of the Nominal Logistic Regression (NLR) model, MINITAB v. 19

In the fourth and last section of the research, the participant was asked about the spontaneous opinion about the causes, impacts and urgency of the occurrence of dengue in the city of Uberlândia. In the case of an opinionated aspect, there was no character limit for filling in this field of the form, already with the aim of applying a qualitative study about the discourse. Therefore, opinions were coded in 3 axes and subdivided into 3 subcodes each, totaling 9 coding possibilities(Table 4).

Table 4: Axes of coding and subcoding of the interviewees' opinions about the social, economic and environmental aspects
that explain the occurrence of notified dengue cases in the city of Uberlândia/MG.

Code	Subcode			
society	socioeconomic inequality	public health and social assistance		
society	socioenvironmental education			
politics and local	local economic activity	planning and ordering of urban space		
economy	public management and governance			
environment	urban microclimate waste and pollutants			
	urban green area management			

The codes are related to the general association of the social, political-economic and environmental pillars and the individual perception about dengue, that is, when the individual spontaneously correlates the occurrence of the epidemic with some social, political-economic or environmental aspect. It is important to highlight that the subcode allows the code to be detailed, and reflects the individual's approach with greater clarity regarding his intention to correlate dengue with explanatory factors.

The free and dissertative opinions of the participants were treated as explanatory data and, therefore, could be intertwined with the other research items described in Tables 1 and 3. For this, a search engine was created throughout the text using keywords identical or approximate keys of codes and subcodes. In this way, it was possible to build several response composition and occurrence maps of hierarchical variables, combining qualitative data and mixed methods with the aid of the MAXQDA AnalyticsPro software (v. 18.2).

III. RESULTS AND DISCUSSION

The output of Nominal Logistic Regression

(NLR) proposes three comparative models of preference between the dependent variables (response) *-high-weak*; *high-moderate*; *high-good* – being the highest response parameter (*high correlation*) taken as a reference value. The predictors *age*, *family monthly income*, *schooling and residential zone* were not significant for the three models of comparative preference (Table 5).

The *sex variable* was significant in the three models, at 1% logit (1), 5% logit (2) and 10% logit (3) of significance. The probability of response between individuals declared in the survey *–womenand men–* is significantly higher, observing the extremes of responses in the survey *– weak and high correlation –* and preferably increases the response by high correlation in the sense of the female group. The estimated odds ratio for female preference between weak and high correlation is about four times higher than among men (Table 5).

In the other models logit (2) and logit (3), the odds ratio decreases among women in the sense of response to high correlation, but still significant (p <0.05; p <0.10, respectively). Within the female group, the preference for the high correlation between the socioenvironmental

aspects of the research in relation to the moderate and good condition, is 2.82 and 2.29 times higher than men, respectively. This important qualitative and quantitative observation of the research reinforces the significant difference of the female group, in terms of response and association of the public health problem with the other attributes that make up the urban environment.

Table 5:Results of Nominal Logistic Regression (NLR) for three logit models (weak/high, moderate/high, good/high) that associate the environmental preference for the occurrence of dengue and the socioeconomic variables in the city of Uberlândia, Minas Gerais state, Brazil.

Duadiatan	Coef. SE Coef.	SE Coof	Z	p-value	Odds	CI de 95%	
Predictor		SE COEL			ratio	Lower	Upper
Logit 1 [l(1)]: (weak/high)							
Intercept	-2,70413	1,36505	-1,98	0,048 **			
Sex	1,38808	0,446776	3,11	0,002 ***	4,01	1,67	9,62
Age	0,0739688	0,290168	0,25	0,799	1,08	0,61	1,90
Family Monthly Income	0,368693	0,259475	1,42	0,155	1,45	0,87	2,40
Schooling	-	0,302981	-0,01	0,993	1,00	0,55	1,81
	0,0027564						
Residential Zone	-0,108339	0,159923	-0,68	0,498	0,90	0,66	1,23
Logit 2 [l(2)]: (moderate/high)							
Intercept	-2,72566	1,46423	-1,86	0,063 *			
Sex	1,03596	0,483643	2,14	0,032 **	2,82	1,09	7,27
Age	0,0044417	0,315429	0,01	0,989	1,00	0,54	1,86
Family Monthly Income	-0,208349	0,281100	-0,74	0,459	0,81	0,47	1,41
Schooling	0,381943	0,334628	1,14	0,254	1,47	0,76	2,82
Residential Zone	0,0957496	0,174383	0,55	0,583	1,10	0,78	1,55
Logit 3 [l(3)]: (good/high)							
Intercept	-0,899890	1,36666	-0,66	0,510			
Sex	0,830146	0,458014	1,81	0,070 *	2,29	0,93	5,63
Age	0,0278781	0,296119	0,09	0,925	1,03	0,58	1,84
Family Monthly Income	- 0,0137107	0,271210	-0,05	0,960	0,99	0,58	1,68
Schooling	-0,182558	0,308969	-0,59	0,555	0,83	0,45	1,53
Residential Zone	0,0368106	0,167333	0,22	0,826	1,04	0,75	1,44

High (reference event). * significant coefficient at 10%, ** at 5% and *** at 1%. Likelihood log = -223,804. Test of all slopes equal to zero: df = 15; G = 24,407; [p-value = 0,058]. Fit Quality Tests (Pearson Method): Chi-square = 354,521; [p-value = 0,057].

In the qualitative analysis, the code map of the opinions of individuals including the variables sex, link-up (Figure 2a) reinforces the greater frequency of response associations among women and the probability of high correlation. Both the female and the male groups emphasize in their spontaneous opinions the need to change a behavioral posture in society, however the female group is able to include and approximate environmental factors as explanatory items to the occurrence of notified dengue cases. The participation of the male group predominates in most of the residential areas sampled in the survey, while the female group is better represented in the north, central and east areas (Figure 2b), corroborating the low impact of environmental perception due to the microregion of residence declared by the individual.



Fig.2: Map of codes hierarchized by frequency of the opinions of individuals identified by male and female groups, associated with the link-up (a) and the residential zones (b) in the city of Uberlândia/MG.

There is an intrinsic relationship between response preferences (weak, moderate, good and high) and the attribution to the code "society", reiterating that the responses converged the occurrence of dengue in the municipality to social responsibility. On a hierarchical level, the code "society" is more evident when the preferences of responses are interposed, than the codes "environment" and "politics and local economy". Only the weak preference directs responses to the "local economy and politics" and "society" codes, while the good and high preferences, in addition to greater proximity to the "environment" code, considers responses also shared with the other listed codes (Figure 3).



Fig.3: Map of codes hierarchized by frequency of the preferences of individuals associated with the link-up in the city of Uberlândia/MG.

The similarity of responses that strongly correlates the codes "society" and "policies and local economy", attributes the character of responsibility for the current model of ordering urban space and public health conditions

that affect mainly the most vulnerable locations to public management municipal. Figure 4 clarifies this aspect better, demonstrating the weak response mode in hierarchical evidence in relation to moderate, good and high, associating with the "socioenvironmental education" response pattern as an explanatory condition for the occurrence of dengue in the municipality and, sequentially attributing it to "Public management and governance" and

the "public health and social assistance" model adopted by the local government as responsible for the current disease scenario.



Fig.4: Map of codes and subcodes hierarchized by frequency of the preferences of individuals associated with the link-up in the city of Uberlândia/MG.

However, the associative reasoning of the high and good response preference can be quite diverse and amplified, considering environmental aspects such as the operation and management model of waste and pollutants, the maintenance and diversity policy of urban green areas and the variation urban microclimate as variants to the dengue scenario in the municipality, approaching the results discussed in Miranda et al (2013). From the hierarchical point of view of the qualitative model, these preferences differ from the group's response pattern that attributes weak correlation between the various variables questioned in the research.

The opposition of the associative reasoning of the preference preference groups (*weak, moderate, good and high*) reinforces the importance of environmental education as an instrument capable of discerning aspects of

citizenship, shared responsibility and a holistic, critical and integrated perception of the environment and the reality in which the individual is inserted, as discussed in Mongensen (1997); Jacobi (2003); Sauvé and Godmaire (2004); Pedreti (2014); Silva and Bertoldi (2016).

The effective participation and socioenvironmental engagement of individuals is evident in Figure 5. The profile of younger individuals (18 to 25 years old), with complete secondary education and income between 3-4 minimum wages make up the \neg good and high preferences most strongly. The weak preference is more strongly associated with individuals who claimed to have completed the undergraduate course, have a family income between 5-10 and 11-20 minimum wages, and that comprise the age group of 26 to 40 years.



Fig.5: Map of codes hierarchized by frequency of the preferences of individuals associated with the variables age, family monthly income and schooling in the city of Uberlândia/MG.

Although not evident in the answers to the qualitative research model, the response of individuals cannot be disregarded as part of the experience of living with the risk of infection by the insect vector, associated with the serious problems of public health care and the deterioration of urban ecosystem services (SUBARIS, et al., 2016; LADNER et al., 2017). It is a broader reflection: proposing the dialogue between environmental events, especially the issues involving the accumulation of urban waste in vacant lots, the variation of the local microclimate and the severity of air pollutants (Figure 4) and the occurrence of dengue in the municipality of Uberlândia.

It is also not possible to dissociate the duties of municipal public management and the worsening of dengue in the municipality. However, strategic actions are needed to reduce social and environmental asymmetries in the city. Therefore, it is essential to revise and modernize the Master Plan in order to enable structural improvements in the city, including regarding the viable planning of urban occupation.

In addition, greater proximity to the municipal public administration and peripheral neighborhoods, especially those with structural and housing deficits, is expected. Preventive care in risky places with advice from the local public health network and the extension of environmental services, translated into inclusion and improved quality of life in the most vulnerable areas are viable strategies for the care and economic treatment of dengue and other epidemiological challenges (BOLLYKY et al, 2015).

Finally, environmental education practices need to be constant (and not seasonal), combined with the modern learning methodology of young people and adults. They must be accompanied by a joint effort by society and public managers to instruct, invest and recognize improvement practices with local communities.

IV. CONCLUSION

The present study demonstrated in the quantitative model, a different pattern of responses, significantly between individuals declared in the research - women and men, with a preference for high correlation in the sense of the female group.

In the qualitative model, the opposite decision of the preference preference groups (weak, moderate, good and high) was evident. The weak correlation reports were connected to the codes "society" and "policies and local economy", attributing greater responsibility to the role of municipal public management in this scenario. They covered more clearly the profile of individuals aged between 26 and 40 years, undergraduate course and family income between 5-10 and 11-20 minimum wages. The high and good correlation groups have diversified the associative capacity between waste and pollutant management, the policy of maintaining and diversity of urban green areas and urban microclimate variation, and express more clearly the profile of younger individuals (18 to 25 years), with complete high school and income between 3-4 minimum wages.

There is a need for proximity to public management and society, with the formulation of inclusive policies that reach communities at greatest epidemiological risk

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Preparation of PANI Nanorods on C-ZIF-8 Seed Layer by UPED Method as Ultra-thin Elastic Electrode for Flexible Capacitor

Ayman Alameen¹, Huixin Zhang¹, Tongtong Jin², Xiaofan Fang², Xiao DU¹, Xuli Ma²

¹Department of Chemical Engineering, Taiyuan University of Technology, Taiyuan 030024, China ²Department of Environmental Science and Engineering, Taiyuan University of Technology, Taiyuan 030024, China

Abstract— Novel ultra-thin PANI nanorods were growth on the aspheric-shape C-ZIF-8 seed layer coated stainless steel wire mesh (SSWM) flexible substrate as an elastic electrode for the flexible capacitor. Synthesized by Unipolar Pulse Electrodeposition (UPED) method, the unique ultra-thin thickness of C-ZIF/PANI nanorods electrode (10 - 20 μ m) were capable of withstanding under critical flexes situation, due to losing the flexion strength as convergence or divergence between the aspheric-shape C-ZIF-8 particles. The morphology growth of PANI nanorods was significantly dependent on the anilinium micellar transformation, relatively long relaxation period (off-time), and the electrodeposit time and cycles numbers. UPED electrodeposition strategy preform to control the electrodeposition cycles and time. BET surface measurement, scanning electron microscopy SEM, X-ray diffraction, and FTIR spectra were measured to characterize the surface morphology of the elastic electrode. Besides, the phenomena role of UPED method in the fabrication process were discussed.

Keywords— PANI nanorods, C-ZIF-8/PANI composite, UPED Electrodeposition, flexible supercapacitor.

I. INTRODUCTION

To satisfying the fast-growing of the portable and wearable electronics market, simultaneously avoid the environmental pollution caused by the consumption of fossil fuels, as a widely used energy source, demand to develop environmentally-friendly flexible energy storage devices, with high energy and power density [1]. Supercapacitors (SCs) bridge the gaps between batteries and conventional capacitors in terms of the energy-power density [2], nowadays flexible capacitor is the strong candidate capable of bridging the gap in the portable and wearable application, in the term of flexible energy storage device, with the stable electrochemical performance [3-6]. But enormous drawback in the capacitance of the flexible capacitor occurs when flexion the electrochemical circuit or device, hindering the efficient applicable of the flexible SCs in the energy storage field [7], This primarily attributed to disintegrating the electrode materials effected by flexion the flexible supercapacitor circuit. Herein the research gaps motivate us to investigate the question of how to develop elastic electrode material capable to harmonically flexion compatible with the flexible substrate flexion? in order to avoid the obstacle of fragmentize the electrode active

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material, simultaneously maintain the same devise efficiency under the different flexion situation.

Carbon materials, metal oxides, and conducting polymers are the most reported appropriate electrode materials, due to the excellent electrochemical properties of those materials [8,9]. Meanwhile, the composite of those materials combines the individual characteristics of each material in the final produced composite, resulting in enhance the adequacy of the general electrochemical circuit [10]. Whoever the intrinsic aggregation of the particles constructing the whole composite is rigid, and applying any flexion strength to manipulate the electrochemical circuit, can quickly disintegrate the electrode surface-active materials [11], leading to a sharp decline in the overall gravimetric capacitance of the flexible capacitor [12]. Our previous work Flexible All-Solid-State Supercapacitor Polyhedron C-ZIF-8/PANI Based on Composite Synthesized by Unipolar Pulse Electrodeposition Method (UPED), demonstrate the capability of C-ZIF-8/PANI composite to stabilize the capacitance of the flexible capacitor devises, in the all different bending-stretching situation.

Meanwhile, the practical experiment indicates that the aspheric-shape ZIF-8 can mobilize in-line with the flexible substrate SSWM, without disintegrating effect on the electrode surface. Moreover, the less conductance of C-ZIF-8, solved by electrodeposition the conductive polymer PANI on the seed layer C-ZIF-8, by preforming unipolar pulse electroception method (UPED), mainly during the on-time and flowing of current-voltage of 0.8V, PANI monomer electrodeposit from the electrolyte (1M H₂SO₄, 0.5M PANI) to the electrode surface, and during the relaxation off-time without flowing current, PANI chain permeates inside the aspheric-shape C-ZIF-8 intrinsic aggregation matrix, creating a pathway for the electrode matrix.

UPED strategy with adjustment for the electrodeposition cycles and time is a significant factor in the result mentioned above. Controlling the electrodeposition time and cycles, led to incase or covered all aspheric-shape C-ZIF-8 particles in individual scale, due to relatively long relaxation time (off-time), furthermore enhancement the particles coherency in the electrode matrix, due to the epoxy properties for the conductive polymer PANI. Herein as such electrode materials accumulate the features of high surface area, excellent conductance, the electrode material can mobilize compatible with the flexible substrate with unique capability of losing the flexion strength by converging or diverging the aspheric-shape particles (C-ZIF-8). However, the electrode thickness is significant factor on the flexible supercapacitor devise, and it must be determined and specified, because thick electrode layer could easily affect by the flexion strength, which led to collapse or fragmentizes the electrode surface.

It worth to noting that PANI can electrodeposited in different morphologies (nanorods, nanofibers, or arrays) on various substrates, precisely the nanorods morphology could shorten the electron pathway. Moreover, the emptiness between the nanorods could relatively gain more surface area in the electrode, to accommodate the storage electrons, induced by electrochemical reactions (chargedischarge process) [10-12], and the magnificent structure of PANI nanorods growth on the top of aspheric-shapes C-ZIF-8 particles seed layer, capable to reeling the active electrode materials compatibly with the flexible substrate, rustling in withstanding the electrode surface under critical flexions degree. Moreover, PANI nanorods growth on low current density, which means electrodeposit PANI layer, would gain thinner thickness, due to conversion a few amounts of PANI monomer from the electrolyte to PANI chain on/or inside the C-ZIF-8 seed layer, meanwhile conserve the influence of the aspheric C-ZIF-8 seed layer, simultaneously avoid backfill it by thick PANI layer, which can preserve the mechanical mechanism of the aspheric-shape particles C-ZIF8 (converge or diverge). Therefore, monitoring the electrodeposit process and adjust the electrodeposition cycles, time and thickness could be efficiency done by UPED method [13], precisely by prepare different sample, with ascending increase the electrodeposit amount of PANI, follow by pursuit the electrodeposition surface morphology in each sample, to determine the starting-point of the nanorods growth.

Herein PANI nanorods grow in the aspheric C-ZIF-8 seed layer by preforming unipolar pluse electrodeposition strategy (UPED), the electrochemical circuit built-in stainless steel warmish (SSWM), the fabricating of the ultrathin electrode layer, and the growing of PANI nanorod investigate and determined by prepared six sample with vary-in the electrodeposit cycles of PANI, the samples named according to the electrodeposit PANI cycles, in such a way 05 UPED cycles, 10 UPED cycles, 15 UPED cycles, 20 UPED cycles, 25 UPED cycles, and 50 UPED cycles. The morphology of the electrode surface characterization investigates by SEM, XRD, FTIR and BET surface measurement to understand and pursue the growth of PANI nanorods, at the lowest possible thickness, beside the role of UPED strategy has been discussed.

II. EXPERIMENTAL

2.1. Materials

Polyaniline (PANI), Zn 2-methyl-imidazole (NO₃)₂·6H₂O, polyvinylidene fluoride alcohol (PVDF), conductive carbon, polyvinyl alcohol (molecular weight of 98000 $g \cdot mol^{-1}$), H_2SO_4 (98%), N-methylpyrolidone (C5H9NO) solutions, were provided from Shanghai Chemicals, Co. Ltd. China. Flexible substrate SSWM with a pore diameter of 40 µm (400 mesh) was purchased from Hardware-Product, HeBei Co. Ltd. China. The SSWM was cut to a size of 2×2 cm², and polished with sandpaper, further treated with ultrasound in aqueous ethanol for 15 minutes, and dried in oven 50 °C for 12 h. sticky tape carefully covered one side of the SSWM for mathematical calculation purposes. Millipore water (18.2 M Ω cm) was used to prepare all the solutions.

2.2. Preparation of aspheric-shape ZIF-8.

The preparation process for aspheric-shape C-ZIF-8 partials done according to the reference [14], (0.183 g of $Zn(NO_3)_2 \cdot 6H_2O$, 0.405 g of 2-methylimidazole) was dissolved in (6, 10 mL) of methanol respectively, and the two solutions firstly were stirred individual for an hour. Then mixed and stirred for 0.5 hour. After that, Teflon-lined

autoclave contains the solution heated at 110 °C overnight. The white precipitation collected by centrifugation (10000 rpm for 20 min) and washed carefully with methanol. At last ZIF -8 was carbonized at 900 °C for 6 hours under an argon atmosphere. C-ZIF-8 further rinse with ethanol/water several times and dried overnight [15].

2.3. Preparation of C-ZIF-8 seed layer on the flexible substrate electrode

C-ZIF-8, polyvinylidene fluoride alcohol (PVDF), conductive carbons, mixed according to the percentage of 8:1:1 respectively, the powder further mixed with Nmethylpyrolidone (C_5H_9NO) solutions under stirring overnight, the obtained ink was used to coat the pre-treated SSWM. Finally, the electrode C-ZIF-8/SSWM sample obtained and dried overnight [16].

2.4. Electrodeposition PANI on the C-ZIF-8 seed layer by UPED method

UPED method performed in three-electrode configuration, C-ZIF-8/SSWM, saturated calomel electrode (SCE) and Pt sheet used as working electrode, reference and counter electrode respectively. All the electrochemical cell immersed in 1M sulfuric acid and 0.5 M aniline, and the electrodeposition was done at room temperature. The current-voltage set at 0.8 V with 5.0 s off-time (t-off) and 0.5 s on-time (t-off) [13]. Each of the different sample prepared by electrodeposited 5 consecutive UPED cycles on the aspheric-shape C-ZIF-8 seed layer, small piece toke from the first sample for more investigation. The second sample prepared by continues electrodeposit 5 consecutive UPED cycles in the same electrode surface and cutting a small piece for surface investigation, the same procedures repeat for the all prepared sample.

2.5. Electrochemical characterization

The carbonization process for the aspheric-shape ZIF-8 investigates by BET surface measurement. Also, the growth of PANI on the C-ZIF-8 seed layer investigates and monitor by (SEM, X-RD and FTIR spectroscopy). All the preparation steps are done in the normal room temperature. Princeton, (VMP3) adjusted with EC-Lab software used to conduct the experiment.

III. RESULTS AND DISCUSSION

3.1. Structural and morphology characterization

Fig. 1(A-B) shown the seed layer C-ZIF-8 particles, successfully syntheses by our prementioned method, the surface morphology of C-ZIF-8 is polyhedron high surface area, construct from individual deformed aspheric particles shape, the irregular multi-face shape capable of converging

or diverging in-line compatibly with flexible substrate SSWM, without any side effect on the electrode surface. Fig. 1(C-D) show the C-ZIF-8 after the carbonization process at 900 °C in the Ar atmosphere, all the particles tend to be bord and rougher, due to carbonize the organic linker, which directly enhances the general circuit conductance, Moreover, the thorough coating of the C-ZIF-8 seed layer on the flexible substrate, successfully backfill the voids on the SSWM substrate. Fig. 2(A-B) shown the preparation of the first sample 5 UPED cycles, one can see the PANI chain penetrate inside the seed layer matrix, due to the gaps between the aspheric-shape particles, the result gives the evidence that the electrodeposit amount of PANI is low, and not enough to incase or cover the aspheric-shapes particles. Fig. 2(C-D) shown the sample of 10 UPED cycles, PANI electrodeposits on the C-ZIF-8 seed layer by 10 consecutive UPED cycles. The particle domain tends to be relatively hemogenic, but still the majority of the aspheric-shapes particles is naked. Fig. 3(A-B) shown the sample of 15 UPED cycles, PANI electrodeposit on the C-ZIF-8 seed layer by 15 consecutive UPED cycles, the surface morphology appeared relatively homogeneous, and most of the aspheric-shapes particles tend to be encased or covered by PANI chain, but still non-PANI nanorod formed yet. Fig. 3(C-D) shown the sample of 20 UPED cycles, PANI electrodeposits on the C-ZIF-8 seed layer by 20 consecutive UPED cycles, herein clearly can see the whole C-ZIF-8 seed layer covered by PANI nanorod. As a result, enhancing the cohesion in the whole circuit, the morphology of transformation PANI from aspheric-shape to cylindrical shape, attribute to the anilinium micellar transformed from the electrolyte to the seed layer surface, in the existence of current (on-time) and the acidic environment (H₂SO₄), also the polymer chain interaction backbone after each on-off electrodeposit cycle, drive the PANI to grow into nanorod morphology [17-18], consensus result has been reported by Jang J and his Co-worker [19]. Besides, the emptiness between the nanorods create an additional pathway and active area to storage the electrons, more importantly, the thickness of the C-ZIF-8/PANI is (10-20 µm), as such thickness allow the whole circuit mobilize compatibly inline with SSWM when the flexible device exposed to manipulating or flexion strength. Fig. 4(A-B) shown the sample of 25 UPED cycles, PANI electrodeposit on the C-ZIF-8 seed layer by 25 consecutive UPED cycles, the surface morphology deliver the avoidances of the PANI electrodeposit chain backfill the domain between the particles, and exceed that to pile the whole matrix by thick overlapping PANI chain layer, besides that less PANI nanorod formation observe, This new outcomes of thick PANI layer, could hinder the convergence or divergence

between C-ZIF-8 seed layers, in-word electrodeposit more than 20 consecutive UPED cycles could threaten the electrode flexibility. Fig. 4(C-D) shown the sample of 50 UPED cycles, PANI electrodeposit on the C-ZIF-8 seed layer by 50 consecutive UPED cycles, the experiment performed to investigate the surface characteristic after electrodeposit thick PANI layer, the surface morphology tends to be more hemogenic, with an absence of PANI nanorod formation.

3.2 XRD Diffraction

Fig. 5 shows X-ray diffraction (XRD) of ZIF-8, C-ZIF-8, and C-ZIF-8/PANI. The characteristic diffraction patterns of C-ZIF-8 disappear due to the carbonization, and only two broad patterns at $2\theta = 25^{\circ}$ and 44° exist after the carbonization, revealing the successful conversion from C-ZIF-8 to carbon materials. The border peaks of C-ZIF-8 are identical signals of amorphous carbon [20], no diffraction peaks of the impurity can be observed. C-ZIF-8/PANI exhibits diffraction peak at vicinity $2\theta = 10^{\circ}$ to 20° , and it can be assigned to the crystalline PANI [21]. However, the diffraction peak at 44° is symmetrical to the amorphous confirming and reveal the successful carbon, electrodeposition of the PANI in the C-ZIF-8 surface.

3.3 FTIR Spectra Scopey

Fig. 6 shows the FTIR spectra of the C-ZIF-8, C-ZIF-8, and C-ZIF-8/PANI. As can be observed, C-ZIF-8 show two peaks located at 3300 and 2827 cm⁻¹, corresponding to the aromatic and aliphatic C-H and N-H stretching band of imidazole (the organic linker), respectively [22]. It realizable that these peaks remind without a noticeable change in the following preparation process, which is strong evidence to the residual of the shape of the aspherical particles even after the carbonization [23], The peak at 1610 cm⁻¹ is ascribed to C=N stretching, while the bands in the spectral region of $400 - 1500 \text{ cm}^{-1}$ are associated with the stretching or bending of the entire ring, these peaks are identical with those of a previous report [24]. C-ZIF-8 spectral shown absence for the most of ZIF-8 peaks after the carbonization, a broad absorption band recorded around 3300 cm⁻¹, attributable to C–H and O–H stretching vibrations, as well as other characteristic peaks around 1610 and 1290 cm⁻¹ corresponding to carbon band C≡N and C-N respectively [25]. C-ZIF-8/PANI nanorod exhibit a border peak at 3300 cm⁻¹, assigned to C-H stretching vibration derived from the imidazole as it prementioned, two distinct bands at 2820 and 1643 cm⁻¹ which are attributed to the asymmetrical carbon stretching vibration of C-H and the O-H respectively [26], The absorption bands at 1556 and 1390 cm-1 in the spectrum of PANI can be assigned to the stretching vibrations of the quinoid (N=Q=N) and benzoin (N–B–N) structure respectively [27]. This stacking interaction of the peaks during different syntheses process demonstrates the successful preparation of the composite PANI nanorod on the C-ZIF-8 surface.

Fig. 7 shows BET surface measurement for ZIF-8 and C-ZIF-8. Fig. 3(A) is indicating that the surface contains mesopore and microporous particles. derive from ZIF-8, [28]. Nevertheless, the carbonization at 900C resulting in decrease surface area from (1701 nm²) to (1200 nm²) [29]. Fig. 3(B) shown C-ZIF-8 and C-ZIF-8 BET surface measurement and pore size distribution. Therefore, the heat treatment of ZIF-8 resulted in the modification the pore size distribution, and this feature, along with the high polyhedron surface area, facilitates the diffusion of electrons into the carbon network and helps to increase the adsorption capacity of the materials. The effect of heat treatment on the surface area of ZIF-8 is inconsistent with the results reported by Gadipelli et al. [30], in their study, it was shown that carbonized MOF-5 (containing Zn) at temperatures below 900 °C resulted in a decrease in surface area. On the contrary, heat treatment at temperatures higher than the evaporation temperature of Zn (908 °C) caused an increase in the surface area. The reason attributed to the reduction of ZnO with carbon and the evolution of Zn, CO, and CO2, which results in more porous network.

3.4 UPED Electrodeposition

Fig. 8 demonstrate the efficiency electrodeposition method UPED, herein the continuous decline on the peaks after each 5 consecutive cycles, attributed to the drop in the aniline concentration from the electrolyte after fabrication each sample, the first fabricated sample (05 UPED cycles) record the higher peaks, due to the higher concentration of the aniline. Also, the general circuit resistance is low, due to the excellent conductance of the aniline in the binging of the reaction. Descending peaks recorded in the flowing fabricating sample 10,15, and 20 UPED cycles, respectively, mainly due to the gradual decline in the concentration of the PANI in the electrolyte after any sample fabrication. As a result of the decreasing in the concentration of PANI from the electrolyte, face increasing in fabricated sample mass wight, as such evidence present the efficiency of UPED method and capability to monitoring the thickness of the fabricated sample.

IV. FIGURES AND TABLES



Fig. 1 SEM characterization (A-B) as Syntheses ZIF-8, (C-D) C-ZIF-8 after the carbonization process.



Fig. 2 SEM characterization of C-ZIF-8/PANI, (A-B) after electrodeposit 05 UPED cycles to Syntheses C-ZIF-8/PANI, (C-D) after electrodeposit 10 UPED cycles to Syntheses C-ZIF-8/PANI.



Fig. 3 SEM characterization of C-ZIF-8/PANI, (A-B) after electrodeposit 15 UPED cycles to Syntheses C-ZIF-8/PANI, (C-D) after electrodeposit 20 UPED cycles to Syntheses C-ZIF-8/PANI.



Fig. 4 SEM characterization of C-ZIF-8/PANI, (A-B) after electrodeposit 25 UPED cycles to Syntheses C-ZIF-8/PANI, (C-D) after electrodeposit 50 UPED cycles to Syntheses C-ZIF-8/PANI.



Fig. 5 X-ray diffraction (XRD) of ZIF-8, C-ZIF-8, and C-ZIF-8/PANI.



Fig. 6 FTIR spectra of the ZIF-8, C-ZIF-8, and C-ZIF-8/PANI.



Fig. 7 shown A-B, ZIF and C-ZIF-8 BET surface measurement, pore size distribution respectively.



Fig. 8 UPED electrodeposition method with current voltage of 0.8V and 0.5,5.0 s on-off time respectively.

V. CONCLUSION

In summary, we have developed a Preparation protocol of PANI nanorods grow on the C-ZIF-8 seed layer by preforming UPED electrodeposition method, as Ultra-thin elastic electrode for the flexible capacitor. UPED electrodeposition method allows to customizing the growth of PANI nanorods on aspheric-shape C-ZIF-8 within the thickness of (10-20 µm), by controlling the transformation of the anilinium micellar, and the interaction in the polymer chain backbone, through controlling the open circuit electrodeposition cycles and time. The comparison of the different produced samples delivers the evidence that at 20 UPED cycles PANI grew in nanorod formation, the unique structure endows the whole electrode matrix a mechanical elasticity to move in-line with the flexible substrate. The method presented here is suitable for the development of ultra-thin flexible electrode materials, this will provide a new opportunity for enriching relevant MOF-based electrode materials in flexible energy conversion and storage devices.

ACKNOWLEDGEMENTS

This work is supported by the National Natural Science Foundation of China (21776191, 21706181) and the International Science & Technology Cooperation Program of China (No. 2017YFE0129200) and the International Science & Technology Cooperation Program of Shanxi Province (No. 201803D421094).

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Dynamic analysis of curved plate - columns system subjected to moving load

Le Xuan Thuy

Department of Solid Mechanics, Le Quy Don Technical University, Viet Nam

Abstract— When calculating and designing a bridge structure, the guarantee of usability, structural durability, aesthetic is important requirements. There are many types of bridge structures proposed when constructed in different locations, including the type of bridge with the curved surface. Approaching this problem, the structure consists of curved plates associated with columns resistant subjected to moving load is solved in this paper. The numerical results are references for calculating and designing bridges and other structures which are subject to moving load.

Keywords— Dynamic analysis, plate, curve, moving load.

I. INTRODUCTION

In the transportation and construction fields, many types of plate, shell structure subjected to the moving load can be seen, such as bridge and road models. Depending on the level of accuracy required and the ability to calculate, the face of the bridge can be described in the form of a plate, shell or beams in the calculation model. These types of structural calculation is influenced by moving load that many scientists are interested in, such as: C. Johansson et al. [1], Ladislav Frysba [2], Nguyen Thai Chung et al. [3, 4], Qinghua Song et al. [5], Nguyen Van Khang et al. [6], Nguyen Van Chinh et al. [7], T.O.Awodola et al. [8], Volkan Kahya et al. [9], Bui Manh Cuong [10]. The publication is quite varied. However, the shape of structures is simple in most studies. Study subjects mentioned are ordinary beams and plates, or plates on elastic foundation.

In this paper, the problem curved plate – columns system subjected to the moving load is solved (Fig. 2). In which, the results of the free vibration and the forced oscillation problem are shown. The structure depicts the curved part of the bridge. The term curved plate here refers to the curved profile of a plate. The calculation program is built on the programming language APDL run on ANSYS software.

The article focuses on the types of elements used in the program and the algorithm using the element "Birth and Death" to describe the moving load. With the program set up, Users can easily change the dimension structures as well as the load, customized to solve many different problems. The results of this paper are the basis to solve more complex problems in the future.



Fig 1. The Bridge with curved surface



Fig 2. The curved plate – columns system model

The system consists of a reinforced plate with a curved profile in the horizontal plane attached to the pillars, clamped supported at the end of columns and simply supports at two short edges of the plate. The load acting on the system is the moving force has rules P(t) run curved orbit along the center line of the plate with velocity v_0 .

II. FINITE ELEMENT MODELING

To describe the bending plate, the SHELL99 element is used. SHELL99 may be used for layered applications of a structural shell model. The element has six degrees of freedom at each node: translations in the nodal x, y, and z directions and rotations about the nodal x, y, and z-axes. SHELL99 allows up to 250 layers. If more than 250 layers are required, a user-input constitutive matrix is available.

Supported beams and columns described by BEAM188 element. BEAM188 is suitable for analyzing slender to moderately stubby/thick beam structures. This element is based on Timoshenko beam theory. Shear deformation effects are included.



Fig 3. SHELL99 Geometry [12]



Fig 4. Cross-sectional shapes can be described when use Beam188 element [11,12]

BEAM188 is a linear (2-node) or a quadratic beam element in 3-D. BEAM188 has six or seven degrees of freedom at each node, with the number of degrees of freedom depending on the value of KEYOPT(1). BEAM188 can be used with any beam cross-section defined via SECTYPE, SECDATA, SECOFFSET, SECWRITE, and SECREAD. The cross-section associated with the beam may be linearly tapered.

Elasticity, creep, and plasticity models are supported (irrespective of cross-section subtype). A cross-section associated with this element type can be a built-up section referencing more than one material.

III. ELEMENT BIRTH AND DEATH DESCRIBE THE MOVING MASS

In the trajectory of moving mass M, the node of the plate element can be added to the M volume or not. M is described by the MASS21 element (MASS21 is a point element having up to six degrees of freedom: translations in the nodal x, y, and z directions and rotations about the nodal x, y, and z axes).

If material is added to or removed from a system, certain elements in model may become "existent" or "nonexistent." In such cases, we can employ element birth and death options to deactivate or reactivate selected elements, respectively [11].

To achieve the "element death" effect, the ANSYS program does not actually remove "killed" elements. Instead, it deactivates them by multiplying their stiffness (or conductivity, or other analogous quantity) by a severe reduction factor (ESTIF). This factor is set to 1E-6 by default, but can be given other values.

Element loads associated with deactivated elements are zeroed out of the load vector, however, they still appear in element-load lists. Similarly, mass, damping, specific heat, and other such effects are set to zero for deactivated elements. The mass and energy of deactivated elements are not included in the summations over the model. An element's strain is also set to zero as soon as that element is killed. In like manner, when elements are "born" they are not actually added to the model; they are simply reactivated. We must create all elements, including those to be born in later stages of your analysis, while in PREP7. We cannot create new elements in the SOLUTION. To "add" an element, we first deactivate it, then reactivate it at the proper load step.

The algorithm consists of two steps:

Step 1: All the moving masses are attached to all the nodes along the trajectory of motion, and then they are deactivated.

Step 2: Depending on the velocity and the time taken, whenever a moving object reaches a certain node, the corresponding mass at that node is activated. When volume passes, MASS21 element at that node is deactivated again.



Fig. 5. Element Birth and Death

IV. GOVERNING EQUATIONS AND SOLUTION METHOD

After assembling the matrices, element vector of elements describing beams, plate, pillar support and moving mass, the governing equations of the system is [11, 12]:

$$[M]{\ddot{q}}+[C]{\dot{q}}+[K]{q}={R}, \qquad (1)$$

in which $\{q\},\{\dot{q}\},\{\dot{q}\}$ are global displacement vector, global velocity vector, and global acceleration vector, respectively;

$$\begin{bmatrix} M \end{bmatrix} = \sum_{e} \left(\begin{bmatrix} M^{e} \end{bmatrix} + \begin{bmatrix} M_{Q}^{e} \end{bmatrix} \right), \begin{bmatrix} K \end{bmatrix} = \sum_{e} \left(\begin{bmatrix} K^{e} \end{bmatrix} + \begin{bmatrix} K_{Q}^{e} \end{bmatrix} \right),$$
$$\begin{bmatrix} C \end{bmatrix} = \sum_{e} \left(\begin{bmatrix} C^{e} \end{bmatrix} + \begin{bmatrix} C_{Q}^{e} \end{bmatrix} \right), \{R\} = \sum_{e} \left\{ P(t) \right\}_{e}$$
(2)

are the global mass matrix, the global stiff matrix, the global resistance matrix and the global load matrix, respectively.

The global resistance matrix $\begin{bmatrix} C^e \end{bmatrix} = \alpha \begin{bmatrix} M \end{bmatrix}_e + \beta \begin{bmatrix} K \end{bmatrix}_e$ (3) in which Rayleigh coefficients α , β defined by resistance score ξ and the first two natural frequencies of the system.

 $\begin{bmatrix} M_Q^e \end{bmatrix}$, $\begin{bmatrix} C_Q^e \end{bmatrix}$, $\begin{bmatrix} K_Q^e \end{bmatrix}$ are matrices related to moving mass.

During the resolution, matrices related to moving load are recalculated after each time step. The equations (1) are solved, we have a set of displacement parameters of the node of the system on each time step, from that calculates the stress, internal force, etc.

Flow diagram of the program [11, 12]:



Fig. 6. Flow diagram

V. CHECK THE RELIABILITY OF THE SIMULATION PROGRAM

To evaluate the reliability of the solving algorithm, plate subjected to moving mass is applied [5]. In ref. [5], the authors used numerical methods to solve the problem. The geometrical and material properties of plate are as follows: L = 1 m, W = 0.5 m, h = 0.01 m, $\rho = 7820 \text{ kg/m}^3$, E = 206.8 Gpa, $\mu = 0.29$. A mass M = 2.3 kg moves at a speed v_M = 10 m/s along the centerline of the plate y = W /2 in x direction (Fig. 7).



Fig 7. The geometry of the plate [5]


Fig. 8. Displacement at center points of the plate

The difference of the max value of the displacement at the midpoint of the plate is 0.8%, indicating that the algorithms and calculation programs established by the authors are reliable.

VI. NUMERICAL ANALYSIS

Consider the curved plate with stiffeners put on the pillar supports. Plates with curved shapes with dimension as Figure 9, thickness w = 20cm; 10 stiffeners in the position as shown, width of stiffener $B_b = 0.2m$, height of stiffener $H_b = 0.4m$; at the end of the support beams have columns have diameter $D_c = 0.6m$, height $H_c = 4.0m$. There is a curved stiffener along the center line, at the bottom of the plate that has the same dimension with the transverse ones. End of columns is clamped. Two short edges of the plate are simply supported. The moving load effect perpendicular to the surface of the plate with the law P(t) = $P_0 \sin\omega t$ ($P_0 = 2.4 \times 10^3$ N, $\omega = 30\pi$ rad/s), move from right to left along the center line of plate with speed $v_0 = 10$ m/s.

The plate is made of composite material with: $E_1=161.9$ GPa, $E_2=9.5$ GPa, $\mu_{12}=0.33$, $G_{12}=G_{13}=G_{23}=7.47$ GPa, $\rho_1=1600$ kg/m³. Material properties of stiffeners and columns: Young modulus E = 210 GPa, Poisson coefficient $\mu = 0.29$, density $\rho = 7800$ kg/m³.

The finite element model of the system is shown in Figure 10. Use the program that was set up, free vibration problem of the curved plate – columns system subjected to moving mass is solved. The natural frequencies of model are shown in Figure 11.



Fig 9. Curved plate dimension



Fig 10. Finite element model of the system



c) Mode 3 ($f_3 = 34.47Hz$)



d) Mode 4 ($f_4 = 36.17Hz$)

Fig 11. Mode shapes of the system

Solving the forced oscillation problem with moving load P(t) action, time calculation is the time moving load go to the end of the way. Some representative results are retrieved at A, B, C as shown in Figures 12, 13, 14, 15, 16, 17 and Table 1.





Fig. 12. Vertical displacement W at point A, B



Fig. 13: Elastic strain intensity at point A, B



Fig. 14. Axial force F_{ZC}



Fig. 15. Bending moment M_{XC}



Fig. 16. The displacement field W at time t = 2s



Fig. 17. The Von mises stress at time t = 2s

Comment: Along the backbone of the plate, when the moving load has not arrived, the oscillating of the review point is quite small, almost equal zero. When the load come near and pass, oscillate of the calculated point increase (Figs. 12,13, 14, 15). The strain at point A is much larger than the one at point B due to the load going pass A and without passing B.

VII. CONCLUSION

In this paper, the simulation program of the curved plate – columns system subjected to the moving load is built based on APDL programming language. Results show the reliability of the algorithm that employs the "Element Birth and Death" technique developed. Deep interference in ANSYS software simulation program allows to solve complex problems.

The program that was set up, is capable of solving many different problems with the change of texture and load parameters, allow to evaluate the effect of these parameters on the oscillation of the system. Research results are the first step to develop calculations with complex structural problems (the system subjected to multi moving load, the system subjected to moving oscillators, and so on).

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Base Shear Reduction by Using Optimum Size of Beams in Top Floors with Different Grades in Multistoried Building at Different Levels

Pankaj Kumar Dhakad¹, Sagar Jamle²

¹M Tech Scholar, Department of Civil Engineering, Oriental University, Indore, India ²Assistant Professor, Department of Civil Engineering, Oriental University, Indore, India

Abstract— The recent development shows that expansion is the key to enlarge the infrastructure not only in horizontal direction but in vertical direction too. For this, tall constructions are favored due to less consumption of the land region for living purpose. With this, the seismic disaster activities in this approach made it more complicated. Indian Standard code of practice 1893:2016 shows the seismic prone zones where the shakes are witnessed. On decreasing the load of the structure decreases the Base Shear on the foundation base without compromising the stiffness of the tall structures. To demonstrate and prove this, six tall structures are prepared using software approach, lessening the beam sizes with grade change in top floors, analyzed it and compared among them. After deep comparative analysis, it has been found out that Building with Base Shear reduction case F1 emerges and hence proved to be the best Base Shear reduction case.

Keywords— Base Shear Reduction, Bending Moments, Concrete Grade, Displacement, Dual System, Multistoried Building, Shear Force, Shear Wall

I. INTRODUCTION

The introduction of lessening the weight of the structure is such a difficult task when construction is for high rise structures. This is only done with the help of changing the grade of concrete so that homogeneity of the components of concrete; or by reducing the components of the structures. The later one will compromise the architectural point of view.

Again the solution of this problem is to make the structural components slender, which will reduce the weight of the entire structure. But the lateral shakes of earthquake will not going to implement this. The last solution of this problem to use some special elements or to detect which part of the structure will be reduced to make it economical. This approach will need more case studies and the research will be useful in the growing infrastructure demand.

Similarly, the grade change of concrete in construction industry plays a vital role in terms of economy and providing the strength. The enactment of grade change will affect the presentation of the complete construction. Therefore it should not be unnoticed.

II. OBJECTIVES OF THE PRESENT STUDY

The objectives selection is a very tough task since what we have decided that has to be going to be proved. The use of this kind of system in which base shear will reduce without losing the concept of lateral load stiffening system by using the dual system in which Special Moment Resisting Frames are used in the combination of Ordinary Core Type Shear Wall around the lift area in multistoried building. The objectives of this work are as follows:

- a. To show the base shear effect on dual structural system.
- b. To make Base Shear reduction cases of same multistoried building and compare among each other under seismic loading.
- c. To determine Base Shear in X and Z direction for all base shear reduction cases.
- d. To show the seismic effect of lessening the sizes of beams in top floors.
- e. To find member Shear Forces and Bending Moment values in Column for all Base Shear reduction cases.
- f. To find out the Torsion values in Beam and Column members.

- g. To determine Principal stresses, Von Mises Stresses and Shearing Stresses for all Base Shear reduction cases.
- h. To examine column Axial Forces in column members for all Base Shear reduction cases.
- i. To examine member Shear Forces and Bending Moment values in Beams for all Base Shear reduction cases.
- j. To show the grade change effect in multistoried building under seismic loading.
- k. To study and find the maximum nodal displacement in transitional X and transitional Z direction for all Base Shear reduction cases.

III. METHODOLOGY AND MODELING APPROACH

As per the objectives, the Response Spectrum Analysis has been performed on different models consist of Building Case A1 made up of G+17 storey Semi commercial building with all beams are of same sizes. Building Case B1 made up of G+ 17 storey Semi commercial building with all beams are not of same sizes and beam sizes changes above G+17. Building Case C1 made up of G+ 17 storey Semi commercial building with all beams are not of same sizes and beam sizes changes above G+16. Building Case D1 made up of G+ 17 storey Semi commercial building with all beams are not of same sizes and beam sizes changes above G+15. Building Case E1 made up of G+17 storey Semi commercial building with all beams are not of same sizes and beam sizes changes above G+14. Building Case F1 made up of G+ 17 storey Semi commercial building with all beams are not of same sizes and beam sizes changes above G+13. All the cases are situated in Earthquake Zone III.

Parameters	Values
Building configuration	G + 17
Building type	Semi-commercial building
Total plinth area	576m ²
Building Length	4m @ 6 bays
Building Width	6m @ 4 bays
Height of building from Ground level	61 m
Height of each floor	3 m

Table 1: Dimensions of different components of building

Depth of footing	3 m
Beam dimensions 1	450 mm x 350 mm with
	M30 grade
Beam dimensions 2	450 mm x 300 mm with
	M25 grade
Column dimensions	450 mm x 650 mm with
	M35 grade
Slab thickness	150 mm
Staircase waist slab	145 mm
Shear wall thickness	200 mm
	Concrete (M25), (M30),
Material properties	(M35),
	Steel (Fe 415)

Seismic parameters on the structure

- 1. Importance factor I = 1.2
- 2. Fundamental natural period of vibration (Ta) = 0.09*h/(d)0.5
- 3. For both the cases, Tax = Taz
- 4. Fundamental natural period (Tax) for X direction = 1.12064 seconds
- 5. Fundamental natural period (Taz) for Z direction = 1.12064 seconds
- 6. Response reduction factor R = 4
- 7. Damping ratio = 5% (0.005)
- 8. Zone factor = 0.16
- 9. Zone = III
- 10. Soil type = Medium soil

Different building model cases selected for analysis using ETABS software are as follows:-

- 1. **Case A1** = Base Shear Reduction Case Beams of Same sizes
- 2. **Case B1** = Base Shear Reduction Beams of Different sizes (size of beam changes above G+17)
- 3. **Case C1** = Base Shear Reduction Beams of Different sizes (size of beam changes above G+16)
- 4. **Case D1** = Base Shear Reduction Beams of Different sizes (size of beam changes above G+15)
- 5. **Case E1** = Base Shear Reduction Beams of Different sizes (size of beam changes above G+14)
- 6. Case F1 = Base Shear Reduction Beams of Different sizes (size of beam changes above G+13)



Fig. 1: Typical floor plan



Fig. 2: Front View of the Structure



Fig. 3: Sectional 3D View of the Base Shear reduction case of the Structure



Fig. 4: Base Shear Reduction Case – Beams of Same sizes: Case A1



Fig. 5: Base Shear Reduction - Beams of Different sizes (size of beam changes above G+17): Case B1



Fig. 6: Base Shear Reduction - Beams of Different sizes (size of beam changes above G+16): Case C1



Fig. 7: Base Shear Reduction - Beams of Different sizes (size of beam changes above G+15): Case D1



Fig. 8: Base Shear Reduction - Beams of Different sizes (size of beam changes above G+14): Case E1



Fig. 9: Base Shear Reduction - Beams of Different sizes (size of beam changes above G+13): Case F1

IV. RESULT ANALYSIS

Graphical representation of each objective is mentioned below:-



Graph 1: Maximum nodal displacement in X and Z direction



Graph 2: Base Shear in X direction for all Wall Belt Stability Cases



Graph 3: Base Shear in Z direction for all Wall Belt Stability Cases



Graph 4: Maximum Axial Forces in Column for all Wall Belt Stability Cases



Graph 5: Maximum Shear Force in Column for all Wall Belt Stability Cases



Graph 6: Maximum Bending Moment in Column for all Wall Belt Stability Cases



Graph 7: Maximum Shear Force in Beam for all Wall Belt Stability Cases



Graph 8: Maximum Bending Moment in Beam for all Wall Belt Stability Cases



Graph 9: Maximum Torsional Moments in Beam for all Wall Belt Stability Cases



Graph 10: Maximum Torsional Moments in Columns for all Wall Belt Stability Cases



Graph 11: Maximum Principal Stresses for all Wall Belt Stability Cases



Graph 12: Maximum Von Mises Stresses for all Wall Belt Stability Cases



Graph 13: Maximum Shearing Stresses for all Wall Belt Stability Cases

V. CONCLUSION

On investigating the result data of various parameters for all six Base Shear reduction cases, conclusions developed are as follows:-

1. Maximum displacement in X direction has a minimum value of 462.225 mm for Building case A1 since the values keep on increasing up to Case F1 when beam

size is less. No special displacement reducing components are implemented in these buildings.

- 2. Again, the maximum displacement in Z direction behaves same as the X direction when no special displacement reducing components are implemented in these buildings.
- 3. Base Shear in X direction has gradually reduced by implementing lesser size of beams in top floors, subsequently decreases the weight of the structure. For this parameter, Case F1 proves to be an efficient parametric case.
- 4. Again, the Base Shear in behaves same as the trend obtained in X direction. Here, due to reducing the beam size in top floors; subsequently decreases the weight of the structure with Base Shear values. Case F1 proves to be efficient case.
- The maximum Axial forces in Column first decreases to Case B1 and then it increases gradually up to Case F1. Observing the least parameter, Case B1 obtained as an efficient Case with a parametric value of 8063.884 KN.
- 6. The sectional Shear Forces along both Y-Y axis and Z-Z axis in column decreases gradually to case F1 and proves to be an efficient case with values of 94.6674 KN and 71.1444 KN respectively.
- Similarly, the Bending Moment along both Y-Y axis and Z-Z axis in column decreases gradually to case F1 and proves to be an efficient case with values of 244.4088 KNm and 170.3592 KNm respectively.
- For beams in the structures, the minimum value of Shear Forces along both Y-Y axis and Z-Z decreases gradually to case F1 and proves to be an efficient case with values of 94.6674 KN and 71.1444 KN respectively.
- 9. Bending Moments in beams slightly increases just because of the size is reduced in top floors and due to lateral effects, the displacing effects slightly increases its values along both in Y-Y axis and in Z-Z axis.
- 10. The main criterion has seen in torsion effects in beams. The values keep on decreasing on lessening the sizes of beams in top floors. For this parameter, again Case F1 seems to be efficient among all.
- 11. Similarly, the same trend has seen in Torsional Moments in columns. The values gradually decrease to a minimum value of 43.4109 KNm for Case F1 and hence prove to be an economical case.

- 12. The principal stresses and Von Mises stresses in plates increases when lateral effects were there along with combination of the vertical loads.
- 13. Maximum Shearing Stresses seems less in Base Shear stability Case F1 with a minimum value among all and this parameter links with the theme of the current work.

Observing all the parameters, the main aim of this work has achieved with lessening the Base Shear parameter in both X and Z direction in Semi-Commercial (G+17) multistoried building under seismic loading. Building Case F1 observed and obtained as efficient case and should be recommended when this type of approach will be adopted in any earthquake zones.

ACKNOWLEDGEMENTS

I extend my deepest gratitude to *Mr. Sagar Jamle*, *Assistant Professor*, Department of Civil Engineering, Oriental University, Indore, (M.P.) for his continuous support and guidance for the completion of this entire work. I am glad that he simultaneously works with 12 research scholars and do support individual scholars intensively.

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Economic Potentials of Home Industry based on Local Food Processing (Cassava) to support Food Security in Situbondo Regency

Martono¹, S. Sari², and D. B. Zahrosa^{3*}

^{1,2}Department of Agribusiness, Faculty of Agriculture, University of Abdurachman Saleh Situbondo, Indonesia ³Department of Agribusiness, Faculty of Agriculture, University of Jember, Indonesia *Corresponding Author

Abstract— Development emphasizing the characteristics of an area can increase food security optimally. However, to improve food security, it is not only applied at the regional level but also at the household level because food security at the household level is closely related to food security at the regional level. The objectives of this study are: (1) To figure out the potential centers of cassava development in Situbondo Regency; (2) To find out the economic analysis of cassava-based processed products in Situbondo Regency; and (3) To develop strategies for developing home industry of cassava-based processed products in Situbondo Regency. The study was conducted in Situbondo Regency. The research method used was descriptive and analytical approaches using primary and secondary data collection methods. Sampling in the vertical home industry was done by using the snowball sampling method, a method that starts from several entrepreneurs who are asked to show other entrepreneurs, especially those who process cassava processed products. The data was analyzed using base sector analysis, economic analysis (income and value-added) and Force Field Analysis (FFA). The results revealed that two out of seventeen sub-districts in Situbondo had potential land area and production, namely Sumber Malang District and Arjasa District. Cassava commodity-based processed products have economic values; they are income and value-added whichvary in each home industry. The strategy of developing cassava-based processed products in Situbondo Regency was the empowerment that focused not only on exploitative goals but also was directed at empowering farmers and home industry entrepreneurs through partnerships.

Keyword— Home Industry, Local Food (Cassava), Income, Value-Added, and Force Field Analysis (FFA).

I. INTRODUCTION

The development of the agricultural industry nowadays both in terms of quantity and type is more dominated by the agricultural processing industry in the countryside. The application of the cassava-based local food processing industry system in Situbondo Regency is expected to be able to motivate farmers and entrepreneurs of the home industry particularly to be able to actively participate as a subject of development in implementing science and technology dynamically so that expeditious production and value-added products produced will extend as well as people's income and welfare.

In this regard, Situbondo Regency government began to pay attention to the problem of developing rural areas, one of which was pursued through the development of the processing industry. But in the process of developing this industry is not easy because it requires a deeper understanding of the characteristics of rural areas both spatially, the need for facilities and infrastructure, forms of rural market institutions and community participation. Spatially, rural areas are often located in areas that are difficult to reach due to limited road and transportation facilities. This condition causes the economic activities of rural communities to be inefficient and generally more subsistent.

On the other hand, the mastery of farmers and home industry entrepreneurs on knowledge and information is very low due to limited education and communication facilities. As a result, economically and politically, the bargaining position of these actors becomes very weak and in the end, their interests have less attention. Therefore, the objectives of this study are: (1) To figure out the potential centers of cassava development in Situbondo Regency; (2) To find out the economic analysis of cassava-based processed products in Situbondo Regency; and (3) To develop strategies for developing IRT for cassava-based processed products in Situbondo Regency.

II. METHODOLOGY

The research area is determined intentionally (purposive method), which is in Situbondo Regency. The research method used is descriptive and analytical approaches using primary and secondary data collection methods. Sampling in the home industry was done using the Snowball Sampling method, a method that starts from several entrepreneurs who are asked to show other entrepreneurs, especially those who proceed with cassava-processed products. The data analysis method uses base sector analysis, economic analysis (income and value-added) and Force Field Analysis (FFA).

III. RESULTS AND DISCUSSION

1. Potential Development Center for Cassava

The cassava center area in East Java selected in this study was Situbondo Regency. The potential of cassava plant centers in Situbondo Regency can be seen in Table 1.

Table 1. Potential of Cassava Centers in Situbondo
Regency

No	District	Wide Area (Ha)	Production (Ton)
1.	Sumbermalang	5	84
2.	Arjasa	284	4.750
	Total	289	4.834

Source: Situbondo Regency in Figures 2019

Table 1 presents in the aspects of the cassava plant area in Situbondo Regency, there are only two districts that have the potential, specificallySumbermalang District with an area of 5 Ha and Arjasa District has the largest land area of 284 Ha. The next is the production aspect. Based on the potential of cassava in Table 1,Arjasa District is the largest cassava-producing region with a production of 4,750 tons and Sumbermalang District of 84 tons. Seen from the calculation of the base sector, the data analysis is presented in Table 2.

No	Distric	Year					Average	Note
	Distric	2014	2015	2016	2017	2018	Average	TOLE
1.	Sumbermalang	14,4	1,25	1,99	3,25	1,47	4,48	Basis
2.	Arjasa	7,59	8,78	8,23	7,00	8,69	8,06	Basis

Table 2. Location Quotient (LQ) Analysis of Cassava Plants in Situbondo Regency

Source: Secondary Data Processed in 2019

Based on Table 2, LQ calculation results were obtained within five years in Situbondo Regency for cassava crop commodities. Sumbermalang and Arjasa sub-districts are the base sectors that can meet cassava production needs in their region and also supply cassava production output out of the region with an average LQ value of 4.48 and 8.06 respectively.Graphically, the average LQ value in cassava plants in Situbondo can be figured out inFigure1.



Fig.1: Average LQ Value of Cassava Commodities in Situbondo Regency in 2014-2018

Based on various explanations regarding the area and level of cassava production, it indicates that Arjasa District is the most potential area for cassava farming activities. Arjasa District, which has an area of 284 Ha, is capable of producing 4,750 tons of cassava.

2. The Economic Analysis of Cassava-Based Processed Products

In the context of extending household food security, extracting local food potential is quite strategic when related to its role, especially as an alternative source of staple food, especially food sources of carbohydrates both as a partial substitution of rice or other food. Situbondo Regency has considerable potential in providing alternative food such as cassava. Furthermore, other types of alternative food with intensive cultivation patterns will be able to provide a very large contribution to the development of alternative food and also provide a large benefit in increasing the income of the community. While in terms of processing, there have been quite a lot of developed food technologies that can produce a variety of alternative processed products. Many of cassava-based products are processed into snacks such as *lupis*, *jemblem*, *lemet*, cassava chips and *tape* in Situbondo. The following is data on economic analysis from the results of discussions with home industry entrepreneurs of cassava-based processed products in Situbondo Regency.

Table 3. Analysis Value of Economic	e Calculation of Cassava-Based Processed Products
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Economic Analysis	The value of cassava-based processed products							
Leononne 7 marysis	Lupis	Jemblem	Lemet	Chips	Tape			
Total Cost (Rp)	163.294,27	28.871,97	23.703,29	1.570.571	2.247.900			
Total Income (Rp)	180.000	50.000	40.000	2.400.000	2.640.000			
Income (Rp)	16.705,73	21.128,03	16.296,71	829.429	392.100			
Value-added (Rp)	11.287,98	14.657,01	10.848,35	1.059,43	277,5			
Value-added Ratio (%)	60,2	76,64	66,97	44,14	19,3			
Cost TK (Rp)	2.000	5.000	5.000	230	228,75			
Ratio TK (%)	17,72	34,11	46,09	21,71	82,4			
Profit (Rp)	9.287,98	9.657,01	5.848,35	829,43	48,75			
Profit Ratio (%)	82,28	65,89	53,91	78,3	17,6			

Source: Secondary Data Processed in 2019

Table 3 presents the results of the economic analysis of cassava-based processed products in Situbondo Regency.

a. The income of *lupis* processing wasRp. 180,000.00 per production process. The expense wasRp. 163,294.27. From the review of total costs and total revenues, the income of the entrepreneurs wasRp 16,705.73 per production process. While the valueadded of *lupis* was Rp.11,287.98/Kg of raw materials. The value-added obtained by the entrepreneur was still profitable after being reduced by labor costs. The value-added ratio is 60.20%. From this value-added ratio, it is noted that the percentage of profit ratio was 82.28% and the rest was the labor cost ratio of 17.72%. The ratio of profits from value-added was greater than the ratio of labor costs which means that *lupis* entrepreneurs concerned more about the allocation of industrial management rather than the allocation of labor factor income;

b. The income of jemblem processing wasRp. 50,000.00 per production process. The expense wasRp. 28,871.97. From a review of the total costs and total revenues, the income gained by the entrepreneurs wasRp. 21,128.03 per production process. While the average value-added wasRp. 14,657.01/Kg of raw materials. The value-added still provides benefits after being reduced by labor costs. The value-added ratio was 76.64%. From this value-added ratio, it admits that the percentage of profit ratio was 65.89% and the rest was the labor cost ratio of 34.11%. The ratio of profit from value-added was greater than the ratio of labor costs which means that jemblem entrepreneurs concerned more about the

allocation of industrial management rather than the allocation of labor factor income;

- The income of lemet processing wasRp. 40,000.00 c. per production process. The expense wasRp. 23,703.29. From the review of the total cost and total revenue, the income attained by the entrepreneurs 16,296.71 production wasRp. per process. Meanwhile, the average value-added wasRp. 10,848.35/Kg of raw materials. The value-added turns out to still provide benefits after being reduced by labor costs. The value-added ratio was 66.97%. From this value-added ratio, it indicates that the percentage of profit ratio was 53.91% and the rest was the labor cost ratio of 46.09%. The ratio of profit from valueadded was greater than the ratio of labor costs which means that the lemet entrepreneur concerned more about the allocation of industrial management rather than the allocation of labor factor income;
- d. The income of processing chips wasRp. 2,400,000.00 per production process. The production cost wasRp. 1,570,571.00. From a review of total costs and total revenues, the income achieved by entrepreneurs wasRp. 829,429.00 per production process. At the same time, the average value added of chips wasRp. 1059.43/Kg of raw materials. The value-added still provides benefits after being reduced by labor costs. The value-added ratio was 44.14%. From this value-added ratio, it infers that the percentage of profit ratio was 78.30% and the rest was the labor cost ratio of 21.71%. The ratio of profit from value-added was

greater than the ratio of labor costs which means that the chips entrepreneursconcerned moreabout the allocation of industrial management rather than the allocation of labor factor income; and

The income of tape processing wasRp. 2,640,000.00 e. per production process. The expense wasRp. 2,247,900.00. From the review of total costs and total revenues. the revenue obtained from the tapeentrepreneurs wasRp. 392,100 per production process. While the average value-added of tape was Rp. 277.50/Kg of raw materials. The value-added turns out to still provide benefits after being reduced by labor costs. The value-added ratio was 19.30%. From this value-added ratio, it indicates that the percentage of profit ratio was 17.60% and the rest was the labor cost ratio of 82.40%. The ratio of profit from value-added was smaller than the ratio of labor costs, which means that tape entrepreneurs concerned more about the allocation of labor factor income rather than the allocation of industrial management.

3. The Strategy of Developing Cassava-Based Home Industry Products

The development of a local food-based home industry made from cassava in Situbondo Regency is emphasized on the driving and inhibiting factors. To find out the strategy that will be applied, the FFA (Force Field Analysis) was used. The results of the FFA Analysis (Force Field Analysis) for local food-based home industries made from cassava in Situbondo Regency will produce values that can be used in formulating strategies.

No	Driving Factors	BF	ND	NRK	NBD	NBK	TNB	FKK
D1	Availability of raw materials	0,17	4	3,56	0,70	0,62	1,31	*1
D2	Opportunities of community to explore of the potential of capital in their region	0,13	3	3,67	0,39	0,48	0,87	
D3	Hereditary experiences in processing product	0,17	3	3,11	0,52	0,54	1,06	
D4	Value-added and profit of cassava processed business	0,17	3	3,33	0,52	0,58	1,10	
D5	Technology and processing methods are relatively simple	0,17	3	3,67	0,52	0,64	1,16	
D6	Availability of a local market for cassava- processed products	0,17	3	3,33	0,52	0,58	1,10	

Table 4. Evaluation of the Driving Factors for the Development of Cassava-Based Local Food Home Industry

Source: Secondary Data Processed in 2019

No	Driving Factors	BF	ND	NRK	NBD	NBK	TNB	FKK
H1	Weak business and institutional management	0,21	3	3,89	0,64	0,83	1,48	
H2	Limited development of quality and standardization	0,21	4	3,78	0,86	0,81	1,67	
H3	Weak involvement of farmers as suppliers of raw materials	0,29	3	2,89	0,86	0,83	1,68	*1
H4	Non-optimal guidance and assistance from stakeholders	0,14	4	3,78	0,57	0,54	1,11	
H5	Limited access to market development	0,14	3	3,33	0,43	0,48	0,90	

Table 5. Evaluation of the Driving Factors for the Development of Cassava-Based Local Food Home Industry

Source: Secondary Data Processed in 2019

Notes:

- BF : Weight of Factor
- ND : Value of Support
- NRK: Value of Average Relation
- NBD: Weight of Support
- NBK: Value of Linkage Weight
- TNB : Total Amount of Weight
- FKK : Key Success Factors



Fig.2: Field of Strength Development of Cassava-Based Local Food Home Industry in Situbondo Regency

Figure 2 describes the direction and value of each driving factors as well as the inhibiting factors for the development of cassava-based local food home industryin Situbondo. The length of the arrow indicates the magnitude of TNB from each factor. Meanwhile, the direction of the arrow is the tug between the inhibiting factor and the driving factor.

The total value of the driving TNB was 6.61 while the total value of the inhibiting TNB was 6.84. Driving TNB is smaller than inhibitingTNB. Based on the strength field values, it infers that the activities of developing cassavabased local food home industryfaced with several obstacles that must have a solution.

The strategy focusing the results of the FFA analysis indicates that the key strengths or selected driving have been focused on the stated goals, namely for the development of a home industry of cassava-based local food. The driving force chosen was the availability of raw materials. The focus of development is to increase the productivity and quality of raw materials that maintain the continuity of raw material availability. However, attention to the availability of raw materials must be balanced by price guarantees that benefit farmers. Whereas for FKK, the obstacle is the weak involvement of farmers as suppliers of raw materials, so it needs to be directed at the pattern of cooperation between entrepreneurs (Home Industries) with farmers producing raw materials.

The formulation of this strategy must concern the compatibility of the optimization of the driving key to the improvement of the inhibiting key. This means that if the driving key and inhibiting key are chosen more than one, then the preparation of the strategy must concern about the compatibility of the combination of each factor to achieve the objectives to be achieved. Based on the selected driving FKK and inhibiting FKK, the strategies can be developed for the enlargement of a cassava-based local food home industry in Situbondo, specifically "Empowerment Directed to Empower Each Other between Farmers and Entrepreneurs (Home Industry) Through Partnerships".

IV. CONCLUSIONS

- 1. Based on the area of cassava plants in Situbondo, Arjasasub-district has the largest area of 332Ha with the production of 37,271 Kw which is then followed by Sumbermalang District with an area of 31 Ha with a production of 3,957 Kw. From the LQ calculation, the average LQ value of each sub-district was 8.06 and 4.48.
- Local food-based processed products made from cassava have value-added and vary in profitability. This variation is strongly influenced by factors of ability, production capacity in one production process, use of costs and pricing.
- 3. The strategy for the development of cassava-based local food home industries in Situbondo Regency is "Empowerment Directed to Empower Each Other between Farmers and Entrepreneurs (Home Industry) Through Partnerships".

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Factors that Interfere in the Mental Health of undergraduate Students

Sara Falção de Sousa^{1,*}, Vinicius Batista Tavares de Oliveira², Carmem Bandeira Soares², Aline Matos de Carvalho Berto³, Andreisa Prieb⁴, Eros Silva Claúdio³, Jaqueline Cibene Moreira Borges⁵, Larlla Veruska Arrates Pires³, Millena Pereira Xavier⁶, Natallia Moreira Lopes Leão⁶, Saulo José de Lima Júnior⁶, Vanderson Ramos Mafra⁶, Yara Silveira⁶

¹Teacher at the University of Gurupi, UnirG, Av. Rio de Janeiro, Nº 1585 - St. Central, Gurupi, 77403-090, Tocantins, Brazil ²Pharmacy student, Unirg, Av. Rio de Janeiro, Nº 1585 - St. Central, Gurupi, 77403-090, Tocantins, Brazil

³Teacher at the University of Gurupi, Unirg, Av. Rio de Janeiro, Nº 1585 - St. Central, Gurupi, 77403-090, Tocantins, Brazil ⁴Medical student at the University of Gurupi, Unirg, Av. Rio de Janeiro, Nº 1585 - St. Central, Gurupi, 77403-090, Tocantins, Brazil ⁵Pharmacist and teacher at the University of Gurupi, Unirg, Av. Rio de Janeiro, N° 1585 - St. Central, Gurupi, 77403-090, Tocantins, Brazil

⁶Pharmacist, Unirg, Av. Rio de Janeiro, Nº 1585 - St. Central, Gurupi, 77403-090, Tocantins, Brazil

*Corresponding Author: Sara Falcão de Sousa

Abstract—Target audience who immediately consider psychotropics are academics, often because the university environment is conducive to numerous risk factors. To make a bibliographic review of the factors that interfere in the mental health of undergraduate students. Was a consultation of scientific production in national journals, theses, dissertations, articles, and academic books. For a better understanding of the factors that are: stress, depression, smoking, unemployment, unbalanced eating habits, and physical inactivity. The importance of the existence of psychological support service to meet social and emotional demand, through which it may be able to manifest itself early and become aware that it can come to a face them.

Keywords—Mental health, Psychotropic, Self-medication.

I. **INTRODUCTION**

The most common mental health problems in adolescents and adults attending higher education are stress, depression, alcoholism, smoking, unemployment, unbalanced eating habits and physical inactivity [1].

Self-medication is a risky system of personal care in response to symptoms. There are several factors that can contribute to the definitive "irrational" practices of the use of medicines by individuals or populations, arising from sometimes by self-knowledge or even by promotional strategies of the industry pharmaceutical [2].

Silva et al. (2018) [3] state that, in relation to the cultural level, a higher self-medication index among individuals with a complete first degree. Probably because of the illiterate subject themselves to public service. Certainly, individuals with a higher cultural level usually

seek medical assistance or possibly cover up these practices.

Psychotropic drugs, according to the World Health Organization (WHO), are substances that act in the central nervous system, and that are responsible for producing behavioral changes, altering the mood, attention, and perception of the individual. The use of psychotropic drugs, especially antidepressants, has increased considerably, due to the improvement in diagnoses of psychiatric disorders, the appearance of new drugs in the pharmaceutical market and new therapeutic indications of existing psychotropic drugs. These drugs are chemicals that act on psychological function and alter mental status, including drugs with an antidepressant, hallucinogenic and/or tranquilizer actions. Having excellent results in improving patient diagnosis [4].

Target audience that significantly consumes these psychotropic drugs are academics, often because that the university environment is conducive to risk factors such as stress, depression, anxiety, alcoholism, smoking, among others, which lead to population to consume these drugs and may lead university students to engage in behaviors that compromise health [5].

With this, this study aimed to show the factors that interfere with the mental health of undergraduate students.

II. MATERIALS AND METHODS

The present study was based on a bibliographic, descriptive, qualitative review, which had as a source of research the virtual databases Scientific Electronic Library Online (SCIELO), Google Scholar, NCBI PubMed, articles published in newspapers data from the Ministry of Health published in the Health Portal (www.portalsaude.saude.gov.br).

The following descriptors, psychotropic and academic health were used to perform the same: mental

health, psychotropic, and academic health and the inclusion criteria of the articles were those published from 2009 to 2018. After the bibliographic survey, 20 articles were selected according to quality, relevance with the proposed theme and update, and were then used for the construction of the present study.

III. RESULTS AND DISCUSSION

The initial enthusiasm of winning a vacancy in the desired course in the entrance exam, causes students to come across a phase of frustrations, caused by the change of everyday habits, difficulty in administering time between an excessive burden of studies and little time for leisure activities, thus being a result of numerous mental disorders. Data show that higher mental distress rates are found among university students compared to young people of the same age who are not in university [6].

The process of adaptation to higher education requires, on the part of some students, strategies that help reduce their sufferings or physical, whether psychological, strategies that are not always healthy behaviors. These unhealthy or risky behaviors are usually the visible part of the set of experiences, experiences, expectations, and disenchantment that some students present throughout their academic journey [7].

A new study was conducted by the American Psychological Association, it was found that more than one-third of first-year college students suffer from psychological disorders. One of the most common problems observed in each of the students analyzed was depression and anxiety disorder [8].

From studies like this, this is believed to be a global mental health issue, as the number of students in need of treatment exceeds the resources of most counseling centers. Considering that university students are a key population to determine a country's economic success, colleges should be urgent in addressing this issue [9].

Today it is considered a challenge for universities to confirm university students for dissemination and subsequent treatment of existing mental disorders or for preventive interventions when there is a high risk of disorders once identified, how to offer services to a very large proportion of these students [10].

To reach the result, [11] and his team analyzed data from the World Health Organization's World Mental Health (WHO) Initiative of World University Students of Mental Health (WHO). In the project, almost

14.000 students from 19 universities in eight countries – Australia, Belgium, Germany, Mexico, Northern Ireland, South Africa, Spain, and the United States – answered questionnaires to assess mental disorders such as depression, anxiety, and panic syndrome. The researchers found that 35% of respondents reported symptoms consistent with at least one mental disorder. Depression was the most common, followed by a generalized anxiety disorder.

This high prevalence is significant not only for the suffering caused at a time of great vital transition,

but also, because it is associated with substantial impairment in academic performance [9].

By achieving sexual maturity, young people and adolescents often seek a range of educational and occupational opportunities, for example, seek to obtain romantic relationships, good physical health, tertiary education, full-time work, a combination of education and work, etc. However, compared to adults, these young people have not yet established a stable life structure and this ends up affecting they are physical and emotional by not taking so much pressure [12].

From studies, researchers realized that stress directly interferes with the quality of the teaching and learning process of students. Several factors for its occurrence are. Thus, it is important to verify the association that exists between these aspects and stress in order to try to reduce it and seek ways to face it [13].

The university public presents a vulnerability to mental illness by constantly going through stressful

events, such as the pressure exerted by family members and teachers, presentation of papers, conducting tests, lack of leisure, sleep deprivation, expectations in relation to the future, thus having a greater chance of developing mood disorders [14].

The abusive use of alcoholic beverages among young people has resulted in the appearance of several problems, among these are sexually transmitted diseases, traffic accidents, unwanted pregnancy, and even behavioral problems. These behaviors are often seen among university health students, thus making it a worrying factor, since they will be in the future influencing their patients to adopt healthy lifestyles [15].

Smoking data among the university population have been the target of several studies. It was found that 26.9% of the academic smokers started the habit before 17-18 years of age, a period where young people are usually starting academic life [6].

A survey on the mental health of the unemployed was found positive relationships between being unemployed and mental health, and it was found that the main feelings that were related were feelings of depression; suffering, frustration, and anguish; irritation, concern, and evaluation [16].

The passage to the academic environment brings with it transformations in food consumption, starting with the exclusion of some of the main meals, later by the intake of poor nutrient foods. It is at this stage of the lives of young academics, that they reveal having time with little time which consequently contributes to young people performing a greater number of meals outside the home, and especially omit their meals or adopt practices feeding swaying as the option for fast foods or low consumption of fruits and vegetables [17].

The entry into academic life brings with it changes that are linked to the teaching-learning model, as well as the routine facing the student. The level of physical activity documented by physical tests or even by own questionnaires represents an important marker of general health, quality of life or even disease risk. It is known that the academic often when joining ceases to practice exercises becoming sedentary. Physical inactivity, along with lifestyle and anxiety and depression levels, is risk factors for the onset or worsening of various diseases, especially chronic degenerative diseases [12].

There are some systems that work with training centers and advice with university students, this timely and effective treatment is important and are considered clinical tools of the internet in which they may be useful to provide treatment to students who they do not seek services on campus or are waiting to be seen. The number of students in need of treatment for these disorders has been increasing more and more, and they end up seeking help from these counseling centers [18].

Cognitive-behavioral therapy (CBT) is a form of psychotherapy that is based on empirical knowledge of psychology. It covers specific and non-specific methods (with regard to mental disorders) that, based on studies on different disorders and psychological knowledge, ultimately have a systematic improvement in the problems treated. This therapy has demonstrated great results and is an attractive option to face the latest challenges based on its low cost and ease of implementation [19].

It is necessary to conduct future research to identify which interventions work best for each type of disorder. For example, some types of depression or anxiety can be treated online therapies, while other disorders, such as the use of illicit substances, may require help in person from a psychologist or other health professional [20].

Therefore, academics use medications, especially psychoactive drugs, with the objective of enhancing performance in graduation, in order to increase grades, to assist in the performance of the tests and to improve attention and memory. Some students showing low graduation performance are labeled as an individual who has some alteration, disability or illness, or at another extreme, well-performing students look for ways to increase their cognitive abilities, thus medicines without proper medical advice. There are also those who have some medical or psychiatric diagnosis and use medications inappropriately. Passenger sufferings and dissatisfactions throughout academic life are labeled as a disease, leading academics to look for ways to "alleviate" these "diseases" they present in the learning process in academia[21].

IV. CONCLUSION

Academic life is considered by many to be a place of intense collection and stress, as well as a period full of ups and downs that directly affect grades, academics of always and physical and psychological health.

It is important to have a psychological support service to meet emotional demand and self-knowledge as necessary because they consider that difficulties can exist from an early age and have been aware that they may face them.

The consumption of medicines among university students is high. However, because these are future health professionals, consumption was expected to be lower and more rationalized. But it seems that it is precisely this greater knowledge that predisposes them to the use of inappropriately.

At the end of all research work, the authors consider it important to have a psychological support service to meet social and emotional demand, because they believe that difficulties may appear early and have been aware that they may come to face them. It was notorious some mental disorders and sufferings presented throughout academic life.

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Effect of Coronavirus disease (COVID-19) to tourism industry

Nashirah Abu Bakar¹, Sofian Rosbi²

¹Islamic Business School, College of Business, University Utara Malaysia, Kedah, Malaysia ²School of Mechatronic Engineering, University Malaysia Perlis, Malaysia

Abstract— The coronavirus disease 2019 (COVID-19) is a new pandemic that spreads primarily through contact with an infected person when they cough or sneeze. The outbreak of COVID-19 is starting in China then spreading to worldwide that contributes to large number of deaths (40,598 deaths, 1st April 2020). The COVID-19 is a disease causes respiratory illness with symptoms such as a cough, fever, and in more severe cases, difficulty breathing. To preventing spreading of this pandemic, many countries implementing lockdown procedure to stopping the chain of infection for this new disease. The government-ordered lockdowns have disrupted life for billions and in the same time creates economic collapse scenario. The country with the most COVID-19 infections reported a record surge in unemployment. Therefore, this research calculates the effect of COVID-19 to tourism industry for affected countries in the worldwide. This study evaluated the impact using supply and demand curve to detect the economic changes in tourism industry. The result shows COVID-19 CREATES panic among public that contributes to lower demand in tourism industry. This is one of effect because of disease spreading including lockdown approach that implemented in current situation. This scenario, contributes to lower demand price by customer. Therefore, according to market equilibrium of supply-demand theory, the price of tourism sector is keep decreasing parallel with decrement in demand. The finding of this study is very important to government in preventing and stopping decrement demand in tourism industry. The government need to introduce a mechanism that economy and in the same time developing anti-virus for COVIC-19. If the action of prevention is not mange properly, the tourism industry will face more decremental effects that creates economic collapse.

Keywords— COVIC-19, Supply-demand curve, Market equilibrium, Tourism industry.

I. INTRODUCTION

Coronavirus disease 2019 (COVID-19) is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). COVID-19 has been traced back on November 2019 by the first case detect in China. COVID-19 defined as an infectious disease caused by a new virus. This virus was spread very fast. As report by World Health Organization (WHO) the total confirmed cases of COVID-19 worldwide are 823,626 cases with 40,598 deaths (1th April 2020) as shown in Figure 1. COVID-19 spreads primarily through contact with an infected person when they cough or sneeze. It also spreads when a person touches a surface or object that has the virus on it, then touches their eyes, nose or mouth. COVID-19 virus can live up to 72 hours.

COVID-19 has given significant impact on the economic development worldwide. With the large-scale quarantines, travel restrictions, and social-distancing measures drive a sharp fall in consumers and business expenditure. This situation was created economic recession globally. However, many efforts have been done by government in order to reduce the spread of COVID-19 virus. For example, a few countries were performing a lockdown approach for movement control order (MCO). The impact of this approach are consumers stay at home, businesses lose revenue and lay off workers and unemployment levels rise sharply.

Besides that, several recommendations were suggested in order to avoid the spread of COVID-19 virus such as frequent hand washing, social distancing (maintaining physical distance from others, especially from those with symptoms), covering coughs and sneezes with a tissue or inner elbow and keeping unwashed hands away from the face. It is also suggested to used masks. This is because until now there is no vaccine or specific antiviral treatment for COVID-19. In hospital, doctors were managed the patients of COVID 19 by involving treatment of symptoms, supportive care, isolation and experimental measures. Therefore, the National Institutes of Health (NIH) mentioned several group that have high risk of developing complications of COVID-19 that are young children, people aged 65 years and above and women who are pregnant.

II. LITERATURE REVIEW

Research regarding COVID-19 suggested that SARS-CoV-2 started by bats before moving into pangolins, and then into humans. Current research concluded that snakes might be the missing link. However, the latest paper refutes this theory, adding more evidence that pangolins are the link. Most scientists agree that bats are a reservoir for SARS-CoV-2. They also agree that to reach humans, the virus needs an intermediate host (Medical News Today, 2020). Centers for Disease Control and Prevention (CDC) are responsible in monitoring the outbreak of a new COVID-19. Figure 1 shows the spreading map of COVID-19 provided by WHO.



Fig.1: COVID-19 spreading map

The first identified of COVID-19 virus is a person from Wuhan, China. Then, this virus has spread worldwide, leading WHO to declare this situation as a pandemic phenomenon, which means this new disease was spread worldwide (Medical News Today, 2020). The symptoms of COVID-19 are varying from person to person that may produce few or no symptoms. However, it can also lead to severe illness and may be fatal. Common symptoms including fever, breathlessness, cough and potential loss of taste or smell. This symptom may take 2–14 days.

COVID-19 can spread from person to person through small droplets from the nose or mouth which are spread when a person with COVID-19 coughs or exhales. These droplets land on objects and surfaces around the person. Other persons then catch COVID-19 by touching these objects or surfaces, then touching their eyes, nose or mouth. Persons can also catch COVID-19 if they breathe in droplets from a person with COVID-19 who coughs out or exhales droplets. Therefore, it is very important to stay more than 1 meter away from a person.

According to WHO (2020) for avoid infection and to slow transmission of COVID-19, persons are encouraged to follow the following suggestions:

• Wash hands regularly with soap and water or clean them with alcohol-based hand rub.

• Maintain at least 1-meter distance between you and others persons coughing or sneezing.

• Avoid touching your face.

• Cover mouth and nose when coughing or sneezing and stay home if you feel unwell.

• Refrain from smoking and other activities that weaken the lungs.

• Practice physical distancing by avoiding unnecessary travel and staying away from large groups of persons.

According to World Health Organization (2020), the highest cases of COVID-19 is United State of America that are 163,199 cases and the second country is Italy with the total cases are 105,792 (2nd April 2020). Thus, it is important for all people to prevent and slow down transmission COVID-19 virus by follow the suggestions by WHO.

The COVID-19 give impact on the demand and supply of the products worldwide. The domestic consumers demand in most countries probable to drop sharply. Demand for food, medical assistance and other essential items may rise, but this would be more than offset by lower demand for non-essential goods such as apparel and various services.

Demand would also fall due to other factors such as foreign buyers delaying or withdrawing orders; tourists, both local and foreign, cancelling trips; and the declines in the stock market which erodes peoples' wealth and their willingness to spend. Lower overall domestic consumer demand will have a negative impact on production and employment. The drop-in consumer demand may have a lower effect in manufacturing, where companies could, if they have access to credit, build up stocks of finished goods rather than reduce production and lay off staff. However, the effects on the small-scale services sector are likely to be dramatic (Khan and Yasmine Khan, 2020).

On the supply side, there are also probable to be disruptions in developing countries, as there may be shortages of imported raw materials and spare parts. However, this is likely to be less of a factor than in developed countries, where long supply chains are now the norm rather than the exception. Moreover, lower fuel prices would help the developing countries, most of who are net importers of energy (Khan and Yasmine Khan, 2020). Therefore, this study will focus on the effect of COVID-19 into demand and supply for tourism industry.

III. ANALYSIS OF SUPPLY AND DEMAND CURVE

The effect of COVID-19 to tourism industry is evaluated using supply and demand curve. The demand function is developed using a few parameters namely tastes and preference of customers, average income of certain countries, price setting of selected goods, customers expectation, number of buyers and economic and environmental scenario. Demand function is the quantity of a good or service that individuals are willing and able to purchase during a fixed period of time. Demand function is an algebraic expression that shows the functional relationship between the demand for a commodity and its various determinants affecting it.

Meanwhile, supply function is determined by important factors namely resource price, production techniques, price of related goods, price expectations, supply stocks and numbers of sellers. A supply function is a mathematical expression of the relationship between quantity demanded of a product with price considering supplier perspective. In economics, supply during a given period of time means the quantities of goods which are offered for sale at particular price. Hence, the supply of a commodity is defined as the amount of that commodity which a seller (or producer) are able and willing to offer for sale at a particular price during a certain period of time.

Figure 2 shows supply and demand curve for tourism industry in market equilibrium condition. The market equilibrium shows the offer price is 50 with offered quantity is 50 (point A). Market equilibrium is a market state where the supply in the market is equal to the demand in the market. The equilibrium price is the price of a good or service when the supply of it is equal to the demand for it in the market. In economics, economic equilibrium is a situation in which economic forces such as supply and demand are balanced and in the absence of external influences the values of economic variables will not change. When the supply and demand curves intersect, the This is where the quantity market is in equilibrium. demanded and quantity supplied are equal. The corresponding price is the equilibrium price or marketclearing price, the quantity is the equilibrium quantity.



Fig.2: Demand and supply in market equilibrium

In year 2019, COVID-19 has changed the economic landscape with large spreading area involving many countries in worldwide. In the same time, spreading of COVID-19, creates pandemic that contributes to slowing down economic activities in certain country. This scenario will contribute to economic collapse if not handle by proper management approach.

The new coronavirus disease continues to spread around the world, prompting governments to step up efforts to reducing the spread of the disease. The COVID-19 spreads from person to person in close proximity, similar to other respiratory illnesses, such as the flu. The droplets of bodily fluids from an infected person are dispersed in the air or on surfaces by coughing or sneezing. These droplets can come into direct contact with other persons or can infect those who pick them up by touching infected surfaces and then their face.

On March 11 in year 2020, the World Health Organization (WHO) characterized the new coronavirus as a pandemic. Until 1^{st} April 2020, the confirmed cases are 823,626 with spreading to 205 territories. The pandemic also 40, 598 deaths as reported by WHO.

Figure 3 shows the changes of market equilibrium after the decrement shift in demand function. The new market equilibrium is with equilibrium price is 40 and equilibrium quantity is 40 that represented as point B. Comparing to normal market equilibrium in Figure 1, the new market equilibrium shows a decrease value in equilibrium price and equilibrium quantity of the shift in demand function due to outbreak of COVID-19.

Price elasticity of demand is an economic measure of the change in the quantity demanded or purchased of a product in relation to its price change. The price elasticity for tourism industry is generally calculated using Equation (1).

$$PE_{D} = \frac{\% \Delta Q}{\% \Lambda P} \quad (1)$$

In Equation (1), the parameters are described as follows:

 PE_{D} : Price elasticity of demand,

 ΔQ : Percentages of changes in quantity demanded,

 $\&\Delta P$: Percentages of changes in price.

Changes in quantity demanded,



Fig.3: Reduced demand of market equilibrium

Changes in price,

$$\%\Delta P = \frac{P_2 - P_1}{P_1} = \frac{40 - 50}{50} \times 100\% = -20\%$$

Therefore, the price elasticity of demand for tourism industry is:

$$PE_D = \frac{-20\%}{-20\%} = 1.0 \dots (3)$$

The value of price elasticity for tourism industry is 1.0 which indicates price moves cause substantial changes in its demand.

IV. CONCLUSION

The coronavirus disease (COVID-19) is a new pandemic that affected worldwide human population. The COVID-19 is caused by the virus severe acute respiratory syndrome coronavirus. The disease is primarily spread between human through respiratory droplets from coughs and sneezes. The spreading of COVID-19 contributes to large number of deaths (40,598 deaths by 1st April 2020). The spreading of this pandemic creates panic among public that contribute to decrement trend in tourism industry. This project evaluated the impact of COVID-19 to tourism industry using demand and supply curve. Result shows, the decrement in demand function creates decrement in equilibrium price offered and equilibrium quantity supplied. The price elasticity of demand for tourism industry is 1.0. This value indicates the price elasticity is in elastic range.

The significant of this study is, the mathematical modelling helps government to manage the dynamic behavior of economic sector in tourism industry. In the same time, government policy need to address a proper solution in preventing the spreading of COVID-19 and elevating the status of economy activity in tourism industry.

Further study can be extended to analysis the forecasting of total accumulation cases for COVID-19. In the same time, the awareness of disease management COVID-19 among public also one of interesting research topic.

ACKNOWLEDGEMENTS

The authors would like to thank Institute for Management and Business Research (IMBRe) of Universiti Utara Malaysia (UUM) for their financial support under research grant scheme "Case Study Research Grant" SO code number 14501.

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Environmental and Social Impacts of Urban and Rural Water areas intercepting the BR 277 (Km 493 to 730) Concerning the Transport of Hazardous Products

Juliana Bento¹, Irene Carniatto², Vanessa Cristina Zamban ³, Laura Alpe Coppetti⁴, Aline Costa Gonzalez⁵

²Adjunct Professor of the Programa de Pós-Graduação em Desenvolvimento Rural Sustentável – PPGDRS da Universidade Estadual do Oeste do Paraná – UNIOESTE - Campus de Marechal Cândido Rondon-PR, and Professor of the Colegiado de Ciências Biológicas da Universidade - Campus de Cascavel-PR, Brasil

³Master in Sustainable Rural Development pelo Programa de Pós-Graduação em Desenvolvimento Rural Sustentável – PPGDRS da Universidade Estadual do Oeste do Paraná – UNIOESTE – Campus Marechal Cândido Rondon, PR, Brasil

⁴Master's Degree student pelo Programa de Pós-Graduação em Engenharia e Tecnologia Ambiental da Universidade Federal do Paraná – Setor Palotina, PR, Brasil. Email: lauraalpecop@gmail.com

⁵Doctoral student of the Programa de Pós-Graduação em Desenvolvimento Rural Sustentável – PPGDRS da Universidade Estadual do Oeste do Paraná – UNIOESTE - Campus de Marechal Cândido Rondon-PR, Brasil

Abstract— The BR-277 is one of the main routes for several products, including hazardous products, causing great concern due to the problems they can cause to the population and the environment in case of an accident. The section of the highway that connects Guaraniaçu to Foz do Iguaçu is in an essential hydrographic region with three main watersheds for the state: the Piquiri, Lower Iguazu and Paraná 3 basins. The study was a survey from 2013 to 2017 of traffic and accidents involving the transportation of hazardous products in 209 kilometers, in the stretch from km 493 to 730 of BR-277 (Guaraniaçu to Foz do Iguaçu), highlighting the socio-environmental impacts to the urban and rural sources that they can cause in the event of accidents. The data was qualitatively analyzed and presented in graphs. The road administrators provided the traffic data, classes, and collisions with hazardous products. The percent of hazardous cargoes was 27 in 2013; 21 in 2014; 15 in 2015; 19 in 2016; and 18 in 2017 — Summing 27501 hazardous cargos for the period. The most transported products were flammable liquids, gases, hazardous, and corrosive substances. There were nine accidents with dangerous products in the stretch, the km 584 showed the highest accident record, with 414 accidents in 5 years. Due to high road haulage, traffic, and the number of accidents in the region, preventive and mitigating measures must be taken. Such as accident risk training for public and private managers and employees working with this type of transportation and reinforcement of the signaling of critical and water source areas.

Keywords—Accidents prevention, Contamination of Water Resources, Hazardous loads.

I. INTRODUCTION

One of the main highways in Brazil and the state of Paraná is BR-277, which, together with BR 369 and 467, are strategic routes for the transfer of products and grains to other states and countries (Der, 2019). It has a length of 730 km, beginning at the Port of Paranaguá and ending at the Friendship Bridge, in Foz do Iguaçu. It is of high strategic relevance as it connects Brazil with the Argentine and Paraguayan border.

Thus, constituting a vital route of connection between Mercosur countries and playing a significant role in the flow of agricultural products produced in the state of Paraná and directed to exports and imports (Balbo et al., 2011).

¹ Master in Sustainable Rural Development pelo Programa de Pós-Graduação em Desenvolvimento Rural Sustentável – PPGDRS da Universidade Estadual do Oeste do Paraná – UNIOESTE – Campus Marechal Cândido Rondon, PR, Brasil.

For this reason, the highway has heavy traffic of the road, being the most used means for the transportation of both passenger and cargo vehicles, and maybe products and inputs for agricultural, livestock, commercial, and industrial activities.

The state of Paraná presented a gross domestic product (GDP) value in 2013 of R \$ 333,481 million, an increase of 17% five years later. Thus, in 2017 was recorded a GDP of 421,914 R \$ million and of these, 22% corresponds to agricultural and agricultural activities (Ipardes, 2018).

In 2017 in the state, 19,829,990 tons (tons) of soybeans, 18,225,121 tons of corn, and 2,225,344 tons of wheat were produced (Ipardes, 2019). One of the regions of the state that stands out in the production of these grains is the western region, which due to the growth and modernization of these agricultural activities, in recent years has intensified the production and marketing of these grains (Reis, 2017). In 2017, production in the region was 3,788,757 tons of soybeans, 4,748,065 tons of corn, and 231,429 tons of wheat.

Thus, the demand for agricultural and agricultural products increased significantly, to meet the structure of the region's agro-industrial production matrix, leading to the growth of infrastructure and urbanization, contributing to the expansion and offer of services associated with the transportation of these products (Corrêa, 2009).

BR-277 has become a strategic route from an economic point of view, is one of the main ways for the flow and distribution of agricultural inputs such as fertilizers, fungicides, pesticides, and herbicides used in plantations (Reis, 2017).

In addition to the transportation of agricultural products, another demand in the region is chemicals, due to its industrial expansion, contributing to regional development, it is estimated that 26% of Parana's GDP originates from its industrial activities (Wongtschowski, 2012; Ipardes, 2018). Thus, as the demand for these products increases, so does their transportation traffic, which, due to their physical and chemical characteristics, may be considered dangerous.

According to the resolution of the National Land Transportation Agency (ANTT) No. 420/04, it is called dangerous products, all substances, or articles found in nature or produced by any process that, due to their physical and chemical characteristics, pose a health risk, for public safety or the environment. Thus, a product is classified as dangerous because of its characteristics and its transport. The United Nations (UN) has adopted technical criteria for its classification based on its physical, chemical, and toxicological properties, such as pressure, temperature, toxicity, corrosivity, radioactivity, flammability, explosiveness, infectives. These aspects also help in identification at the moment of transportation (Teixeira, 2010).

The transport of these substances cannot be treated as any other goods, since in the event of accidents or collisions with vehicles carrying hazardous cargo, in addition to the loss of life and material damage that usually occurs, this extends to severe environmental damage, such as contamination of water bodies and soil (Rechkoska, Rechoski; Georgioska, 2012).

The highways are intercepted by water bodies, permanent preservation areas, and legal reserves, as well as surrounding rural, indigenous, and riverside communities. Thus, rivers near highways are generally used for public supply. Accidents with hazardous products near waterways can cause severe environmental damage and may have several effects, spreading through the contamination of these water bodies, compromising their natural characteristics and surroundings, and harming individuals who depend in some way on this resource (Canto, 2014).

Thus, there is a concern regarding the social and environmental impacts that accidents with dangerous products can cause, on ecological and social risks and vulnerabilities of water resources, which are presented in studies by Martínez-Alegría; Ordóñez; Taboada(2003), Bubbico; Di Cave and Mazzarotta (2004), Nardocci and Leal (2006), Pedro and Costa (2009), Souza (2009), Teixeira (2010), Balbo et al. (2011), Beltrami; Freitas et al. (2013), Andrade (2016), Cordeiro et al.(2016), Tinoco; Nodari and Pereira (2016), Machado et al. (2017), Siqueira et al. (2017), Machado et al. (2018), Troglio et al. (2018).

The BR 277 stretch from kilometer (km) 493 (Guaraniaçu) to km 730 (Foz do Iguaçu), is a crucial hydrographic region known as the watershed of three relevant watersheds of the Paraná state, the Piquiri basin, do Baixo Iguaçu and Paraná 3, where they have water sources close to the highway, which has intense road traffic. Therefore, the objective of this study was to conduct a survey of traffic and accidents that occurred with the transportation of dangerous products along the BR 277 (Guaraniaçu to Foz do Iguaçu) stretch, highlighting the social and environmental impacts that can cause, in case of accidents, to urban and rural springs.

II. METHODOLOGY

2.1 Area of study

It contemplated the stretch of the survey, from Km 493 to 730 of BR-277, between the cities of Guaraniaçu to Foz do Iguaçu, located in western Paraná. We considered 209 km and the coverage of 11 municipalities, namely: Guaraniaçu, Ibema, Catanduvas, Rattlesnake, Santa Tereza do Oeste, Blue Sky, Matelândia, Medianeira, São Miguel do Iguaçu, Santa Terezinha de Itaipu and Foz do Iguaçu. The chosen route was due to the vast and vital hydrographic region, which is close to the BR-277 highway, as shown in figure 1 — Area of water dividers between three critical watersheds: Paraná 3, Baixo Iguaçu and Piquiri (Covatti, 2006), (Figure 1).



Fig. 1: Study area excerpt KM 493 A 730 from BR 277 (Guaraniaçu to Foz do Iguaçu, Paraná) SOURCE: The authors 2018.

2.2 Data Analysis

Data for all vehicles that circulated, transporting hazardous products, through the three toll plazas along the study stretch, referring to the two-way (east/west) and (west/east) of the state, were acquired through of the concessionaire that manages the road. Thus, the traffic of hazardous products during the period from 2013 to 2017 then, analyzed qualitatively and presented through graphs, for a better understanding of the results.

Thus, the main classes of hazardous products that had the most circulation in the stretch and those with low traffic were listed, such as 1 (explosives), 4 (flammable solids), 5 (oxidizing substances and organic peroxide) and 6 (toxic and infectious substances), which have been grouped and presented in others. There were no records of classes 7 and 8. These classes are defined by the United Nations (UN) (based on their physical and chemical characteristics that can cause damage to the environment and the health of the population. According to ANTT 420/04, a product or article is considered to be hazardous to transport when it falls within at least one of the new hazardous product classes.

Thus, it was possible to identify four of the nine classes presented above, which refer to class 2 (gases), class 3 (flammable liquids), class 8 (corrosive substances), and class 9 (miscellaneous hazardous substances).

For the composition of the mapping of the critical points of the stretch, in which a more significant number of general accidents were registered, the database of the Superintendence of Water Resources Development and Enviroment Sanitation (2007) was used to delimit the watersheds and their hydrographic network; for the limit of the municipalities, the Brazilian Institute of Geography and Statistics (2015); For the delimitation of the highway, the base of the National Department of Transport Infrastructure (2015) was used.

Thus, it was possible to identify four of the nine classes presented above, which refer to class 2 (gases), class 3 (flammable liquids), class 8 (corrosive substances), and class 9 (miscellaneous hazardous substances).

In the QGIS Software 2.18, the map was prepared, which through the coordinates and the accident numbers, it was possible to highlight the critical points with the highest occurrences of accidents and mark the locations, where there were accidents with dangerous products. With the help of bibliographic references, the possible social and environmental impacts were listed

III. RESULTS AND DISCUSSION

3.1 Dangerous Cargo Traffic

From traffic data, we observed that from 2013 to 2017, a total of 27,501 hazardous cargoes were trafficked in the analyzed segment (Graph 1).



Graph 1: Dangerous cargo flow 2013-2017 from KM 493 to 730 of BR-277(Guaraniaçu to Foz do Iguaçu,Paraná).

Source: The Authors (2018)

Graph 1 shows that in 2013 about 27% of the total value was registered; in 2014, 21% were recorded, in 2015 (15%), in 2016 (19%), and 2017 (18%).

The reduction from 2013 to 2014 is due to the installation of the automatic payment gate service at the tolls, as these automatic gateways do not register the vehicle and its cargo, and only record the monetary value of its passage at the toll booth. This type of system failure, which does not record the license plate, description, and types of loads they carry, leads to underreporting of the actual number of vehicles carrying dangerous goods, which may be much higher. Therefore, it is estimated that the values shown in the graph could be higher.

Another point raised was that the year 2015 had a low value compared to other years, this is probably due to the economic crisis that Brazil has been experiencing in recent years, according to the National Transport Confederation (CNT) (2017). The 2015 crisis impacted all productive activities, in which investments in both infrastructure and sectors were reduced. In that year, Gross Domestic Product (GDP) fell by 3.8%, and in 2016 there was another decrease of -3.6%. Thus, all segments of the economy (agriculture, industry, and services) had negative records in this period. Barbosa Filho (2017) demonstrates in his study that in 2015 Brazil went through what is called the "sustainability crisis" due to the series of shocks between supply and demand, caused mostly by errors of public management. Thus affecting the GDP and directly affecting the economic sectors.

Graph 2 shows traffic related to the transportation of various hazardous products, which are conducted daily on the stretch of BR-277 that connects Guaraniaçu to Foz do Iguaçu.



Graphic 2: Classes of Dangerous Goods Transported from KM 493 to 730 of BR-277 (Guaraniaçu to Foz do Iguaçu, Paraná).

Source: The Authors (2018)

Thus, it was possible to identify four of the nine classes presented above, which refer to class 2 (gases), class 3(flammable liquids), class 8 (corrosive substances), and class 9 (miscellaneous hazardous substances).

The most transported class was 3, which refers to flammable liquids, i.e., fuels such as gasoline, ethanol, and diesel oil. Over the five years analyzed, a total of 16,793 hazardous cargoes were obtained. In 2013 they were 32%, 2014 (24%), 2015 (15%), 2016 (16%) and 2017 (13%). This frequency is due to the great demand for numerous activities that this type of product has, such as the supply of cars, trucks, and other equipment, as well as its use in industrial and agricultural activities (Pedro; Costa, 2009).

The second most transported class was 9, which refers to hazardous substances totaling 4980 loads. In 2013 there was 14%; in 2014 (15%), in 2015 (16%), in 2016, there was an increase to 26%, and in 2017 the record was 30%. Pesticides such as herbicides, fungicides, among others, fall into this class. Data released by the Parana State Pesticides Trade and Use Monitoring System (SIAGRO, 2019) showed that the total pesticides marketed in 2013 was 7,214,300 tons and in 2017, 5,067,300 tons in the 11 municipalities covering the study area.

These data, in comparison to the transport of class 9, contradict, since observing figure 3, it can be noticed that there was a smaller flow of dangerous cargoes in 2013 and more significant in 2017. However, it is worth mentioning BR-277 is used as a corridor for the neighboring countries of Mercosul, so these numbers of increased class 9 flow, should refer to imports of these types of products.

Class 2 was the third class with the most transport, which corresponds to gases that are substances that, due to their physical state, move freely, thus expanding indefinitely, occupying the entire environment, even when having different air densities and may present hazards such as being flammable, toxic and corrosive (Cetesb, 2018).

One of the most traded is Liquefied Petroleum Gas (LPG), which is used as a raw material in various segments, such as domestic (cooking gas), as fuel, commercial, and industrial use. 4.423 cargoes were transported during the five years. In 2013 there were 31%, in 2014 (21%), for the period from 2015 to 2017 maintained 16% each year.

Class 8 includes corrosive substances, which have properties known as acids and bases, such as sulfuric acid, hydrochloric acid, nitric acid, sodium hydroxide, potassium hydroxide, among others. Occurrences involving acids or bases that reach water bodies may cause changes in pH and conductivity. Besides, contact with these products causes burns, damage to living tissue, and death of aquatic organisms, depending on the severity of contamination (Gouveia et al. 2014; Cetesb, 2018).

However, it was the class that had the lowest number of records compared to the others, totaling 649 loads in five years. It is that in 2013 was 23% in 2014 (25%) 2015 (16%) 2016 (23%) and 2017 (13%) of the product transported loads.

However, the other "classes 1 (explosives), 4 (flammable solids), 5 (oxidizing substances and organic peroxide) and 6 (toxic and infecting substances)", which had lower traffic were grouped into others. Thus, represented in graph 3, the total record of the five years was 656 loads. Of the total in 2013 and 2014, 15% were transported, in 2015 (11%), in 2016 (17%) and in 2017 there was a 42% increase, due to neighboring countries, especially Paraguay, where Foz do Iguaçu border region has been developing an industrial hub, thus increasing the demand for chemicals.



Graph 3. The flow of the other classes carried in the stretch of KM 493 A 730 of BR-277 (Guaraniaçu to Foz do Iguaçu, Paraná).

SOURCE: The authors (2018)

3.2 Accidents with dangerous goods transport

The analysis of the general accidents showed that in the surveyed segment, 7,233 records occurred from January 2013 to December 2017. In Table 3, it is possible to observe the kilometers that can be considered critical points, because it shows a higher number of occurrences

Table 3: Points of higher occurrence of accidents in the study stretch.

KM	2013	2014	2015	2016	2017	Total
584	91	93	90	60	80	414
725	58	57	35	55	40	245
723	46	50	31	43	34	204
726	38	47	30	38	34	187

586	36	38	28	31	34	167
TOTAL	269	285	214	227	222	1217

Source: Ecocatarates, 2019.

According to statistics released by the State Coordination of Protection and Civil Defense of Paraná (2019) from 2013 to 2017, there were 111 occurrences of accidents with dangerous products in the state. There were nine registrations with vehicles that transported dangerous products during the period in the study stretch.

The km 584 where the clover cataracts are located is a vital connecting corridor between BRs - 163, 467, 369, and 277. In addition to giving access to the municipality of Cascavel, in the five years were reported 414 incidents in the place. With hazardous products in this location, had a record in 2013, with diesel.

In 2014 there was a record in km 602, according to the service agencies, were approximately 30 thousand liters of spilled diesel oil, whose area of influence is the São Francisco River basin, which is not part of the Cascavel water abstraction. Thus, the water supply was not affected, even though the product reached 25 km away from the accident site and could have contaminated other rivers, which are part of the Paraná basin 3; however, there were no reports after it occurred. The responsible environmental agency fined the fuel network.

In light of Law No. 9,605 of February 12, 1998 (Brasil, 1998), which provides for criminal and administrative sanctions arising from conduct and activities that are harmful to the environment, Article 54 states that, to cause pollution of any kind at such levels as to result or damage to human health or causing the death of animals or significant destruction of the flora, will have a detention sentence of six months to a year and a fine if the crime causes water pollution that makes it necessary to interrupt public supply of water from a community.

Thus, diesel oil, due to its molecular weight and its constituents, presents itself as less volatile and less watersoluble, with reduced mobility, different from gasoline and its components (Finotti; Caicedo; Rodriguez, 2001). The impacts that this product can cause was demonstrated by Freitas et al. (2013), with the changes that *Danio rerio* fish suffered when exposed to high concentrations of diesel and gasoline, showing changes in their physiology as aneurysm, respiratory epithelial cell necrosis and consequently other lesions, demonstrating the high toxicity of these fuels — Exposing the risks of these substances to human and animal health and the environment.

Another accident happened in 2017, at km 587, where it is a point that has springs near the BR, besides the presence

of Paulo Gorski Ecological Park. The transported product was characterized as batteries containing liquid acid. This type of material is part of class 8 - corrosive substances, ie, corrosive liquids, including soluble ones, can alter water conditions and can significantly decrease or increase its pH, thus making it difficult for many organisms to survive (Lew, 2008; RAO, 2008).

At km 645, near Blue Sky, in 2013, the truck transported about 16 thousand liters of gasoline, whose three thousand liters of fuel spilled on the highway. Already in 2014, at km 546 in Catanduvas, there was an accident with aviation kerosene, both products are included in class 3 of flammable liquids.

Finotti; Caicedo; Rodriguez (2001) presented in their research the effects of gasoline constituents, namely: Benzene, Toluene, Ethylbenzene, and Xylene, known as BTEX, which are monoaromatic hydrocarbons classified as hazardous. The author classifies benzene as carcinogenic, while toluene, ethylbenzene, and xylene are classified as toxic. These gasoline constituents have higher water solubility, so in case of accidents near water bodies, besides contaminating the surface part, it can also reach the water table easily.

Arcuri et al. (2012) demonstrated in their study the consequences that gasoline constituents can have on human health and contact with the substance or inhalation causes several short to long term damages. It highlights some, such as central nervous system depression and neurobehavioral, hematological, neoplastic, and mutagenic changes.

Also, two pesticide accidents were recorded in 2017; one was at km 697 located near the municipality of São Miguel do Iguaçu, which product was Poison Megaxan 75 wg powder and the other was with ethyl dichlorophosphate at km 659, in the urban area of Matelândia. Vehicles transporting these products in urban areas, agricultural areas, or near environmental preservation areas were found to be susceptible to accidents, and, depending on the product being transported, leakage may occur.

Once spilled, this product can be carried into water resources, contaminating them, thereby disrupting public supply to the population. This problem is intensified in municipalities that have only a source of water supply, because in case of leakage of such hazardous products, this will lead to water scarcity to the population, bringing with it various social and environmental problems and health, as well as, losses in industry, commerce, and agriculture, either due to lack of water or contamination (Siqueira, 2016). In this sense, Scucato (2008) mentions that pesticides can be persistent, mobile, and toxic in soil, water, and air. In addition to being accumulators in the ground and biota, whose residues can reach surface waters, runoff, and groundwater by leaching. Thus, an accident with this type of product can cause damage to the health of the population, such as contact poisoning or the consumption of food contaminated by pesticide residues that are difficult to measure. In the case of chronic intoxication, it can manifest itself through paralytic diseases and neoplasms.

In 2014, besides the accidents already presented, there were two more, one in km 543, near the city of Ibema with explosive product, but it was not specified what type of product and in km 526 in Guaraniaçu, with a vehicle that carried asphalt emulsion, which is considered a hazardous substance as it is a mixture of various compounds and usually has kerosene in its composition. Thus, the spillage of this product can lead to reduced dissolved oxygen levels in water resources, with the possibility of a film-forming on the water surface, causing the death of aquatic organisms (Petrobras, 2019).

Therefore, water bodies are more susceptible to environmental damage, as it is complicated to control the risks and impossible to predict the place and time of these accidents (Viana, 2009). These accidents have serious consequences, such as injuries and deaths, high property damage, traffic stoppage, environmental impact on soil, air, and water, as well as damage to fauna and flora, which can last for years (Santos; Góis, 2011).

3.3 Critical points of the study excerpt

In figure 2, we observe the critical aspects, which were considered places that had the highest incidence of general accidents and are indicated by the red circle. They are located at intersections of the highways with other BR or marginal roads. Thus, of the five points, two are located in the municipality of Cascavel, km 584, where is located the Clover Falls, with a record of 414 accidents and km 586, which is the intersection of Bairro Cascavel Velho, with 167 accidents. The other critical points are located in the municipality of Foz do Iguaçu, in the following locations: km 725 (245 accidents), 723 (204 accidents), and 726 (187 accidents). Hazardous product incidents were recorded at five critical points and one near km 586.



Fig.2: Area of occurrence of accidents with dangerous loads of km 493 to 730 of BR-277 (Guaraniaçu to Foz do Iguaçu, Paraná).

Source: The authors, 2019

Beltrami, Freitas and Machado (2012) analyzed data from the sectors of the National Secretariat of Civil Defense, the Ministry of Environment and the Ministry of Health on accidents with hazardous products, from 2006 to 2009. Thus, reported that the total number of occurrences in four years was 3,601, resulting in an average of 900 hazardous product accidents per year and 75 per month. In the state of Paraná alone, there were 275 occurrences in this same period.

The author also points out that even a state that has an organized Civil Defense structure, in case of accidents with dangerous products, does not have the data registered in the national system.

The Brazilian Institute of Environment and Renewable Natural Resources (IBAMA)has a system on environmental accidents; however, the last report was issued in 2014, and in nine years, 4713 environmental disasters were registered in the Brazilian transport matrix, which predominates by road (this includes the transport of dangerous goods). Thus, accidents with dangerous products on Brazilian highways had their highest number of registrations in 2013, which were 195, totaling 27% and in 2014, whose records were 205, making 28.3% of occurrences (Ibama, 2015).

IV. CONCLUSION

This study demonstrated the need to implement risk management since, in five years, nine accidents caused considerable environmental and social damage.

Thus, conducting studies on vulnerabilities and preventive actions on the highways can help reduce accidents, as well as promote training on the subject, for the companies that perform these transports and also for the managers of the interests, such as the municipal one, environmental and federal, and the strengthening of information and educational campaigns for people who work in the area, especially the carriers that perform this activity.

Finally, there is the need to encourage preventive and mitigating measures such as the improvement of signs and delimitation of the most critical areas, such as those near water sources, proposing structural measures on the highway, for the preservation of watercourses and the restoration of the riparian forest environment.

ACKNOWLEDGEMENTS

The authors thank the CEPED UNIOESTE Center for Education, Research and Extension on Disaster Protection and Opportunity for the development of research, the Sanitation Company of Paraná - SANEPAR for funding, the support of the University Center for Disaster Studies and Research - CEPED/PR and REDESASTRE, to the Development Support Foundation of the State School of Philosophy, Sciences and Letters of Paranaguá of the State University of Paraná FUNESPAR, and Ecocataratas S/A.

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Analyses of Poções and Camalaú weirs after São Francisco's river transposition using morphological process on Sentinel 2 orbital images

Thamires Gil Godoy¹, Daniel José Padovani Ederli¹, Fernando Pontes Baixo¹, Erivaldo Antonio Silva¹, Rogério Galante Negri², Samara Calçado De Azevedo³

² São Paulo State University/UNESP, Sciences and Technology Institute, Department of Environmental Engineering, Campus São José dos Campos – SP 12247-004, Brazil

³ Federal University of Itajuba, Natural Resources Department, Av. BPS 1303, Itajubá – MG 37500-903, Brazil.

Abstract— Brazil suffers from the constant season drought, mainly in the northeast, directly affecting the water supply. Therefore, studies on the causes, effects and solutions have been developed and becoming of great importance for society. The São Francisco river transposition was designed to mitigate the drought supplying weirs along its course. Among them are Poções and Camalaú, located respectively in Monteiro and Camalaú in Paraíba state. In this sense, the paper aims to evaluate the temporal effect of drought on the Poções and Camalaú. Remote sensing images, obtained by Sentinel-2 satellite in four different dates, were used with digital image processing techniques to detect weir's area. Therefore, it was possible to verify the occurrence of a considerable increase of the area and, consequently, of the volume of water after during the first three years of the transposition. However, after a problem with the transposition, a drastic decrease in the flooded area of both weirs occurs. The paper presented an efficient use of digital image processing and Sentinel-2 images to perform a temporal evaluation of flood areas.

Keywords— Camalaú, mathematical morphology, Poções, Sentinel – 2A, temporal evaluation.

I. INTRODUCTION

Brazil, mainly in the northeast region, constantly suffers with the lack of rain. According to Azevedo et al (2018), its in the northeast region that more than 50% of the drought cases registered in Brazil occurs due to the semiarid climate periods of sparse rain.

In this sense, Santos et al (2018) affirms that a semiarid climate region has high rainfall variability, thus needs study about pluvial supply and storage alternatives in the region in a way that ensures better living conditions to the population. One of the alternative means is the Transposition of the São Francisco River.

The drought season is a natural phenomenon that is part of the climate variability of a determined region. Besides that, the occurrence of dry weather in a determined region may cause undesirable impacts on the society, politics and environment. (Carvalho e Alcântra, 2018). It is known that about 57% of Brazil's northeast territory has been intensely utilized in the last decades, resulting in the severe degradation of natural resources (Marengo et al, 2012).

In this sense, after suffering with drought in Ceará, the Engineer Ferreira Filho determined the first possible solution when he suggested to Marco Antônio Macedo, manager of Crato's judicial district, to bring water to his state through São Francisco's river. This history originated the first transposition of São Francisco's river in 1847(FAPESP, 2016). A long the years, many names contributed with the project, however it has only began in 2007 and after twelve years, the constructions have not

¹ São Paulo State University/UNESP, Faculty of Science and Technology and Institute of Science and Technology, Dept. Cartography, 19060-900 Centro Educacional Presidente Prudente, Brazil

finished yet and have already cost to the population approximately R\$ 9.6 billion, twice the initial budget.

The change of the water flow occurs in two stretches, east and north. In the east stretch, the smaller of the stretches, are localized the Poções and Camalaú weirs, at Monteiro and Camalaú cities respectively, both at Paraíba state. These two weirs supply 36 thousand inhabitants. Both weirs mentioned serve as passageway for water to reach Epitácio Pessoa weir, commonly known as Boqueirão. The Boqueirão weir is responsible for supplying approximately 1 million people in nineteen cities.

Nevertheless, in the first semester of 2017, the Boqueirão weir stored only 3.5% of its total capacity. Due to this emergency situation, São Francisco's waters arrived to Monteiro and Camalaú before the constructions ceased at these sites.

In this sense, it was verified the necessity to evaluate the behavior of the weirs of interest along the period in which São Francisco's River transposition began. Therefore, this work proposes a study and an evaluation, through remote sensing image and techniques and digital image processing, to verify the levels of water stored by the weirs of Monteiro and Camalaú before and after the water passage. Thus, this work presents the obtained results of the flooded area in both weirs of interest along the year in which the implementation of the transposition occurred, together with the analysis of the weirs' behavior in the studied period.

II. MATERIALS AND METHODS

Two test sites were selected for the realization of this study; the first test site is in the city of Monteiro and the second in the city of Camalaú. Both test sites have weirs included in the east transposition of São Francisco River, and on March 2017 the weirs started to receive São Francisco's water.

The analyses of the flooded area of Poções and Camalaú, were made utilizing collected data of Sentinel-2 satellite, these data were made available by the USGS (United States Geological Survey) in 2016, in the NIR wavelength with radiometric resolution of 12 bits per pixel and 10 m of spatial resolution.

Considering that São Francisco's waters arrived in the weirs of Poções and Camalaú, due the transposition made in March 2017, some images were selected on the dates of October 2016, November 2017, December 2018 and September 2019.

In the figure 1 there is an explanation of the test sites, referenced in the geodesic system WGS84; on the left side, the weirs of Poções and on the right side the weirs of Camalaú.



Fig. 1: Weirs location

The software Matlab was utilized to perform the processing of the acquired images, so that the extraction of the flooded areas of the studied weirs could have been made. Also, the software Cartomorph, developed in FCT-UNESP, was used to evaluate the results obtained on the extraction of the flooded areas.

III. EXTRACTION METHODOLOGY OF THE WATERBODIES

Aiming to facilitate the distinction of targets presented on images and consequently improve the results of the weirs extraction, the image processing was started with the histogram equalization.

In sequence an empirical binarization of these images was performed, aiming the weirs' segmentation. To do that, the digital number of a random pixel of the target was observed, this specific value is called threshold, and it was determined that the pixels with values above the threshold, would have their maximum digital number, that is, the pixels above the threshold would become white and the pixels below the threshold would become dark.

The next step was the transformation of the image in its opposite, that is do the image negative, in a way that the white pixels become dark pixels and vice versa. This step is necessary for the application of the next step, which is the noise removal.

To perform the noise removal, a function of area opening was applied. I this function a threshold is included that removes areas below the number of pixels specified. In the end of the extraction the weirs areas were calculated, in the chosen dates, considering the spatial resolution of the chosen images.

IV. EXTRACTION ANALYSES METHODOLOGY

Aiming the quality extraction analyses, the metrics completeness and correctness were calculated utilizing the software Cartomorph, as described by Cardim, Silva and Dias (2014). The first step for this study was the manual feature extraction of the eight images, creating like that, the reference images for the statistical calculations, which are considered like ideal results of the extraction performed. Then, it determined a tolerance area around the target, which is going to be considered like a correct area during the comparisons between de reference images with the resulting image of the extraction process.

The comparison is made in two steps. First, the tolerance area is generated around the target in the reference image comparing it with the extracted image. In a second moment, an inverse comparison is made, that is, the reference image is compared with the extracted image increased of the tolerance image. The comparisons described are exemplified, respectively, by figures 2a and 2b.

The tolerance is also generated around the target in the automatically processed image, then, the processed image is compared to the reference image. These are exemplified in figure 2, where 2a represents the total number of reference image points that coincide with the extracted feature and 2b shows the points of the extracted image that coincides with the reference image.



Fig. 2: Exemplification of completeness and correctness metrics

The metric completeness shows in percentage, how many pixels of the reference image were extracted correctly by the extraction method. To calculate this metric the equation 1 was used

$$completeness = \frac{matched \ pixels \ of \ reference \ image \ comparison}{total \ of \ pixels \ of \ the \ reference \ image}, \tag{1}$$

 $correctness = \frac{matched \ pixels \ of \ extracted \ image \ comparison}{total \ number \ of \ pixels \ of \ the \ extracted \ image}$ (2)

The metric correctness shows the percentage of pixels extracted from the image that coincide with the reference image. The calculation of this metric is given by the equation 2.

V. RESULTS AND DISCUSSION

i. Results of the waterbodies extraction

Considering that the raw images have 12 bits of radiometric resolution, it was necessary apply a contrast readjustment on the images to improve visualization and subsequent application of thresholds on them, as shown in figure 3. In addition, the extracted images used for detection of the weir's flooded area are presented in figure 4.

After performing all procedures described in methodology, it were obtained the results shown in figure 4.

Starting from the extraction results, the calculation of the flooded area was made by multiplying the amount of target pixels by the spatial resolution of Sentinel-2 in m².

Tables 1 and 2 show the comparison between the weirs' areas on the studied dates. The total area of the weirs was unknown; therefore, the date with the highest value of the extracted area was adopted as 100%. Therefore, the percentage of flooded area on the other dates, for both weirs, was calculated proportionally to the area adopted as 100%.



Fig. 3: Images of the Poções and Camalaú weirs on the four dates evaluated before the detection of the water bodies

Date	Area (m ²)	Percentage
October 2016	783500	50,90
November 2017	828100	53,79
December 2018	1539400	100
September 2019	801800	52,09
Table.1: Calci	ulated area o	f weir Poções
Date	Area (m ²)	Percentage
October 2016	395700	65,14
November 2017	387700	64,84
December 2018	607500	100
September 2019	296400	48,79

Table.2: Calculated area of weir Camalaú

After applying the weir's extraction methodology, it was examined that in the course of a year, from October 2016 to November 2017, even with the arrival of River São Francisco's waters, it doesn't happen a significant improvement in the flooded area of the two weirs. This happened due the transposition's canal rupture in the previous stretch of the studied area, where it was necessary to diminish the water flow to fix the rupture.

From November 2017 to October 2018, the Poções and Camalaú Weirs stopped receiving water due the resume of the recovery construction, this was necessary so that the weirs could storage the rainwaters safely. However, in November 2018, an inspection made by the Public Federal Ministry and the Public Ministry of Paraiba informed that the construction that receives water from Poções was able to receive water of the São Francisco River's transposition, thus the volume of Poções and Camalaú weirs increased considerably resulting in leakage of water from Poções to Camalaú. This fact can be observed through the extraction of water bodies in December 2018, where it presented the biggest calculated area in four years since the weirs ware analysed.

Already with respect to the period from December 2018 to October 2019, the flooded area has halved on both weirs. This incident happened due to the low water flow to the Poções weir and the shutdown of the lifting station EBV6, which pumps the water from Poções to Camalaú.

ii. Results of extraction analyses

Using the software Cartomorph, with a pixel tolerance, a statistical analysis of the results obtained with the automatic weirs extraction was performed. The table 3 shows the calculated metrics.

Date	Weir	Completeness (%)	Correctness (%)
October	Poções	99,2196	98,9967
2016	Camalaú	99,9998	97,0380
November	Poções	99,9989	92,5363
2017	Camalaú	96,2914	99,1848
December	Poções	99,8154	92,95330
2018	Camalaú	99,4083	98,86826
September	Poções	99,9056	98,19109
2019	Camalaú	98,2565	99,09245

Table.3: Statistical analysis of extraction results

All statistical values obtained were superior to 90%, indicating excellent results for the targets extractions using mathematical morphology and thus validating analysis results of the flooded areas by the weirs in study.



Fig. 4: Images of the Poções and Camalaú weirs on the four dates evaluated after the detection of the water bodies.

VI. CONCLUSIONS

The arriving of São Francisco River to Cariri region, where the weirs are located, happened later than expected and inadequately. Initially the construction would end in 2010, only three years after the beginning of the construction. Although, now a days, in 2019, the project has not been finished yet. Due to the second biggest drought in Boqueirão Weir's history, successor of the studied weirs, and considering the emergency in fueling the nineteen cities that depend of Boqueirão Weir, the water spill in the Poções and Camalaú Weirs was anticipated, that is, the spill occurred before the constructions' ending.

After almost three years of the inauguration, River São Francisco's transposition presents too many canals with seriously structural problems like fissures, sedimentation, vegetation that prejudice the water flow and the improper use of the water with irrigation above the permitted area.

Therefore, it is perceived that the non-supplying of the weirs does not happen only because of constructive factors, but also due an inappropriate use of the water by the people. It is noticeable that after years of planning and execution of the transposition the fundamental thing has not been constructed yet, that is, the social and environmental conscience has not been constructed yet by the state and the population.

ACKNOWLEDGEMENTS

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (CAPES) – Finance code 001, National Council of Scientific Research - CNPq and São Paulo Research Foundation (FAPESP).

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Internation and Stay in the Intensive Care Unit from the Perceptions of Adult Patients

Samara de França Ferreira¹, Nayara Alves de Sousa²,Giovanna Porto dos Santos³, Manoela Gomes da Silva⁴, Priscila d'Almeida Ferreira⁵, Juliana Barros Ferreira⁶, Karine Orrico Góes⁷

^{1,4}Physiotherapist. Graduated from the State University of Southwest Bahia (UESB).

^{2,3}Physiotherapist. PhD by the State University of Santa Cruz (UESC). Adjunct Professor B at the State University of Southwest Bahia (UESB).

⁵Physiotherapist. PhD from the State University of Southwest Bahia (UESB). Adjunct Professor B at the State University of Southwest Bahia (UESB).

⁶Physiotherapist. Master in Health Technologies by the Bahiana School of Medicine and Public Health (EBMSP). Professor at Fainor, FTC and Uninassau.

⁷Physiotherapist. PhD by the State University of Santa Cruz (UESC). Adjunct Professor B at the State University of Southwest Bahia (UESB). Luiz Eduardo Magalhães Avenue, 1000, Icatú block, apartment 502, Candeias neighborhood, Vitória da Conquista-Bahia.

Abstract— Practices in intensive care units (ICUs) are constantly developing in Brazil, knowing the repercussions of an inpatient process is essential for humanized care. This work aims to investigate the perceptions of adult patients regarding their hospitalization and stay in the Intensive Care Unit. This is a descriptive study with a qualitative approach containing a population composed of 20 adult patients aged 18 years or older, hospitalized for at least 24 hours, assisted by physiotherapy while being lucid and oriented. A questionnaire consisting of a closed question referring to sociodemographic data and another open question related to the patient's perception regarding his hospitalization and stay in the ICU was used. The data were analyzed using descriptive statistics, using the Statistical Package for Social Sciencespor (SPSS) software, version 22.0 for Windows. Most patients were female, with a mean age above 53 years, with a predominance of respiratory and cardiovascular diseases. It was found that the patients demonstrated a positive perception in relation to the ICU stay, mainly regarding the care provided by the team, however there are still gaps regarding the functioning of the environment.

Keywords—Intensive Care Unit, perceptions, patients, hospitalizations.

I. INTRODUCTION

Practices in intensive care units (ICUs) are one of the areas of greatest scientific and technological growth in Brazil in recent years (MONDADORI *et al.*,2016). Such advances in multidisciplinary interaction have been directly related to the growth in survival of critically ill patients (FRANÇA *et al.*2012). However, because ICUs are places for intensive care for patients with severe conditions, they are still one of the most aggressive and traumatic hospital environments (LOPES & BRITO, 2009).

Fear, anguish, pain, suffering, insecurity and stress are some of the feelings triggered in the ICU experience (BACKES *et al.*, 2015; PROENÇA & AGNOLO, 2011). The difficulty in preserving patients' privacy, the distance from family life, the presence of physical stresses such as constant noise and light, the cold environment, are among determining factors (SANTUZZI, 2013; TOMÁS, 2018). On the other hand, there is already recognition on the part of patients regarding the assistance provided in intensive care units, which stand out for the continuous, comprehensive care and the humanized care provided by the team (PROENÇA & AGNOLO, 2011).

Currently, discussions about Integrality and Humanization in health care practices have been growing (SALMÓRIA & CAMARGO, 2008). Patients submitted to ICU care need, in addition to pathophysiological care, more attention to the psychosocial factor closely related to physical disease (LOPES & BRITO, 2009). Thus, the perception of patients who had an experience in the ICU is an important parameter for a reliable assessment of how intensive healthcare practices have been manifested, from the users' point of view.

In this context, considering the countless repercussions of hospitalization in intensive care units and the need for advances for effective humanized health care, the purpose of this article is to investigate the perceptions of adult patients regarding their hospitalization and stay in the Therapy Unit Intensive, in order to awaken further discussions on the theme and thus contribute so that improvements can be implemented in the exercise of care, of the hospital services offered and thus minimize or even avoid possible trauma of an inpatient process.

II. METHODS

This research is part of a larger project entitled: "Physiotherapeutic Care and Humanization in Intensive Care Units in a Public Hospital", which was approved by the Ethics and Research Committee of the State University of Southwest Bahia (UESB), according to opinion 3.050.221, on November 30, 2018 by the Ethics and Research Committee of the State University of Southwest Bahia (UESB).

This is a descriptive study, with a qualitative approach, developed in Intensive Care Units (ICUs) 1, 2 and 3 at Hospital Geral Prado Valadares (HGPV), in the municipality of Jequié, in Bahia, from January to October 2019. Such health institution has numerous services, including intensive care units, which serve, in addition to the local population, about 26 neighboring municipalities.

Twenty adult patients participated in this research, hospitalized for at least 24 hours, aged 18 years or over, of both sexes, who had already undergone at least three physical therapy sessions, with preserved oral and / or written verbalization capacity and be lucid and oriented what was assessed using the Glasgow coma scale version updated in 2018.

All subjects signed the Free and Informed Consent Term (ICF), were assured that their data and information would remain confidential and confidential, not allowing their identification, as well as having the right to interrupt their participation in any stage of the research. Patients with reduced level of consciousness and impaired understanding were excluded.

A questionnaire consisting of a closed question on sociodemographic data and an open question related to the patient's perception of his hospitalization and stay in the ICU was used for collection.

The questionnaire was applied through an interview with the patient's bed in the intensive care units, without

The collected data were cataloged and the following categories were established: I) sociodemographic data; II) the patient's perception regarding his hospitalization and stay in the ICU.

About the sociodemographic data, questions were asked about name, age, sex, marital status, education, hospitalization diagnosis, length of stay and physiotherapy sessions. As for the patient's perception, it was argued about how it was going to be to experience hospitalization and stay in the sector.

The analysis of the first category was performed using descriptive statistics and presented as a form of absolute and percentage numbers, using the Statistical Package for Social Sciencespor (SPSS) software, version 22.0 for Windows and the second category was analyzed through descriptive analysis.

III. RESULTS AND DISCUSSION

The results are presented in 2 (two) categories: 3.1 sociodemographic data; 3.2 the patient's perception regarding his hospitalization and stay in the Intensive Care Unit (ICU).

3.1 Sociodemographic data

The research consisted of 20 adult patients, who were hospitalized in the ICU sector for at least 24 hours and who had already undergone at least three physiotherapy sessions. Table 1 describes the main characteristics of the patients being considered: age, sex, marital status, education, hospitalization diagnosis, length of hospital stay and physiotherapy sessions.

Variables	% answer	N	%
Gender	100		
Female		11	55%
Male		9	45%
Age	100		
18 a 32 years		2	10%
33 a 42 years		0	0%
43 a 52 years		2	10%
53 a 62 years		6	30%
63 a 72 years		8	40%
73 a 83 years		2	10%
Marital status			
Single		8	40%
Married		9	45%
Widowed		3	15%
School	100		
Incomplete primary		15	75%
Complete high school		3	15%
Illiterate		2	10%
Diagnosis of Intensive Care Unit	100		
admission			
Systemic lupus		1	5%
Arm Fracture		1	5%
Aneurysm		3	15%
Chronic obstructive pulmonar disease		4	20%
Pneumonia / Pleural effusion		1	5%
Exploratory Laparotomy		1	5%
Neoplasm		2	10%
Hepigastric hernioplasty		1	5%
Polytrauma		1	5%
Cardiopathy		5	25%
Intensive Care UnitIntensive Care Unit lenght of stay	100		
3 a 6 days		10	50%
7 a 10 days		6	30%
11 a 13 days		3	15%
30 days		1	5%

Table 1 – Characteristics of patients admitted to the intensive care unit. Jequié/BA, 2019.

Physiotherapy sessions	100		
3 a 5		8	40%
6 a 9		5	25%
Over 10 sessions		7	35%

% = percentage, n = number of participants. Source: Research data.

As shown in Table 1, most patients were female (55%), which corroborates the data presented in another study (FAQUINELLO & DIÓZ, 2007), although part of the scientific literature points to a male predominance in intensive care units (MONDADORI *et al.*,2016; LOPES & BRITO, 2009; TOMÁS, 2018). Of these, 45% were married, and 40% were single. As for education, most patients had attended incomplete elementary school, which corresponded to 75% of the surveyed population.

Among the interviewees, 80% (16) were aged over 53 years, which reveals an increasing presence of elderly patients hospitalized in ICUs, a reality evidenced in other studies(LOPES & BRITO, 2009), which is attributed both to the aging of the population and to the advancement in the control of chronic-degenerative diseases (MONTEIRO *et al.*, 2017).

Brazilian researchers show in their study that 60% of consumption and expenses in UTIS are used by elderly people between 50 and 75 years old (RODRIGUEZ, 2016), and that by 2050 these results may intensify proportionally to the elderly population (VIANA & WHITAKER, 2011).

As for the main reasons for hospitalizations, respiratory disorders stood out, which corresponded to 25% of the cases and cardiovascular 25%. Regarding the prevalent causes of acceptance in the ICU, the data of this research are similar to other findings, in which the complications of the respiratory, cardiovascular system and surgical situations were among the main reasons with 28.6%, 15.6% and 27.5% respectively (GUIA *et al.*, 2015).

Regarding the length of stay in the ICU, 50% of the interviewed patients had already completed about 3 to 6 days of hospitalization. Checking these data with that of the literature, it is ensured that the majority of patients remained hospitalized for a period of time equal to or less than 6 days (TURGEON *et al.*,2011).

In addition, about 40% of patients had already undergone at least 3 to 5 physiotherapy sessions. Considering its importance in this environment, studies indicate that patients undergoing early motor physiotherapy show improved functionality, such as bed rest and early walking, consequently reducing the length of hospital stay (PINHEIRO & CHRISTOFOLETTI, 2012). In view of this, it is also important to know the patients' perceptions about the ICU admission process.

3.2 Perception of the patient regarding his hospitalization and stay in the ICU

To present the results of this category, the patients who participated in this research are nominated by numbers from 1 to 20 (ex: p1), thus equaling the number of selected subjects. Thus, when asked about their hospitalizations and stays in the Intensive Care Unit (ICU), some patients reported:

"[It's being a jewel, nothing to complain about, just the food that takes time to arrive]"(p1) "[She reports being well treated, but

hungry]" (p2)

"[Good service, food takes a long time to arrive and there is little]". (P3)

"[Well cared for, well treated, but food is lacking.]" (P7)

As noted, questions about food were emphasized, which suggests a possible relationship with the fact that these patients are idle in a bed and this generates anxiety or even the feeling that time is passing slowly and as soon as the food is slow to arrive, or even because it has to adapt to a more regulated and balanced diet. However, no other studies that could confirm or refute such findings were found in the literature.

Despite this, considering the importance of food, a study shows that the number of malnourished patients tends to increase according to the length of hospital stay, despite the existence of physical and psychological particularities, as well as other factors inherent to this process (RIBEIRO, 2010). It is valid to rethink about the nutrition dynamics of these patients and their repercussions in the recovery process, since adequate nutrition is an essential part of improving health. Furthermore, the fact of being fasted due to a procedure that sometimes cannot be performed on the day, was one of the factors that caused discomfort to patients, as reported. "[It was okay, it bothers me not to eat because of surgery and the procedure is not performed on the day]" (p16)

One of the positive factors analyzed is that many of the patients reported feeling well treated during hospitalization, which is consistent with the findings of another study, which showed positive perceptions such as the feeling of well-being, satisfaction and confidence regarding the treatment to which they were treated. was submitted to and taken care of by professionals MOREIRA & CASTRO, 2006).

"[Even if I am healed, I would like to stay here.]" (P9) "[Okay.]" (P10)

"[The treatment was great, he liked everything.]" (P11) "[Everyone treats it well here, just the tiredness of the back that bothers them.]" (P12)

"[So far, there is nothing to complain about.]" (P14)

"[Well, no, it's not, everything is fine about the appointments, but it's a place that nobody would like to be. No complaints other than that, I am being treated well.] "(P15)

Even though the ICU characterizes an environment that causes feelings of fear, insecurity, as shown by some studies (PROENÇA & AGNOLO, 2011; ABRÃO *et al.*,2014), the results presented in this research demonstrate that many of the patients reported that they were well cared for and supported in this place, especially with regard to the care provided by the team, as reported:

"[Normal, good, everyone treats them with respect.]" (P18)

"[Everything here is good, it's great to be in the hospital, they treat me well, talk to me, give me attention, it's in the hospital, it's too good.]" (P19)

Corroborating the scenario found, another study carried out with patients in the intensive care unit, points out the humanized care of the team as one of the main factors for the positive perception that patients had of the work performed in the ICUs, which referred that the service had a differentiated character when compared to other hospital sectors (PROENÇA & AGNOLO, 2011).

The feeling of isolation and loneliness that is often faced during hospitalization, ends up generating more suffering for patients, since they lose contact with their living environment and consequently feel helpless (CASTRO & ROSERO, 2015; GOMES & CARVALHO, 2018).

Therefore, the relationships established between patients and health professionals, based on trust, respect and empathy, seem to constitute an important link of adaptation and a means of encouraging a lighter coexistence in an hospitalization process, which contribute positively to the good-being like this. Thus, humanized care, the bond created with the patient and the assistance provided is essential in such work (PROENÇA & AGNOLO, 2011).

On the other hand, as shown in other studies (GOMES & CARVALHO, 2018; STUMM *et al.*,2008; CARRARA *et al.*. 2015), some negative factors experienced within the Intensive Care Unit were mentioned. Among them, there is the issue of noise from devices and even communication between the team that appear as one of the main stressors in these environments, which can affect psychologically and physiologically both patients and professionals (MOREIRA & CASTRO, 2006; CARRARA *et al.*. 2015; BITENCOURT *et al.*, 2007; PEREIRA *et al.*,2003).

"[It's been a good experience, despite talking about the noise, I think it's quiet, the noise of the alarms that bothered me at the beginning because of the headache." (P17)

It was demonstrated in a study carried out between 2010 and 2011 in a teaching hospital, the report of patients who felt restless and who were unable to sleep because of the noise and the light on (STUMM *et al.*,2008). In addition to these factors, there are reports about the lack of privacy and inactivity as stressors (PROENÇA & AGNOLO, 2011). Among the findings of this study, the climatic issue of the environment was also addressed.

"[It is good, there is no need to improve anything ... It is only very cold.]" (P13)

Another desire mentioned by the patients was in relation to the desire to return to their homes and the need to have the presence of family members in their lives. I wish this, highlighted in other studies (STUMM *et al.*,2008; CARRARA *et al.*, 2015). The presence of family members in the hospitalization process provides support and security for patients (SEVERO & GIRAR-PERLINI, 2005). In addition, studies also ensure that the family is part of the healing process. Therefore, this care also reaches family members, who feel fragile and suffered by the situation experienced, however, it is sometimes seen as an obstacle to the routine assistance of ICUs (PASSOS *et al.*,2015; MADAM *et al.*, 2012).

"[Okay, I have nothing to complain about, but I want to go home]". (P4)

"[Hospital is good for looking for resources, but not for address. Crazy to go to the room to receive a visit from his wife.] "(P8) The repercussions of an internment affect not only the patient, but also family members who are faced with situations of impotence in the face of the problem, so much so, that this perspective has already been discussed by other studies (TOMÁS, 2018; MONTEIRO *et al.*,2017; REIS *et al.*,2016).

In addition, despite the difficulties faced during hospitalization, there was recognition on the part of patients about the benefits acquired after admission to the intensive care unit, which revealed an improvement in health and recognized the need to be in this environment.

"[I was intubated, I arrived unconscious, I have little time, but they treat me well, I am well cared for and the way I arrived I am much better.]" (P20)

"[Waiting for the condition of the body, waiting for the conditions to improve, they always treat me well and with respect, I have nothing to complain about.]" (P6)

The Proença e Agnolo 2011 study, also reveals this perspective, in which patients highlight the team's continued, comprehensive and humanized care. Another aspect observed refers to the fact that, while there is a view that the ICU is related to serious illnesses and death, patients recognize the environment as a place that sends hope for their recovery, since they have resources and qualified professionals to revert situations considered serious (SEVERO & GIRAR-PERLINI, 2005). Associated with this scenario, the desire to change habits is already manifested after the experience, as stated by one interviewee.

"[A moment in the life of irresponsibility, and despite the heart attack, my head changed that I had to relive to change my habits.]" (P5)

This awakening is extremely important, considering that maintaining health and improving quality of life depends to a large extent on patients. Such awareness is essential if lifestyle changes are to be adopted.

The experiences in this hospital suggest that the service provided has a qualified assistance, but they also have some gaps, given the complexity of the environment of the Intensive Care Units. However, it is possible to observe that patients feel well supported and assisted in terms of their needs, which is extremely important considering the growing reflection on humanized health care, highlighted in some studies (MONDADORI *et al.*,2016; LOPES & BRITO, 2009; SANCHES *et al.*,2016).

The National Humanization Policy (PNH), launched in 1994 in the Unified Health System (SUS), is one of the strategies of the Ministry of Health so that the principles of SUS and its changes in health care and management are ensured (SILVA & SILVEIRA, 2011).

Among the possible limitations of this study, the fact that the interviews were conducted within the intensive care units, may have led to the probability of omitting information, either due to embarrassment or even inhibition, since these patients were still under treatment. unity.

However, the present study brings significant contributions in terms of giving voice to those who have been and are going through the hospitalization process and thus experienced the difficulties and challenges faced by patients in their entirety.

Understanding the hospitalization process from the perspective of patients will provide subsidies for a more humanized environment and care, which encompasses all professionals who are inserted in these units. In addition, the physical therapists that play an important role in the recovery and reintegration of these patients in society stand out in this study, since the main objective of treatment aims at the individual's functionality.

IV. CONCLUSION

In view of the results presented, there was a positive perception of hospitalization in the three intensive care units addressed, mainly to the care provided by the team. However, there are still gaps related to some characteristics inherent to the environment, such as cold, noise, regulated food, the distance from family members and home.

In this sense, it is necessary that more studies be carried out in the context of care in Intensive Care Units and their repercussions, with larger populations and in different regions of the country, since their results will contribute to the development of programs and measures of coping, considering the individuality and need of each patient and thus promoting the improvement of the quality of care in these places.

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Humanized physical therapy assistance to hospitalized children from the perspective of family members

Manoela Gomes da Silva¹, Giovanna Porto dos Santos², Karine Orrico Góes³, Juliana Barros Ferreira⁴, Samara de França Ferreira⁵, Priscila d'Almeida Ferreira⁶, Nayara Alves de Sousa⁷

^{1,5}Physiotherapist. Graduated from the State University of Southwest Bahia (UESB).

^{2,3}Physiotherapist. PhD by the State University of Santa Cruz (UESC). Adjunct Professor B at the State University of Southwest Bahia (UESB).

⁴Physiotherapist. Master in Health Technologies by the Bahiana School of Medicine and Public Health (EBMSP). Professor at Fainor, FTC and UninassauAU.

⁶Physiotherapist. PhD from the State University of Southwest Bahia (UESB). Adjunct Professor B at the State University of Southwest Bahia (UESB).

⁷Physiotherapist. PhD by the State University of Santa Cruz (UESC). Adjunct Professor B at the State University of Southwest Bahia (UESB). Rua Dr. Raimundo Bahia da Nova, 36, Address of Bem Querer, Vitória da Conquista-Bahia

Abstract— Introduction: Nursing care in the hospital environment can have an emotional impact on children and families, but humanized care has made this process less traumatic. Objective: To verify if the physiotherapist's care with the children hospitalized in a public hospital occurs in a humanized way from the perspective of the relatives. Methods: This is an observational, descriptive and quantitative study. The population was composed of 20 relatives of children under 12 years of age, hospitalized at least 24 hours, who performed at least three physiotherapy sessions. As instrument, a questionnaire elaborated by Lopes (2009) was used, adapted by the researchers. Results: The majority of the children were male (55%), mean age 03-24 months (55%), with a predominance of pneumonia (25%). The female gender (95%) was the prevalence of family members, mothers (90%), single women (40%), with ages ranging from 18 to 29 years (50%). Cardiorespiratory Measurement and guidelines (16%) were the most used physiotherapeutic procedures. The care of the physiotherapist was predominant (100%) and the use of playful care was (75%) negative. Conclusion: it was observed that the care of the physiotherapist with hospitalized children occurs in a humanized way, but leaves gaps regarding the use of playfulness.

Keywords—Physiotherapy, Humanization, Hospitalization.

I. INTRODUCTION

Hospitalization results from a pathology in the child, which has the consequence of an alteration in the family routine, and can cause different sensations, which alternate between guilt, uncertainty, anguish, fear, distress and fear (OLIVEIRA et al., 2010). Therefore, the duties and tasks of the child's companion during the hospitalization period are highlighted, especially because they face complications such as: being away from family comfort to a different environment, full of doubts, vulnerabilities and changes in the daily routine (HAYAKAWA et al., 2009).

These circumstances can cause exhaustion for both the child and those who monitor and therefore generate an emotional impact (COYNE, 2006). During child hospitalization, the family experiences periods of insecurity in relation to the child's health condition, resulting from the probability of complications of the clinical condition, with risk of death (GOMES et al., 2012).

The care attributed to the child during the hospitalization period, and also to his family, provides

assistance that is conducive to the progress of reestablishing the child's health and aims at humanized assistance (SOSSELA et al., 2017). According to the National Humanization Policy (PNH), humanizing means first of all to respect the people involved, be it a family member, a health professional or a child. In view of this hospitality, special attention must be emphasized, the ability to understand understood, help available, verify the claims and establish a union between the patient, the family member and the team (BRASIL, 2004).

The hospital team has an essential role in providing necessary assistance to the family, understanding the caregiver's attitude towards the care received and the circumstances that are found (COSTA et al., 2018). This is composed of several professionals, among them the physical therapist who is able to identify restrictions, difficulties, variations, functional disabilities, propensities and individualities and from these observations proposes a therapeutic plan based on the needs of each child (REIS et al., 2016).

Therefore, after the assessment, indications of an instructive nature are made to enable preventions, with regular reevaluations and interventions taking into account the children's particularities. The insertion of the physiotherapist in hospital environments improves health, quality of life of hospitalized children and reduces possible trauma resulting from the length of hospital stay (REIS et al., 2016).

In view of the data presented above and considering that there is a low scientific investigation in relation to the subject addressed (SILVA et al., 2017), the present study proposes to verify if the physiotherapist's care with children admitted to a public hospital occurs in a humanized way from the perspective of family members.

II. METHODOLOGY

This is an observational, descriptive study, with a quantitative approach. Approved by the Ethics and Research Committee, according to opinion 3,050,213 on November 30, 2018. This study is part of a larger project entitled: 'Humanized Physiotherapeutic Care for Children in Pediatrics'. The research was carried out in the Pediatrics sector of a Public Hospital, in the interior of Bahia, from December 2018 to March 2019.

The study population consisted of 20 family members (parents, mothers or guardians) of children under 12 years old, who were hospitalized in the Pediatrics sector for at least 24 hours and who had already undergone at least three physical therapy sessions. Family members were invited to participate in the research and signed the Free and Informed Consent Form (ICF). Parents under 18 were excluded and the right to interrupt their participation in any stage of the research was guaranteed, without any penalty or loss, as well as confidentiality and anonymity regarding the data collected.

The questionnaire was applied in the child's own room or in the external area of pediatrics, without the presence of any other health professional, especially physiotherapists, in order to provide the families with the necessary safety and comfort, preserve the confidentiality of responses and avoid embarrassment or mandatory requirements.

This questionnaire was developed by Lopes (2009) and adapted by the researchers, consisting of closed questions regarding the characteristics of the children, the sociodemographic characteristics of the family members and the physiotherapeutic procedures performed.

About the characteristics of the children, it was argued about: gender, age, diagnosis of hospitalization, length of hospital stay and physiotherapy sessions. Regarding the sociodemographic characteristics of the family members, they were asked about: gender, age group of the family member, degree of kinship and marital status.

Regarding the physiotherapeutic procedures, it was asked whether during any conduct by the physiotherapist he realized that there was a lack of care, punctuating with no or yes, if so in which / which procedures: positioning therapy, breathing exercises, aspiration, cough stimulus, motor kinesiotherapy, stretches and if others specify. It was also asked whether playfulness (toys) was used during the conduct and which physical therapy procedures were performed.

The collected data were submitted to descriptive statistics and presented as absolute numbers and percentages, using the Statistical Package for Social Sciencespor (SPSS) software, version 22.0 for Windows.

III. RESULTS

The research consisted of 20 family members (parents, mothers or guardians) of children under 12 years of age, who were hospitalized in the Pediatrics sector for at least 24 hours and who had already undergone at least three physical therapy sessions. The incidence of males was predominant (55%). Regarding the age variable, children between 03 months and 12 years were surveyed, with dominance from 03 to 24 months prevailing in more than half of the total children surveyed (55%). As for the diagnosis of hospitalization, pneumonia remained with

more than (25%), followed by respiratory infection (15%) and bronchiolitis (10%). When assessing the length of hospital stay, it was seen that the majority was hospitalized between 4 to 7 days (55%). In analyzing data on the

number of physiotherapy sessions performed, most children performed between 6 to 9 sessions (45%) (TABLE 1).

Table 1	- Characteristics of C	Children. Jequié / BA, 2	2019.
Variables	% answer	N	%
Genre	100		
Feminine		9	45%
Male		11	55%
Age	100		
0 to 24 months		11	55%
3 years		2	10%
4 years		2	10%
6 years		1	5%
9 years		1	5%
10 years		1	5%
12 years		2	10%
Inpatient Diagnosis	100		
Shortness of breath		1	5%
Urinary infection		1	5%
Pneumonia		5	25%
Seizure crisis		1	5%
Bronchiolitis		2	10%
Respiratory infection		3	15%
Sepsis		1	5%
Nephrotic syndrome ? (Pleural effusion and pneumonia)		1	5%
Left upper limb fracture		1	5%
Rheumatic Korea		1	5%
Bacterial meningitis		1	5%
Renal Parenchymal Disease		1	5%
Acute Cerebellar Axia		1	5%
Length of hospital stay (days)	100		
1 to 3		3	15%
4 to 7		11	55%
Over 7 days		6	30%
Physiotherapy sessions	100		
3 to 5		8	40%
6 to 9		9	45%
Over 10 sessions		2	15%

% = percentage, n = number of participants. Source: Research data.

Regarding the sociodemographic characteristics of the family members, as shown in Table 2, the most prevalent gender was female (95%), the age group of the family members was between 18 and 29 years old (50%) and the degree of kinship most prevalent was mothers (90%) and single (40%) (TABLE 2).

Variables	% answer	Ν	%
Genre	100		
Feminine		19	95%
Male		1	5%
Age of family member	100		
18 to 29 years		10	50%
30 to 39 years		9	45%
40 to 49 years		1	5%
Degree of kinship	100		
Dad		1	5%
Mother		18	90%
Others		1	5%
Marital Status	100		
Not married		8	40%
Married		6	30%
Stable union		6	30%

Table 2 - Sociodemographic	characteristics a	of family members.	Jequié / BA, 201	9.
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% = percentage, n = number of participants. Source: Research data.

As for the physical therapist's care, there was a predominance of (100%). Regarding the use of playfulness during consultations, it was (75%) negative.

According to table 3, in the physical therapy procedures performed, it was noticed that the Cardiorespiratory Measurement (MCR) and the guidelines were (16%) and the other procedures (22%) (TABLE 3).

Table 3 - Physiotherapeutic procedures performed. Jequié / BA, 2019.

Variables	%answer	Ν	%
Procedures	100		
Cardiorespiratory Measurement (MCR)		220	16%
Retrograde Rhinopharyngeal Clearance with Instillation (DRRI)		88	6%
Mucociliary transport		66	5%
Prolonged Slow Expiration (ELPR)		88	6%
Vibrocompression		77	5%
Positioning		55	4%
Increased Expiratory Flow (AFE)		88	6%
Compression-decompression		66	5%
Cough Stimulation		66	5%
Ambulation		66	5%

Guidance	220	16%
Others	28	22%

% = percentage, n = number of participants. Source: Research data.

IV. DISCUSSION

The purpose of this study was to verify the physiotherapist's care with children admitted to a public hospital and certified that the humanization process occurs in the visits, but leaves gaps regarding the use of playfulness.

The study showed a predominance of males. Corroborating this research, studies show that male children are associated with major hospitalization events, especially children under the age of one year and between four and six years (MENEZES et al., 2010). Another study also confirmed the prevalence of males hospitalized for respiratory diseases in childhood (CAETANO et al., 2002).

The diseases of the respiratory tract that occur in childhood are in their prevalence caused by viruses and / or bacteria that usually are prevalent in environments with a large flow of people, closed and humid places (GONZALES et al., 2008). Studies also point out that pathologies of the urinary and renal tract are common during childhood, with hygiene practices and the peculiar characteristic of the genitals one of the important reasons that contribute to this eventuality (AVERBUCH et al., 2014).

When examining the findings of the study and those in the literature, it should be noted that research conducted with children hospitalized with a diagnosis of pneumonia, it was found that the average length of stay was 7 days (VERAS et al., 2010). A survey carried out in Joinville-Santa Catarina found that the children remained around 7.5 days of hospitalization. Referring to community-acquired pneumonia, the common hospitalization period of 7.5 days is seen positively, since recovery usually occurs within 72 hours (SOARES, 2011). Staying hospitalized for around 5 days is the fundamental time to consolidate comorbidities, make use of antibiotic therapy in its almost total cycle and succeed with another that can be administered at home (STORCK et al., 2012).

There is also the monitoring of vital signs that are important to maintain, modify or establish conducts. Vital signs characterize the hemodynamic situation and act as possible indicators of imbalance of these functions, which can be of a physical and / or psychic order, the identification of changes in these parameters allows us to make a quick assessment, enabling an early intervention, if necessary. These data are measured by checking the temperature, respiratory rate, heart rate, pulse and blood pressure (AMARAL et al., 2012).

Regarding age and gender, most of the accompanying family members are mothers, young and single. The findings of the present study are in accordance with the literature (ALMEIDA et al., 2012). It is believed that the life of the mothers undergoes changes in the personal, social, financial and occupational spheres, as they are accompanying the child during the hospitalization process (COSTA, 2018). A study shows that family perceptions in relation to humanization come from sensations, which remain according to their intensity and duration and this refers to the care that is an attribute or peculiarity of the quality of humanization (NOGUEIRA et al., 2012). This perception of care involves the moral principles of health professionals to provide care based on welcoming and sensitivity (CAREGNATO, 2017).

In another study, companions of hospitalized children described humanization, in a complete way, when there is a condition of the therapeutic relationship and of a good and clear communication established between the multidisciplinary and family team. Therefore, when care is provided with respect and attention, showing competence and relevance in communication, these are effective particularities of humanized care (SPIR, 2011). Studies point out that the creation of a child's affection with an adult occurs through the achievement that can be facilitated through play, however, this relationship happens in a progressive way (FUJISAWA, 2010).

Treatment with recreational activities has both physical and emotional benefits, and favors the approach of hospitalized children, because playing, in addition to being pleasurable, is an instrument that facilitates treatment (ARÁUJO et al., 2017). The moment playfulness is addressed, the child identifies the moment he plays and establishes expectations for other care. It is important to emphasize that play therapy needs to be continuously related to the established purposes, this being a double return solution. The playful moment experienced in physiotherapy is different from having fun freely, as it requires that it be in accordance with physiotherapeutic purposes (NOGUEIRA, 2012). It should be noted that the treatment of children is less traumatic when using playful activities, as this practice fills a considerable space in improving child health. It is known that therapeutic playfulness still presents itself in a very limited way and because it is an effective mediator in the bonds between child, family, team and hospital environment, it is necessary to make a greater effort in the use of these activities during all pediatric care (MUSSA et al., 2008).

Physiotherapeutic guidelines for children's companions during and after hospitalization are essential to unify and complement the treatment performed. Therefore, physical therapy assistance is also directed towards education and prevention in order to reduce possible readmissions of these children (SANTA et al., 2002).

V. CONCLUSION

It was found that the physiotherapist's care for hospitalized children occurs in a humanized way, but leaves gaps regarding the use of playfulness in physiotherapy treatments.

One of the limitations of this study was that a qualitative analysis was not carried out to check the perception of family members. Therefore, other studies in this line of research are being carried out in order to implement new research on hospital humanization and physical therapy interventions.

Thus, it is hoped that this study can contribute to new reflections on public policies, serving to expand analyzes on the practice of humanization in health services.

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Nursing Care for Patients with Systemic Lupus Erythematosus Based on the Environmental Theory

Lidiane Assunção de Vasconcelos¹, Andrea Dos Santos Mendes Gomes², Lauany Vitoria Ferreira Corrêa³, Liuan Ferreira Campelo da Silva⁴, Mariene de Jesus Austríaco Castro⁵, Tamylle Daniele Guimarães Dias⁶, Wenison Batista Costa⁷, Stephany Siqueira Braga⁸, Kelly Adriani dos Santos Baeta⁹, Cibele Maria de Almeida¹⁰, Adriana do Santos Mendes Gomes¹¹, Raimunda Silva Gatti Norte¹², Lauricéia Valente de Oliveira¹³, Mariana Valente de Oliveira¹⁴.

¹Master in Health, Environment and Society in the Amazon, Federal University of Pará (UFPA). Professor at Cosmopolitan College. Belém, Pará, Brazil.

²Master in Public Health, Federal University of Pará (UFPA). Specialist in Nursing Intensive Care Center at Hospital Ophir Loyola. Belém, Pará, Brazil.

^{3,4,5,6,7,8}Nursing students, State University of Pará (UEPA). Belém, Pará, Brazil.

⁹Nurse graduated from the University Center of the State of Pará (CESUPA). Belém, Pará, Brazil.

¹⁰Doctor. Master's student in health education. Belém, Pará, Brazil.

¹¹Nurse. Specialist in Health Management. Belém, Pará, Brazil.

¹²Physiotherapist. Master in Health Education in the Amazon. Belém, Pará, Brazil.

¹³Doctor. Anesthesiologist at the Ophir Loyola Teaching and Training Center. Belém, Pará, Brazil.

¹⁴Medical Student at the University Center of the State of Pará (CESUPA). Belém, Pará, Brazil.

Abstract— Systemic Lupus Erythematosus (SLE) is an inflammatory, autoimmune, chronic disease of unknown etiology that can affect several organs and tissues. Parallel to this, the environmental theory, has as focus the environment, and the role of nursing is to maintain the balance of this environment, prioritizing the provision of an environment that stimulates and facilitates the development of health for the patient. Therefore, an educational action was proposed to promote a greater explanation and approach about the environmental conditions that the individual will be exposed to and which will influence the exacerbation of the disease. The activity was developed through the problematization methodology by the Arco de Maguerez. Explanatory folders were prepared containing information and guidance on the disease and the care related to environmental factors that could trigger a manifestation or possible reactivation of the pathology was emphasized. There was a great acceptance of the material distributed by the students and strong interaction between patients and the health team, through questions directed to the students at the time of the explanation and exposure of the folders, which were instantly remedied, in a way that evidenced the absorption of the information, guidelines passed on and sensitized patients to change habits. Therefore, health professionals are fundamental agents of change, who use their power of influence to promote the change of habits and stigmas that are disseminated by the lack of information, providing greater understanding and knowledge about the variables of the disease, and the necessary care for maintaining the health of SLE patients.

Keywords—Health Education, Nursing, Systemic Lupus Erythematosus, Experience Report, Nursing Theory.

I. INTRODUCTION

Systemic Lupus Erythematosus (SLE) is an inflammatory, chronic disease of unknown etiology that can affect several organs and tissues. It manifests itself in an autoimmune manner, being characterized by the presence of autoantibodies that are directed against the cells of the body itself. The cause is not fully understood, however, the development of the disease is linked to genetic predisposition and environmental factors, such as ultraviolet light and some medications (Borba et al., 2008). In addition, it is a disease of low incidence that affects mainly women and young people, affecting women 10 to 12 times in the reproductive phase, in relation to men and, although it can occur at any age, it is more frequent in adulthood, with greater incidence close to 30 years old (Bittencourt; Beserra & Nóbrega, 2008).

The disease progresses in a chronic way and has periods of latency and remission. The clinical manifestations of SLE can be general, in which the most frequent are: skin lesions characterized by the presence of erythema in the shape of a butterfly wing or evening, on the cheekbones and back of the nose, and the discoid lesions that are well defined and deep; joint pain and edema; inflammation of the lung and heart membranes (Pleura and Pericardium); Inflammation of the kidney; Changes in blood composition, such as decreased erythrocytes leukocytes (anemia), (leukopenia), lymphocytes (lymphopenia) platelets or (thrombocytopenia), in addition to inflammation in the small vessels (vasculitis). In addition, some symptoms of lesser incidence can also occur in the latent phase of the disease, such as enlarged liver, spleen and lymph nodes (Bittencourt et al., 2008).

According to Robbins and Cotran (2010) genetic factors are one of the fundamental causes for the development of the disease, however, environmental factors also have great relevance in their pathogenesis. In this context, it is worth noting that exposure to ultraviolet (UV) light exacerbates the disease in many individuals. This is because UV irradiation can induce cell death and can alter DNA in such a way that it becomes immunogenic, that is, it stimulates an immune system response. In addition, exposure to sunlight can modulate the immune response, as it induces skin pigment cells (keratinocytes) to produce a substance that is known to promote an inflammatory response.

In this context, Nightingale (1989) - considered the precursor of nursing - developed the environmental theory, in which the environment is the main focus, according to her, the environment encompasses external conditions and

influences that directly affect the life and development of the organism, having the ability to prevent, suppress or contribute to disease and death. Thus, the body tends to respond to nature in a subtle or exaggerated way, for example in places of high or low temperature and / or high or low humidity, one can observe the manifestations of diseases that have a characteristic epidemiology, which are characterized as epidemics. This, then, reaffirms the scope of the environmental theory that nature has the ability to interfere directly and indirectly in the health of the individual (Nightingale, 1989). In this theory, the disease is considered a health restoration process, and the role of nursing is to balance the environment, offering the minimum conditions of recovery, such as ventilation, air, water, cleaning and heat in order to conserve the patient's vital energy in order to recover from the disease, prioritizing the provision of an environment that stimulates and facilitates the development of health for the patient (Nightingale, 1989).

Furthermore, in environmental the theory, communication with the patient is essential, as it is seen as part of the principles of care, since through it, it will be possible to evaluate the conditions of the patient's emotional and physical state as well as obtain the complaints provided by him (George, 1993). This exposes the great importance of communication so that more efficient assistance occurs, as it is necessary to have an open and honest conversation about the real conditions of the patient, allowing, then, the nurse to inform and provide the appropriate care, as well as the patient has the duty to follow the guidelines and care provided for better health recovery.

From Florence's theory, it is possible to perceive the human being as part of nature, being seen as an individual, whose natural defenses are influenced by a healthy environment or not. He also believed that providing an adequate environment was the differential in the recovery of patients, and it is this precept that underlies the theory (Nightingale, 1989). In this sense, having Nightingale's (1989) theory of ambience as a foundation, it is necessary to have a greater explanation and approach about the environmental conditions that the individual will be exposed to and that may influence the exacerbation of the disease.

In this perspective, this article aims to report the experience of nursing students in carrying out an educational action based on the Environmental Theory to patients with Systemic Lupus Erythematosus (SLE) in a public hospital in Belém / PA, in which it was used illustrative folders, in order to explain to the patient the factors that may influence the manifestation of the

pathology symptoms, the conditions in which he will be exposed, as well as the complications and the necessary care that he must acquire due to the return to his environment of housing, since this is one of the main points for the recovery and maintenance of the patient's health.

II. MATERIALS AND METHODS

The This is an experience report from the second semester of 2019 made by five nursing students from the discipline Nursing Theory / Semiology and Semiotechnics on the realization of an Integrated Health Activity (AIS) whose theme is Nursing Assistance to the patient that bears Systemic Lupus Erythematosus (SLE) based on the Environmental Theory that took place at the Public Hospital of Belém / PA.

AIS aims to develop projects and integrate several areas of knowledge, especially those related to health promotion and education through progressive actions in order to develop critical analysis of the student, developing creative and efficient activities aimed at the community and for nursing care.

The elaboration of the activity was developed through the problematization method by the Arco de Maguerez. It consists of five steps: Observation of reality; Survey of key points; Theorization; Solution hypotheses and Return to reality (Berbel, 2011). Based on that, proposals for themes to be addressed were developed.

The observation of reality occurred in the practice periods from 08/28/2019 to 09/18/2019, when students identified a high incidence of hospitalizations of patients with SLE, in this perspective, it was considered necessary to approach the present theme. The survey of key points was drawn from debates held between the members of the group and their advisor, in which was sought to identify the relationship between pathology and Florence Nightingale's environmental theory.

For theorizing, the students followed the guidelines made by the guiding teacher, which consisted of the search for theoretical and scientific material, such as studies and research about SLE, the Environmentalist Theory and the methods of nursing care necessary to improve the patient's quality of life. From this, theoretical bases were searched in articles and official documents, in the electronic media accessing Google Scholar, Periodicals Capes and MedLine, the library of the Magalhães Barata Nursing School was also used.

Following the fourth stage of the Arc, hypotheses for solution were pointed out according to the observed reality

and its limitations. Health education as nursing care for patients with SLE was the method chosen by the group to address the issue in question with the target audience, considering that assistance through this strategy tends to promote patient awareness of the importance of changing habits, attitudes and behaviors, which can significantly improve the individual's quality of life. It was also decided to carry out the action with the hospital's nursing team, in order for them to pass on the guidelines to the next patients who come to be attended by the institution.

To carry out the action, explanatory folders were prepared containing information and guidance on the disease, in which, in addition to the common care to keep the immune system high, care related to environmental factors that could trigger a manifestation or possible reactivation of the pathology was emphasized, among which were listed: quality of sleep and rest, frequent use of sunscreen, physical activity, especially aerobics, consumption of healthy foods (fruits and vegetables), restriction of alcoholic beverages and smoke and personal hygiene care, being extremely important for the prevention of infections. In addition, some myths and truths about SLE were selected in order to demystify to the patient erroneous information that is propagated by society and to clarify pertinent doubts, for example, if the woman with Lupus can become pregnant.

The return to reality, phase of the Arc in which the action takes place, took place on October 16, 2019 in the afternoon shift, from 2 pm to 5 pm, in which the target audience present were female patients, and the activity was carried out in their beds themselves due to the needs of mobility impaired by the disease, as well as for health professionals, folders were presented at the team's own nursing post.

III. RESULTS AND DISCUSSION

During the educational action, the students started identifying themselves and presenting the educational institution, as well as the work to be exposed, about what it was about, the objective and importance of its accomplishment. Then, the students presented the folders and explained their respective contents, explaining about the disease, what the individual should know about their condition, the care needed to control the disease and the circumstances by which they would be exposed, taking into account risk of evolving to a more aggressive condition of the disease if adequate treatment was not carried out.

There was a great acceptance of the material distributed by the students, as well as strong interaction between patients and the health team, through questions directed to students at the time of explaining and exposing the folders, which were instantly remedied, so that it showed the absorption of the guidelines passed on and made patients aware of the change in habits

IV. FINAL CONSIDERATIONS

The stages of the work made it possible for students to identify the patient's needs regarding the care that must be provided and the real importance that nursing care has in maintaining the health of the individual, both in the hospital and in the living environment. This reinforces the idea that health care practiced by nurses should not be restricted to the hospital environment alone, but must pass through the walls of the infirmary and allow oriented care to reach the client's place of living.

In addition, it should be noted that the study described has great relevance in the current scenario, because despite the high incidence of the disease, there are few studies that cover nursing care aimed at patients with Lupus. Parallel to this, it is observed the importance of carrying out the work and the impact it will bring to the improvement of the patients' quality of life, because as guided and explained by the students, the care given is essential for the control of the pathology and improvement of your clinical condition.

Thus, health professionals are fundamental agents of change, especially those in the field of nursing, who can use their power of influence to promote the change of habits and stigmas that are disseminated by the lack of information, providing better understanding and greater knowledge. About what the disease is, its functioning and the necessary care to maintain the health of SLE patients.

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Government and Popular Participation in the Brazilian Eastern Amazon Regionⁱ

Edma Silva Moreira¹, Airton dos Reis Pereira²

¹Professor at Universidade Federal do Sul e Sudeste do Pará (Unifesspa), Brazil ² Professor at Universidade do Estado do Pará (UEPA – Marabá), Brazil

Abstract— This article intends to reflect on the popular participation in the collective struggles for land access in the Brazilian Western Amazon region, specifically the South and Southwest regions of the state of Pará, Brazil. This research also aims to contribute on the analysis of the different roles the Brazilian Government takes in these struggles, both as controlling entity towards the social movements (using physical violence as well as symbolic violence), and as part of the struggle when it takes over the distribution of expropriated land for landless settlers. Our analysis is based on specific literature, documents and interviews of leaderships from different social movements, as well as agents representing the Comissão Pastoral da Terra (CPT) of the region. The term "popular participation" is used here through a critical purview that understands that collective actions are more than the restricted and traditional meaning of popular participation within institutionalized spaces designed to allow different levels of public oversight towards state policies and policy making. We propose an understanding of popular participation that encompasess collective actions not necessarily accepted by the Brazilian Government, but that generate results towards the territorialization of peasants, the increase of transitory and final rural settlements, rural workers resistance and the improvement of the ability of settlers to remains in land autonomously and with dignity.

Keywords— Popular Participation; Land Struggles; Government; Brazilian Western Amazon Region.

ⁱ This article was written with the valuable contribution of Jaiane Vale Reis (on an undergrad research scholarship from FAPESPA). We would like to thank her very much.

I. INTRODUCTION

This article intends to reflect on the popular participation in the collective endeavor for land access in the Brazilian Western Amazon region, specifically the South and Southwest regions of the state of Pará, Brazil. This research also aims to contribute to the analysis of the different roles the Brazilian Government has partaken in these struggles, both as controlling entity towards the social movements (using physical as well as symbolic violence), and as a part of the changing forces when it takes over the distribution for landless settlers of expropriated rural property.

The term "popular participation" will be used here through a critical purview that expands the concept to all collective actions seeking to change public interests, as well as social structures, and, therefore, proposes social transformation. (MARX; ENGELS, 1998; SANTOS, 2002; BORDENAVE, 1983). The critical usage of said term contemplates a less restricted and traditional perception about the meaning of popular participation, not only as the collective actions within institutionalized spaces designed to allow different levels of public oversight towards state policies and policy making. We propose an understanding of popular participation that encompassed collective actions - not necessarily accepted by the Brazilian government - that generates different types of results toward the settlement of rural workers/peasants, the increase of the numbers of transitory and final rural settlements, the ability of rural workers to resist and, also, the improvement of the effectiveness of settlers able to remain in their land in a productive, autonomous and dignified way.

The time frame for this analysis comprises the experiences of fighting for land in Brazil between the redemocratization period - after the end of the Military Dictatorship (1964-1985) - until fairly recent years. Our goal is to demonstrate the lasting effects of the fighting for land long-established in this specific part of the Brazilian Amazon Region. It is worth mentioning, that rural workers have come a long way in securing their legal rights towards land access, as they endured extreme violence from the Brazilian government, as well as from powerful landowners and large agribusiness companies. Surprisingly, they have been able to maintain their traditional and autonomous ways of life.

A picture of extreme violence, physical and symbolic, has marked the lives and territories of peasants who aim to conquer and remain in the land, in the forest and in the rivers, is currently evident in the eastern Amazon (HÉBETTE; MAGALHÃES; MANESCHY, 2002).According to the data provided the Brazilian Catholic Church Agency to mediate land distribution disputes - Comissão Pastoral da Terra (CPT) - the number of violence acts committed against rural workers and/or environmentalists in 2017has increased since2016, being so far, the most violent year since 1996, when 19 landless workers were slaughtered by police authorities in the city of Eldorado dos Carajás, in the state of Pará (PA). Out of the 71 murders in rural areas in 2017, 80% (56 deaths) happened in Brazilian states within the Amazon region. The state of Paráholds the first place in this ranking of violence, with 30.98% (22 deaths) of the total number of killings in the country (CPT, 2017). As a matter of fact, the increase of this type violence appears as tendency. The CPT's most recent report shows that 29 rural workers were killed in land disputes in Brazil in 2019. 86% of those (25 killings) happened in the Amazon region. 41% of the killings happened in the State of Pará(12 deaths), 5 killings happened in the State of Amazonas, 3 killings in the State of MatoGrosso and the same number of deaths happened in the State of Maranhão(CPT, 2020).

The data supporting this article has been taken from the specific literature concerning land disputes in the region, different press and CPT documents, as well as the official numbers from the National Institute for Colonization and Agrarian Reform (*Instituto Nacional de Colonização e Reforma Agrária*, INCRA).

It is also important to point out that this research would not be possible without the valuable contribution in the form of oral accounts from *posseiros* (rural workers occupying and cultivating land, without any property titles and as a form of collective action and resistance), members of multiple unions and CPT's agents.

These oral accounts enable a better understanding of the political interests and agendas of the individuals that were actually involved in the fighting for land. These accounts are also revealing of the "indescribable", that we understand as all those things that rarely appear on written documents: "oral accounts tell us not only what the people did, but what they wanted to do; what they believed they were doing and what they believe they accomplished" (PORTELLI, 1997, p.31). This article, thus, aspires to understand the popular participation in the Brazilian Western Amazon Region recent history of the fighting for land, as it takes into account the rural workers personal experiences and struggles, but also their deep solidarity towards each other, their collective labor traditions and their mutual exchanges habits.

This article is divided into four parts: The Introduction, where some of objects of this study are presented, as well as the description of the methodology of the research(and the chosen theoretical basis). The second part is dedicated to presenting the Brazilian Western Amazon region, specifically the South and Southwest regions of the state of Pará. We will focus on the volatile consequences of the increasing of land concentration and public policies towards the creation of 513 settlement projects (INCRA, 2019). The third part will reflect on popular participation in the fighting for land access, forms of social resistance and the violence endured by rural workers in this region. In the conclusion, the importance of popular participation in the improvement of historically disenfranchised populations seeking recognition of their basic rights, autonomy and dignity is going to be stressed.

II. THE AMAZON: AN EVER CHANGING AND DISPUTED TERRITORY.

In 1970s, federal plans were created towards the integration and development of the Northeast and the Amazon regions in Brazil. Those projects were the National Integration Program (Programa de Integração Nacional, PIN) and the National Plan for Development (Plano Nacional de Desenvolvimento, PND) (HEBETTE, 1991; GUIMARÃES NETO, 2011). The political agenda behind both plans were to guarantee the presence of the Brazilian government throughout its territory in a more modern, authoritarian, rational and universal manner. The Amazon region was, then, divided into two parts - Western and Eastern Regions - and new federal and state highways were built to better connect them. Various agribusiness activities also began to grow in many native forest and natural fields. Around this time, there was a surge on mining activities and they began the construction of large hydroelectric power plants. These factors had a profound environmental impact as they changed the direction of the flow of many rivers (as well as affected the quality of their waters).

In the South and Southwest regions of the state of Pará, the construction of the Transamazon Highway (*Rodovia Transamazônica*, BR-230), combined with the PA-70 (nowadays BR-222), BR-158 and PA- 150(nowadays BR-155) highways, among others, provoked a rapid rise of the flow of people and other economic activities all throughout the area. Municipalities like Marabáand Conceição do Araguaia stopped being perceived as cities "in the river shore" ("beira de rio"), to become cities surrounded by large highways ("de beira de estrada")(PEREIRA, 2015, p. 72). The Brazilian federal government policies towards the economic development of the country brought attention to regions that were previously considered "empty", as it was the case of the Amazon region. Various types of business ventures, as well as impoverished workers, started arriving in the areaseeking profits, work opportunities and land (MARTINS, GUIMARÃES NETO, 1993; 2005). Thousands of acres of forest began to be taken down by both small and large undertakings in order to become pasture. Particularly important to the conversion of forest areas into cattle land were the abundant government aids regulated by the Superintendence for Development of the Amazon (Superintendênciade Desenvolvimento da Amazônia, SUDAM), founded 1966. Logging and fishing companies were too attracted to the region, frequently involved in the displacement of various recent migrant and local populations.

The forest areas became a commodity to be potentially explored for profits encouraged by a banking system specifically designed to benefit large landowners and big companies. The building of various bank branches throughout the region can be perceived as a palpable reality of the new financial rationale rooted in the destruction of nature (VELHO, 2009).

Alongside the newly built highways, the military regime intended to develop colonization plans for the expanding of crops and the raising of cattle. This was the model designed to the colonization of the surroundings of the Transamazon Highway(Rodovia Transamazônica). They meant to settle 100.000 families - in tracts of land of 100 hectares per family – in said highway from the city of Marabá, through Altamira, to Itaituba. These schemes were named Integrated Colonization Programs (ProgramasIntegrados de Colonização, PIC) and were devised to be carried out until1974. The bureaucrats behind the PICs, however, apparently knew very little about the Amazon geography. As they drafted rectangular properties equally distant from planned "agro-villages, agrópolis and rurópolis, to be built alongside the newly erected highways, they did not take into account the characteristics of the terrain, water supply or climate conditions" (PEREIRA, 2015, p. 105). As these plans reach the phase of actual construction, INCRA personnel realized that many of the local roadsin the designs were to take place in

hills, swamps and rivers. But these characteristics mattered very little. The colonizing spirit did not consider man in his human condition and still denied nature, considering important only the technical, scientifically calculated and effective aspects of planning.

Thus, intense conflicts started to spread across the Amazon involving, on the one hand, excluded social segments struggling for land and, on the other, agents responsible for the implementation of a model of predatory capitalist development that, by denying the knowledge of social groups (indigenous people, quilombolas communities, fishermen, shellfish gatherers, extraction workers), is deeply violent. It was also in this moment that we can observe an acute increase of large private groups investing in the purchasing of forest in order to transform them into pasture (facilitated by tax policies). According to Costa (2000a), 21 large companies, such as Bradesco S/A, Volkswagen do Brazil S/A¹ e Mendes JrConstruction Company, among others, secured about 47.2% of all the investments in a sample of 106 projects officially approved by the SUDAM, until December of 1985. Each project received an average of 4.9 millions of dollars. The segment to obtain the second largest amount of financing were constituted by family owned business from the Center and South regions of Brazil, such as the Lanari do Val, Rodrigues da Cunha andLunardelli², among others. Out of 28 projects analyzed by Costa (2000a), these families secured about 22.4% of the financing, adding up to US\$50.5 million.

Brazilian governmental policies, therefore, effectively warranted a process of rapid concentration of rural properties, as well as preserving and augmenting an agrarian structure based on political and financial privileges. The colonization leg of this plan meant to secure progress and national integration.

The described rapid – and violent - concentration of rural property process is, up to this day, a determinant factor in quotidian lives of rural workers, as this union

¹Bradesco S/A Group owned FazendaTainá-Rekan e, with 64.000 hectares, in Conceição do Araguaia; Volkswagen do Brasil S/A owned Fazenda Vale do Rio Cristalino with 139.000 hectares, in Santana do Araguaia.

² The Lunardelli Family owned, for example, theCia. de Terras da Mata Geral(Fazenda Santa Tereza), with 201.528 hectares, in the city of Redenção; they also owned the estate of the Development for the South of Pará Company (Companhia de Desenvolvimento do Sul do Pará S/A, CODESPAR), with 52.358,4 hectares, in the city of Santana do Araguaia and owned Agricultural Administration Company (AdministraçãoAgrícolaLtda, NICOBRAN), with 143.847 hectares, in the city of Santana do Araguaia. For more detailed information see: Silva (2009); Moreno (2012); Codespar (1975, p. 9).

leader offer us his description of his migration experience from the State of Maranhão to the State of Goiás and, then, to the State of:

[...] We arrived in Brejo do Meio where we encountered one of uncle John's son. Uncle John, then, said – look, sons, there is no police after Bastião's land. You will need to borrow shotguns because it is too dangerous. First because you will be deep in the forest. Secondly because there will be private militia (jagunços) watching over miles of farmland. You will have to go through the farmland and when they understand who you are, they will think you will be looking forward to occupying their land [...]. (SINDICALISTA, 2019).³

During the 1970s, many rural properties belonging to these large economical groups began to be occupied by disenfranchised rural workers willing to resist collectively. Since the Military regime was still operating in Brazil, there was little room for social protests or institutions to appeal to. In this context, the solidarity and collective strength among these rural workers were the only real assurances that their struggle would stand a chance in achieving their goals. These different coping mechanisms based on solidarity were formed initially as ways to better deal with practical adversities that came with the unknown territory to which they migrated. They had to deal with a virtually impenetrable forest, as well as wide and deep rivers, in order to tame the territory into farmland capableof harboring these migrants' futures. An example of these types of aspirations is in this fragment by a future union leader in the State of Pará: "[...]. I said, boy, for me it is good, I won't go... for you I am not sure it is good, but for me it is good. I am going to move there, build a life for myself and raise my children once they are born" (SINDICALISTA, 2019)4.

Learningthe meaning of fulfilling this mission, achieving the dream of setting roots in a land of their own, is an important step to understanding the role of resistance in the history of the rural working class in the Amazon region. These aspirations animates projects, inspires desires to build a territory – and territorialities (*territorialidades*) – based closeness and purposeful connections communally bonded by the committed labor of the land, as well as the responsible use of the forest resources. The products of one's labor, in the perspective of these rural workers, are only as valuable as they can be shared with the community:

Firstly, on the day the farm burned down, soon six comrades arrived to help. When harvest season came, there were so many people helping that a person could only manage to pick two baskets (*cofos*⁵) to make seeds. There were a lot of folks! By then, there were more than 70 families just to help that harvest season. We all contributed and harvest all that had been planted, everybody did their part cultivating the land, infiltrating the forest as we could not find any owner to those lands up to the water and the rivers [...](SINDICALISTA, 2019).⁶

According to many rural workers, their way of resisting and upholding these communal standards led to an open opposition to relocating to cities, as well as engendered the collective wish not only to protect their values, but also to propose an alternative to the development and progress models that did not take into account their contribution to the social-economic advancement of the region(MOREIRA, 2004; ALMEIDA 2009; ALMEIDA, 1993). The Amazon rural working class, as a result, had to resist and fight for their survival once the economic model being implemented in the region left them little or no room to earn a minimally dignified living, especially as the Brazilian government was consonant with the illegal concession of public land to *grileiros*⁷ and powerful landowners. (HÉBETTE, 2004).

From the rural working class of the Amazon region countless associative schemes emerged to represent their interests, to strengthen their collective political response as they aimed to remain in their rural settings true

³ Translated by the author. Original text: [...] Cheguemos no Brejo do Meio. Tinha um filho do tio João. O tio João disse - olha meus filhos, quando vocês for pra lá, passa no Bastião, que de lá pra frente não tem mais polícia. Vocês pega uma espingarda emprestada pra levar porque é muito perigoso. Primero que é só mata. Segundo que tem muito jagunço vigiando terras, glebas e glebas de terra. Vocês vão passar no meio dessas glebas. A hora que o povo ver vocês com os manchim nas costas vão pensar que vocês vão ocupar as terras deles [...]. (SINDICALISTA, 2019).

⁴Translated by the author. Original text: "[...]. Eu disse: rapaz, pra mim é bom, não vou... pra vocês não sei não, mas pra mim é bom. Eu vou morar e fazer minha vida lá, vou criar meus filhos lá quando nascer" (SINDICALISTA, 2019).

⁵A kind of oval basket, with a narrow opening, used to carry or store cereals, fruits, root vegetables, fish, etc.

⁶Translatedbytheauthor. Original text: "Aí primeiro, no dia que a roça queimou, chegou logo seis companheiros pra ajudar. Aí plantemos a roça. Quando foi pra colher era gente que só dava pra cada um tirar dois cofo pra fazer semente. Era gente demais menino! Nesse tempo, já tinha 70 famílias só pra colher essa roça. Todo mundo ia lá e tirava um pedacinho porque o pico era nesse sentido aqui: eu tirava um, tirava um taião, aí chegava outro e tirava outro e ia sumindo na mata, aí sem achar dono, sem achar nada, só água e rio [...]" (SINDICALISTA, 2019).

⁷In Brazil, land grabbing (*grilagem*) is the forgery of documents to illegally take possession of unoccupied land or land belonging to third parties, as well as undivided buildings or buildings. The term also designates the sale of land owned by the government or privately owned by falsifying land ownership documents. The agent of such an activity is called a land grabber (*grileiro*).

to their ways of life and their own collective bonds. These specific cultural traits were crucial to the establishment of their associations (MANESCHY; MAIA; CONCEIÇÃO, 2008; DOIMO; DOXSEY; BELING NETO, 1986). Their collective action, in many ways, redefined the meaning of participation, democracy, citizenship, participatory development, among other things. They also associated themselves with entities such as the CPT, as the CPT aimed to provide support to rural workers fighting for land without any protection from the Brazilian government.

In the course of events, we are able to observe and to contribute in different ways in order for the social movements to shape their own protagonism in the fight for their rights and citizenship(AGENTE DE PASTORAL, 2019).⁸

There is no doubt that these rural workers groups provoked deep changes in the socio-political dynamics of the rural reality in Brazil. Through popular participation, they contributed to the formulation of a new political culture, one that demands from the Brazilian gavernment the recognition of their propositions. The political context in Brazil hints to a unique possibility of social mobilization and the exercising of rights as results of the reestablishment of democracy in Latin America (ALVAREZ, DAGNINO, ESCOBAR, 2000; HÉBETTE, 2004, MARTINS, 1995).

In the Southwest of the State ofPará, a large number of diverse zones for the organized fighting for rights are originated in thiscontext. With the end of the Military Regime, unions resume their actions and secure a leading role in the fight of both rural and urban workers. In the cities of São João do Araguaia, Itupiranga and Marabá, for example, the workers raised to leadership of the rural workers unions, weakening the long influence of powerful landowners. They, then, joined forces with other local unions, as well as the Federal University of the State of Pará (Universidade Federal do Pará, UFPA), to create the Agri-Environmental Center of the Tocantins (Centro Agro-Ambiental do Tocantins) in order to broaden the scope of economic alternatives to oppose the model that the Brazilian government had promoted for the rural reality of the Amazon region for years (HEBETTE, 2004). Popular participation followed the flourishment of these social partnerships, as the Brazilian government tended still to defend the Capitalist class (The Bourgeoisie).

The end of the Military Regime proved to be fruitful to the implementation of social and political changes, such as the creation of city councils in which rural workers unions were initially part of. In the Southwest of Pará, however, the city councils were generally averse to the land dispute matters and were promptly co-opted by local elite groups, linked to a long history of practices of social control through violence.

The re-establishment of democracy on one hand allowed the growth of different forms of social organization, defined by Almeida (1993) as mobilization units (*unidades de mobilizações*) constituted by rural workers. These organizations not only became very prominent, but also began forging their own discourses, their raison d'être for the problems they faced. They also aligned themselves with other social groups and associations, as they collectively negotiated their interests.They began a long journey to master different legal terminologies in order to navigate new bureaucratic realities, as they shaped new strategies to further their fight for the right to remain in the lands they had been cultivating, as Alvarez, Dagnino, and Escobar (2000) describe in their works.

In the case of the Amazon region, the rural working class fight for their rights, through popular participation, originated the understanding of the land as the locus of the reproduction of life. In this context, 513 projects for Agrarian Reform were conceived, leading to 72.077 families settled in more than 4 million of hectares of land in the South and Southwest regions of Pará(INCRA, 2019). On the other hand, an alarming increase of violent land conflicts emanated from these new circumstances. Evictions, slaughters and the killing of rural workers became more frequent and acute in the region. Many city councils, committees and organizations, as they participated in various forums and regional conferences, did not acknowledge that the land disputes resulted from structural problems in the formation of Brazilian society. There was very little interest from the Brazilian government to instigate structural changes that would risk its long political alignment with large landowners.

Since 2017, the Southwest region of Pará has become again the home to mass evictions, repossessions and the dislodgement of multiple families occupying federal lands against the interests of large landowners. That was the case of the temporary settlements of Hugo Chaves, Helenira Resende, and the case of the Landi estate. Concerning the Landi estate, this was the eighth evictions. All this processes were interloped by countless acts of physical and symbolic violence, as they disrupted groups

⁸Translatedbytheauthor. Original text: Nos processos aí, a gente vai constatando e observando e também participando de formas diversas dos movimentos irem desenvolvendo seu protagonismo para poder então buscar a conquista dos seus direitos, da cidadania (AGENTE DE PASTORAL, 2019).

of families and fragmented solidarity bonds. There was also the destruction of crops, housing and schools. With little options of places to go, some of the dislodged families sought harbor in nearby temporary and permanent settlements. As for the large landowners, the lifeless land perceived just as commodity serves to expand the value of their financial assets (MOREIRA et al, 2017).

These repossession lawsuits, however, cannot be fully comprehended without the careful consideration of the prominent role of certain capitalist forces shaping Brazilian economy currently:

Nowadays, indigenous and *quilombola* communities lands, the Agrarian Reform settlement programs and environmentally protected areas are not only under the constant and direct attack coming from various large landowners groups, but these traditional communities have also lost ground in the state and federal legislatures, as well as, the support of the executive branches. On one hand the attacks result in deaths and physical violence against different types of rural communities. On the other hand, in a political level, the attacks restrict the rights and the ability of negotiation of these same communities. (DATALUTA, 2017, p. 2).⁹

It is crucial to remind ourselves that in this region - the Southwest of Pará – in 1996, the State of Pará partook in the slaughter of 19 landless workers in the S curve (*curva do S*), in the city of Eldorado dos Carajás. The military police of Pará, in 2016, compelled by powerful landowner, again slaughtered 10 landless workers in the city of Pau D'arco. These crimes shed light to a reality of social resistance in order for communities to be able to remain in the land they had been cultivating, as well as present a counter-hegemonic economic alternative through popular participation.

III. POPULAR PARTICIPATION AS A WAY OFRESISTANCE IN THE FIGHTING FOR LANDACCESS

The development model envisioned by different Brazilian governments for the Amazon region has been based on the establishment of vast properties substantiated by massive transfer of public funds to large landowners and private companies – both from Brazil and from abroad – based in the Center-South region of the country. Most of these ventures have allocated their investments in the raising of cattle (COSTA, 2000b). In the mid-1980s, 9 million hectares in the South and Southwest regions of Pará had been converted into pasture (KOHLHEPP, 2002), as we attempted to demonstrate previously in this research.

Many of these properties began to be occupied by migrants, coming from different regions of the country, attracted by the propaganda that sold the Amazon region as a land of opportunity and easy profits. This scenario is described by a union member that migrated from the State of Goiás in 1984:

Then, one day, my uncle, named João Borges, said: Pipira, son, you are all young, I have a ranch in Pará, very far away, we intend to go on foot, it is about 240 kilometers [...] It is a place only for ballsy men, it is not for the faint of heart. Since you are all very courageous, my sons, and work in other people's land to survive, you should go work a land where you get to keep all its fruits. These lands belong to the federal government, only the federal government and the state own land there. You can arrive and just decide how much land you are able to work (SINDICALISTA, 2019)¹⁰.

In the very South of the State of Pará, in a territory formed by eleven municipalities, data from the CPT show us that, between 1975 and 1990, about 258 rural properties were occupied by migrant rural workers. The wasthe case oftheestatesofPecosa, Nazaré, Jocon, Três Irmãos, Batente, São José dos Três Morros, Vale da Serra, Tupã Ciretran, Canaã, Curral de Pedras, Canarana, amongothers. In theareasurroundingthecitiesof São João do Araguaia, Marabá, São Domingos do Araguaia, São Geraldo do Araguaia and Itupiranga, manypropertieson rural leasing begantobeoccupied too. as it wasthe case ofareasofBrazilianNuttreessuch as Pau Seco, Castanheira, Cuxiú, Santo Antônio I, Santo Antônio II, Fortaleza, Dois Irmãos, Vira Sebo, Terra Nova, Surubim, Rainha, Ubá, Araras and Belo Vale, amongothers (PEREIRA, 2015).

⁹Translatedbytheauthor. Original text: Atualmente, as terras das sociedades indígenas, as áreas quilombolas, os projetos de assentamento de reforma agrária e as áreas de proteção ambiental são o foco de ataques dos ruralistas nos âmbitos legislativo, executivo e diretamente nos espaços rurais, sendo que, por um lado, os ataques se dão no âmbito político-legislacional e, do outro, por meio de crimes contra a vida, geralmente por meio da execução de violência física contra os povos do campo (DATALUTA, 2017, p. 2).

¹⁰Translatedbytheauthor. Original text: Aí, um dia o meu tio, que era o João Borges, chegou e disse: Pipira, meu filho, vocês são novos, eu tenho uma terra lá no Pará, é longe, nós vamos de pé, é 240 quilômetros [...]. Lá é pra cabra que tem os grãos roxo. Não é pra cabra de peia não. Como vocês têm coragem, meus filhos, vivem trabalhando pra sobreviver na terra dos outros, vocês pode chegar lá e tirar o tanto de terra que vocês quiserem. Terra da União, lá só é dono a União, o Estado. Vocês podem chegar lá e abrir os braços assim e dizer: vamos tirar o tanto de terra que nós quisermos (SINDICALISTA, 2019).

Once in these occupations, the workers started to be victims of all types of violence, including expulsions and killings.Hitmen were frequently hired to carry out these actions. But also civil and military police officers, even chiefs of police, federal police agents, as well as INCRA / Executive Group for Land between the Araguaia and Tocantins Rivers (*GrupoExecutivo de Terras do Araguaia e Tocantins, GETAT*) personnel contributed to the wave of violence.

Not only rural workers were the direct victims of violence (murders, attempted murders, death threats, assaults, false imprisonment and torture), but their housing and land too (expulsions, destruction of houses, barns and crops). These violent acts dismantled group bonds and social connections. These acts of violence were rarely random, generally targeting influential leaders not only to annihilate them, but to shatter their collective political strength. (PEREIRA, 2015, p.36).¹¹

According to the numbers of the CPT-Pará, 1001 rural workers were killed between 1970 and 2018. 709 of the killings happened in the South and Southwest regions of the state. A large number of these rural workers belonged to unions and were considered leaders of their communities or temporary settlements, such is the case of Raimundo Ferreira Lima (*the Gringo*), JoãoCanuto, ExpeditoRibeiro, José Piau, José Dutra da Costa (*also known as Dezinho*), Onalício Barros (*Fusquinha*), Valentin Serra (*the Doctor*), among others. As indicated previously, these killings aimed not only to annihilate these men, but also the collective political force they represented. According to Medeiros (1996):

[...] It is with these notable people that the acts of violence are particularly cruel as they are also more frequent. To reap a leader is to attempt to maim the organization, education and thinking progress of the social movements they headed. It is, above all else, not a personal attack, but a symbolic aggression towards a beacon of hope and resistance symbol (p.137).¹² It is paramount, however, that we do not perceive the Amazon rural working class of southernPará as victims or passive subjects of events.The violent practices from landowners and businessmen towards the workers – frequently with the consent of the Brazilian government – also generated participation initiatives. The rural workers too devised strategies to confront, negotiate and fight back. Aligning themselves with groups and organizations with shared interests, they found ways to resist in lands that were being litigated, as well as they learn how to better navigate officialchannels to apply pressure in the government. According to a CPT agent, the geographical area described as South and Southwest of Pará is the breeding ground to many forms of popular participations and direct resistance to hitmen and police officer attacks:

[...] the *posseiros* developed many forms of participation. In anfirst step, the participation and resistance happened in the rural environment, as they confronted the direct violence perpetrated by landowners. The most used strategy was running into the woods, or "*atrás do toco*", as they said when running away from threats and persecutions. (AGENTE DE PASTORAL, 2019).¹³

The above fragment of a memory shows us how rural workers fought back the hitmen hired by landowners (with the backing of the Brazilian government) and managed to remain in the lands they had occupied. As the interviewedagent describes the "*atrás do toco*" (running into the woods) strategy, she is asserting that rural workers occupying federal lands in Southern Pará, in the 1970s and 1980s, were victims of landowners who misappropriated public lands and/or retained unproductive estates. For the rural worker the fighting was also for survival: "to shoot back was a matter of defending one's life"(EX AGENTE DE PASTORAL, 2006).

A CPT agent adds:

I have no doubt that the different forms of participation, such as the collective work and crops, were ways to display strength and werealso a defense mechanism. While some

¹¹ Translatedbytheauthor. Original text: Não apenas os trabalhadores de forma direta (os assassinatos, as tentativas de assassinatos, as ameaças de morte, as agressões, prisões e torturas), mas também as suas unidades de produção e de moradia (expulsões, destruição de casas, de depósitos de cereais e de plantações), desestruturando grupos, relações de parentesco e vizinhanças. Uma violência, em diversas situações, também seletiva, recaindo, não por acaso, com maior intensidade sobre as lideranças mais expressivas com o intuito não só de tirar-lhes a vida, mas desarticular a organização política do conjunto dos trabalhadores (PEREIRA, 2015, p.36).

¹² Translatedbytheauthor. Original text: [...] é sobre essas personagens que a violência incide mais fortemente e atinge maiores requintes de crueldade. Ceifar uma liderança é também

procurar destruir um longo processo de preparação, de educação, de produção de novas percepções, gestadas no interior dos próprios movimentos. E é, acima de tudo, atacar não uma pessoa em particular, mas um símbolo de resistência e a voz que porta uma utopia mobilizadora (p.137).

¹³Translatedbytheauthor. Original text: [...] os posseiros foram desenvolvendo formas diversas de participação. Numa primeira etapa, a participação, a resistência na luta, se dava lá no campo, enfrentando as ações, as perseguições por parte dos fazendeiros. Os posseiros falavam que a forma mais adotada por eles, reagindo a atuação dos fazendeiros, era "atrás do toco" como eles falavam porque tinha que se defender da violência dos fazendeiros, das ameaças, das perseguições (AGENTE DE PASTORAL, 2019).

worked the fields, others were busy over watching, otherwise they would not have survived, and they would have been massacred. (AGENTE DE PASTORAL, 2019).¹⁴

Therefore, it is possible that the violent environment that once encouraged these rural workers communities to unite in order to better defend themselves from the hitmen attacks, also impacted in the furthering of other practices such as the collective crops and sharing the working load.

There were other important forms of participation which evolved from the fighting for land access too. Countless communities, early on, chose to settle in places that were very difficult to reach. The role of the forest, in this sense, was not only as a place that provided food, but also a place of shelter and protection. These realities facilitated new inside and outside forms of communication that intended to safeguard the community from the attacks of hitmen or other dangers from outside the estate in litigation they have been occupying. "We know that there was someone spying for the landowners", a former*posseiro* and union member describes: "but we also had someone spying for us. We had people giving us information inside the occupation and outside too" (EX-POSSEIRO E SINDICALISTA, 2006).

Many other forms of communication were effective. A whistle or a sound mimicking a bird, blowing the front sight of the barrel of the shotgun or even mimicking a bark would alert the community about the arrival of outsiders. They also made use of other strategies such as hazardous or obstructed bridges, narrow pathways, ditches, slogs blocking the roads or the trails were all means to avoid unpredictable attacks from hitman and the police in their lands (PEREIRA, 2015; 2004).

Other communities, however, chose different strategies for showing strength and courage, even if they were bluffing, at certain times, these were also effective ways to resist. There were cases of communities that dug trenches they never used, or even discharged their weapon in the forest when they noticed the presence of hitmen nearby; they also would send threatening messages to the hitmen exhibiting their comparable fire power. Blocking roads and sequestering the cattle of the landowner whoinvaded their territory were some of the resistance strategies they adopted to be able to remain in their crops (PEREIRA, 2015).

IV. CONCLUSION

In a context of extreme and perennial violence against rural workers, their resistance becomes the source of meaning for the opposition against the brutal reality of the rural environment in the Amazon region. Thebarbarism of these circumstances are derived from the realization and the consummation of the Brazilian government policies aiming national integration. The purposes behind the colonization projects had little interest in taking into account local populations and their ways of life. In that purview nature was only useful if itsby-products became commodities.

We attempted to present in this study the idea that popular participation among rural workers in Southern Pará, in the Western region of the Brazilian Amazon, goes beyond the collective actions within institutionalized spaces designed to allow different levels of public oversight towards governmental policies and policy making (such as city councils, forum committees, organizations and conferences).We believe that the these rural workers' experiences demonstrate that popular participation can also be found in the practices of solidarity within their communities, their mutual exchanges, the collective way of organizing the workload and the sharing of the harvest. Popular participation in some situations involves activities and actions that are not sanctioned by the government. The establishment of more than500 Agrarian Reform settlement projects and the collective strategies of occupying unproductive rural properties - as well as public lands illegally seized by landowners - in this part of the Amazon region show us how popular participation has been crucial to the (re)existence and the reproduction of territories and territorialities of historically disenfranchised social groups. Through popular participation, rural workers have experienced the possession and occupation of land in the region, as well as they developed different and more sustainable ways to cultivate their crops.

In the context framed by this research, popular participation often happens inside the violent dispute of opposing models. Therefore, popular participation cannot be confused with democratic participation.Democratic participation frequently involves the dialogue and the receptivity to negotiation towards an agreement concerning local interests. That was not always the case for the Southern Pará disputes.

¹⁴Translatedbytheauthor. Original text: Não tenho dúvidas que as diferentes formas de participação como defesa, os mutirões, as roças coletivas, de fortalecimento interno para mostrar sua força e também como medida de segurança para poder se preservando porque num grupo enquanto uns trabalhavam, outros vigiavam e tudo mais. Então assim, na dinâmica do conflito ou os trabalhadores enfrentam e resistem ou são massacrados (AGENTE DE PASTORAL, 2019).

Currently, the confrontations are still a subversive form of participation to rural workers. They negotiate and demand a change in public policies, but still use strategies such as occupation of lands. These strategies and their fight are necessary to the survival alternatives to the expansion of large properties cultivating single crops. The large property model is irresponsible towards the environment; they also irresponsibly take down the forest and contaminate the rivers. The large property model annihilates other alternatives of life and impoverishes workers. Toparticipateistoresist!

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Waste from Health Services: Situation and Actions in a Public Hospital from Manaus (Amazonas, Brazil)

Jacqueline Cabral Macedo¹, Edivaldo Herculano C. de Oliveira²

¹ Student of the Professional Master's Degree in Sciences and Environment of the Federal University of Pará- UFPA, Brazil
² Professor of the Professional Master's Degree in Sciences and Environment of the Federal University of Pará; Researcher in Public Health; Tissue Culture and Cytogenetic Laboratory -SAMAM - IEC; Associate Professor IVFaculdade de Ciências Naturais -ICEN – UFPA, Brazil

Abstract— The amount of solid waste is a serious environmental problem. We highlight among these wastes those that can be highly contaminating, such as health services wastes, called "hospital waste". There are several reports of victims of occupational accidents, especially with puncture wounds, and contamination by pathogenic agents such as HIV-1 may even occur. Thus, it is necessary to sensitize users and professionals to the risk of contamination by serious pathologies, including those that have no cure. Thus, the main objective of this study was to analyze the situation of health service waste disposal in a public hospital in the city of Manaus (AM), and, based on the results, to propose improvements in the process. After the detection of many inconsistencies and the need for better knowledge on the part of its employees, it was proposed to write and distribute a booklet as a precursor, didactic, illustrative tool for employees and users of this hospital. The material was distributed and accompanied by informative lectures on the risks and rules regarding the correct handling and disposal of hospital waste. Considering the good reception and participation of the employees, we concluded that education and clarification are important tools for the implementation of improvements in the handling of the issue of waste generated at the unit, prevention of drilling accidents aiming at improvements in the management and responsible disposal of health service waste, and thus contribute to the Environment and Public Health.

Keywords— health service waste, educational technology, waste disposal, public health.

I. INTRODUCTION

The production of waste is inevitable, from human activities solid waste is generated in two ways: as an inherent part of the production process and also when the useful life of the products ends1. Unfortunately, this does not happen only with what we call garbage or household waste. There are also wastes that can be highly contaminating, such as Health Services Waste (HSW), commonly referred to as "hospital waste".

Faced with increased waste production, one of the most serious problems is the disposal and treatment of hospital waste, as responsible investments in educational and logistical technologies for the management of RSS in health services are still rare. Corroborating this research is the study from Braga (2013)², carried out at Hospital Universitary Osvaldo Cruz - HUOC, in the city of Recife/PE, which evidenced the lack of logistics and other appropriate

technologies aimed specifically at various types of hospital waste.

The Ministry of Health $(2006)^3$, in the discussions of the guidelines that composed the Pacts for Life and in defense of the Single Health System (SUS), as well as the responsible management, attributes relevance in the questions of understanding that unfavorable environmental conditions of most health services are potential generators of negative impacts to the environment, with serious implications for the health of individuals. They represent incalculable risks (chemical, physical, and biological) to public health, whose sources of pollution are distinct: high production of health service waste and poor management, emission of hazardous gases, inadequate treatment of water for human consumption, improper final destination for effluents and waste, pest control, among others. Therefore, the environmental issue assumes fundamental relevance, especially for health workers, since working and living healthily depend intrinsically on the quality of human and

environmental life. These professionals must incorporate health and environmental education into their daily practices. The handling, disposal and correct destination of RSS are the responsibility of the management of institutions and of all professionals who work in these establishments. Thus, learning the basic concepts of solid waste management and being aware of the possible consequences generates a qualified and committed professional with the environment⁴.

As the main fact of this study and the relevance of the theme, we bring the experience of 21 years of working activities of one of the researchers as a servant of the Amazonas State Health Secretariat (SUSAM). Of these 21 years, 18 were dedicated to the Emergency and Trauma Sector and Medical Clinic of a public hospital in the city of Manaus, capital of the state. It was during logos of years of toil in these sectors that the researcher observed flaws in the processes of Health Services Waste Management (RSS), and Environmental Education for employees in that unit. From the inconsequence's observed, and after 02 meetings held in July and August of the year 2019 with the management, then arose the idea of the researchers to produce an Educational Technology for Environmental Health for employees with coverage to the users of the unit.

Still this issue of RSS, we have opened gaps for the following questions: in what way could health professionals

contribute to addressing this Public Health problem? Do the health units' management train their teams for Environmental Education? In what way? The main objective of this study is to disseminate an Educational Booklet, as an educational tool suggested to a public hospital in the city of Manaus (AM).

THE RESEARCH LANDSCAPE

The researchers experience the sad reality of the lack of management and correct final destination of health services waste generated in the unit they have chosen to describe in this study. With full freedom granted by the unit's management, accompanied by the administrative manager, the researchers visited the unit's external area, which caused perplexity when they saw the scenes in Figures 1A, B and C. In addition to the worrying situation of the management of waste generated at the unit, we detected another situation distinct from the context of our study, the social one. When we entered the woods surrounding the unit, we found that resident and nonresident chemical dependents near the hospital collect the boxes of perforators left in the hospital trash, open them, and reuse the syringes already discarded in them, subject to contamination by infectious diseases such as AIDS and Hepatitis C. They also use the rest of the drugs present in the ampoules and in the discarded bottles.



Fig.1 A, B and C: Open-air hospital waste. A: Empty ampoule of Fentanyl; B-Ampoule of Midazolam; C: Open hole boxes. Source: authors' collection

As the images show, there is a frightening diversity of drug vials and syringes. The extensive area of land that belongs to a private entity neighboring the unit, which, according to the administrative management, has filed
lawsuits involving the issues of Health Services Waste (RSS), against the unit due to the serious situation proven in the images. Thus, we justify our suggestion of Educational Technology elaborated for the employees and users of this public hospital in the city of Manaus in Amazonas in the format of a booklet. Coinciding with the opinion of Reis (2005), the integration of reduction and management in waste generation is related to the promotion of educational attitudes and practical environmental education actions, which are rare in places that provide health care. The author also complements that it is necessary to educate in order to preserve the environment where we live. The development of the interface between health and environment, with the purpose of implementing an environmental health policy, emerges from the need to improve the current model of the Single Health System (BRAZIL, 2007).

Thus, this study has as main objective to disseminate in a public hospital, educational technology for Environmental Health, from the production a didactic precursor instrument, illustrative in the form of a booklet for employees and users of this hospital. The target of the construction of this material was to work collaboratively with the Center for Permanent Health Education (NEPS), helping in the implementation of improvements in the bundling of the issue of waste generated at the unit. At the end of the work, we aimed at disseminating this material to other health institutions in the capital. With positive results of our study, in the future we would have health professionals more aware of environmental issues.

HEALTH SERVICE WASTE: THE SITUATION IN BRAZIL

Waste from Health Services (RSS), for the Brazilian standards of terminology, classification, handling and collection of waste and health services, are defined as waste resulting from the activities performed by establishments providing health services. It covers the residues from the most diverse sources potentially generating, such as hospitals, medical, veterinary and dental clinics, pharmacies, outpatient clinics, health posts, clinical analysis laboratories, food analysis laboratories, research laboratories, medical and dental offices, biotechnology companies, retirement homes and funeral homes5. The National Health Surveillance Agency (ANVISA), broadens this understanding from the RDC ANVISA 306 of 2004 and CONAMA Resolution 358 of 200563, which defines as Waste from Health Services (RSS), all waste generated in service activities related to human or animal health care, analytical laboratories of health products, mortuaries, funeral homes and services where embalming activities are performed, legal medicine services, drugstores and pharmacies, among many others.

In all health facilities, integrated RSS management should advocate not to generate, minimize and reuse waste where possible in order to avoid negative effects on the environment and public health. As for RSS, it is important to note that of the 149,000 tons of residential and commercial waste generated daily, only a fraction below 2% is composed of RSS and, of these, only 10 to 25% need special care7. In any case, the implementation of segregation processes of the different types of waste is unquestionable, especially in those that predominate biological risks, and the concept of the disease transmissibility chain, which involves characteristics of the aggressor agent, such as survival capacity, virulence8 should be considered.

NATIONAL SOLID WASTE POLICY - PNRS

Brazil has tirelessly created a mechanism for Environmental Sustainability. In 2010 it established the National Policy for Solid Waste (PNRS). This is an integrated management that articulates the management of solid waste in the social, environmental and economic spheres. Under Federal Law No. 12,305/2010, the PNRS recognizes the work of cooperatives and associations of collectors, and defines that they are prioritized in hiring for the execution of urban cleaning services. The establishment of a regulatory framework in this area should be understood as an instrument inducing social, economic and environmental development9.

Among the objectives of Law 12305/2010, the "protection of public health and environmental quality" (art. 7, item I) and guidance on the order of priority in the management and handling of solid waste, understood as the "non-generation, reduction, reuse, recycling and treatment of solid waste, as well as the final environmentally appropriate disposal of the waste" (art. 7, item II), are contemplated, and are legally correct behaviors in the management of solid waste and, therefore, the violation of these general obligations entails the incidence of financial charges to polluters¹⁰.

The constant dumping of garbage in unprotected environments associated with the continuous dumping of waste and objects of the most varied species in rivers, public roads, lands and in many places that should be protected, has brought generalized disorders to the Brazilian people11. This statement is based on the disposal of unserviceable materials of various types, attracting vectors of diseases such as dengue, leptospirosis, dermatitis, accidents with perforating materials.

THE INADEQUATE SEGREGATION

On March 28, 2018, the health surveillance launches the Resolution of the Collegiate Directorate - RDC No. 222, which in its Chapter III, Article 11, provides the rules for segregation, packaging and identification. According to the article, the RSS must be segregated at the time of their generation, according to classification by groups. In its article 12, it guides that at the moment of RSS generation, if segregation according to different groups is not possible, the collectors and bags should be handled in compliance with the classification rules described in the annex to the resolution, with important details.

Inadequate segregation contributes to an increase in the amount of contaminated waste and occupational accident risks for workers. Wrong segregation can result in contact with the contaminated, making them also infected, thus increasing the risks of contamination for the population. RSS is a challenge for hospital managers since, in addition to environmental issues, it has also become a public health issue. Added to this challenge, says the researchers, is the high cost to hospitals in subsidizing outsourced companies for segregation activities and other activities for the correct disposal of these RSS.

In a more specific approach to professionals handling RSS, health professionals, especially those in Nursing, are constantly exposed to risks of accidents at work12. One of the characteristics of the work process of Nursing, especially in hospital environments, is the physical proximity to the users and the performance of invasive procedures. Therefore, contact, even if indirect, with organic fluids is common13. In this process, workers are susceptible to infections by blood-borne pathogens, such as the HIV virus and the HVB and HCV viruses.

In a survey conducted at the Ambulatory de DST e AIDS ad Foundation de Medicine Tropical do Amazonas (FMT), located in the city of Manaus (AM), the experience of a collaborator who was the victim of an occupational accident was reported. A 56 year old female nursing professional worked in the nursing area for many years. The patient was the victim of an occupational accident in 1999 when, immediately after the end of a venous puncture in a patient known to be HIV-1 positive, she had contact with her blood in the ocular mucosa after sudden movement of the patient.

The fact triggered its follow-up with the finding of seroconversion to HIV-1 positive status, during the followup recommended by the Ministry of Health. A serological test (HIV- ELISA) was carried out soon after the accident, on the same date, which resulted negative. The same test was repeated approximately eight weeks later with a positive result. The authors emphasize in the study that it is not enough to have responsible disposal plans, RSS management and permanent education technology for people and environment health. It is necessary to sensitize users and professionals to the risk of contamination by serious pathologies, including those that have no cure13.

ENVIRONMENTAL EDUCATION FOR NURSING PROFESSIONALS

The Health Sciences area is composed of specialties unique to human care, among them Nursing, as a profession that composes the field of health, also needs to be involved in the discussions of environmental issues. Establishing action proposals that are compatible with two aspects in particular: one of them is related to the development of actions aimed at the preservation of the environment, facing the impact resulting from human actions, sometimes harmful to the natural environment^{4,14}. In the issue of Health Services Waste (RSS), its management and responsible disposal have the nursing team as one of the main responsible14.

The concept of Environmental Education can be understood as a process where the main individual must be involved in the teaching-learning link to be applied. In the team, each one must be a participative agent in the analysis of each environmental complaint previously diagnosed, especially with the RSS¹⁵. In this way, it is easier to seek solutions to achieve results and prepare disseminators of skills, through ethical behaviors to exercise the office of educators in the process whose are inserted. It is impossible not to agree with the mentioned author, because especially health professionals who work in large reference health units, regarding the correct management of the RSS, need by the management of the units, training activities to proceed correctly in the disposal of waste generated.

ENVIRONMENTAL EDUCATION IN BRAZIL AND ITS PRACTICES IN THE AMAZONS

The Amazon with all its wealth of biodiversity faces in the last decades disastrous situations in the questions related to what to do with the waste generated. In research carried out in the city of Parintins, in Amazonas with the objective of researching on Environmental Education in that city and the management of solid waste in the small city considered by the Amazonians, capital of Brazilian Folklore16. According to researches, in the Folkloric Festival of Parintins - which takes place annually in the last weekend of June, carnival period and in the end of year festivities, it is verified that the generation of solid residues in the city grows vertiginously and reaches peaks above 75 tons/day. This phenomenon shows the relationship between the increase in consumption and the production of waste in the city, its subsequent disposal of rejects and even recyclable materials in the city's public dump. The study found that the municipality of Parintins still does not operate a system of selective collection, in the year of the study it was being implemented. There is no Environmental Education project for the local population ^{17.18}.

In that city, the domestic waste collected daily is composed of the most diverse types of materials such as: organic, glass, bottles, aluminum cans, cardboard, plastic cups, paper, all with final destination to the city's public garbage dump. It is a little more than 4 km away from the city's airport, which means that due to the large number of vultures and other birds associated with garbage, there are no day flights available in the municipality, due to the imminent risk of collision of birds with the aircraft turbines18.

ENVIRONMENTAL EDUCATION IN HEALTH FACILITIES

In the hospital sphere, when the subject is Environmental Education and <u>Health Services Waste</u> Management (RSS), we consider that all professionals in the multidisciplinary team have great importance in the process of Educating to Prevent. However, of all the categories that make up the team, one is essential in the implementation of permanent education activities, the nurse. Our statement is in agreement with the placement that nursing as a science reaches areas such as care, management and education.

The desired result of the teaching-learning process of health education is health promotion, with the nurse being the main agent in this process. In addition, Law 7498/198619, which regulates the exercise of the profession, art. II, defines as nursing activity exercised by the nurse, as part of the health team, the education aimed at improving the health of the population and its team.

Still on the health units, it is believed that Environmental Education is essential to prepare new mentalities and values, that creative, integrative and interactive minds are needed for the new Educational Technologies for public health, and that it is not only with modern software that we will achieve this, but also opening doors for a sustainable, equitable and democratic future20. Camponogara (2011)²¹, on its turn, analyzes the ecological problem from the perspective of health workers a unique situation, taking into account that a hospital has a huge amount of activities with environmental impact, which generates countless waste and consumes a large amount of environmental resources. Unfortunately, in these environments, according to the author, there are no spaces for reflection and in this way the automatism and mechanization of conducts, many times wrong, is perpetuated. In these conditions, professionals remain on the sidelines of participative management, conforming themselves to the reality set and the lack of perspectives that are already so common to them, in the hope that one day the situation may change for the better.

EXPERIENCES OF EDUCATIONAL PRIMERS ALREADY DEVISED FOR ENVIRONMENTAL EDUCATION IN DEALING WITH WASTE FROM HEALTH SERVICES (RSS)

It is recommended that any idea about an Education process and its developments, when proposed in non-formal educational environments, such as the work environment, for example, need theoretical and methodological support capable of dealing with different daily demands22^{. 23}. 22, 23 Based on this statement, concomitant with information collected, supported by the current trajectory of non-conformities in the issues of the activities aimed at the correct management of RSS in the target institution of this study, we aimed to prepare an educational primer as a theoretical-methodological support, as an action to clarify these topics.

The working space of most health service professionals is the same as that of the reception and care of patients and their careers. The environment, the way they work, the way they are trained to perform their activities, can interfere with and compromise their work activities and the health of those who experience the same environment, that is, the patients23. Before bringing experiences lived in health care establishments, in the implementation of educational technologies for environmental health, we emphasize what the federal autarchies recommend that in Brazil, Law no. 12.305/2010, RDC no. 306/2004 of ANVISA and the CONAMA Resolution, bring legal norms related to the management of health service residues. Law No. 12305/2010 establishes the National Policy on Solid Waste, providing on its principles, objectives and instruments, as well as on the guidelines for integrated management and management of solid waste - including hazardous waste -, the responsibilities of generators and public authorities and applicable economic instruments ^{24,25}.

II. METHODOLOGY

The study was exploratory and descriptive, and in addition to the bibliographic research, field research on the management of health service waste at a public hospital in Manaus (AM, Brazil) was performed, aiming at the knowledge of the real situation at the chosen hospital. In MEDLINE, LILACS, COCHRANE; BIREME; BDENF and BDTD databases, bases chosen for search, we obtained as results a total of 73 scientific articles. We have chosen to thoroughly review 41 of these, following some criteria for choice such as: availability of full texts released for consultation, emphasis on the disposal and management of solid waste in health and discussions on Environmental Education in public health units. At the end, in response to the request of the hospital management, we listed the information for the elaboration of an educational and illustrative booklet, which was presented to the unit's Nucleus of Permanent Education.

III. RESULTS AND DISCUSSION

THE EDUCATION AND CLARIFICATION TOOL: INFORMATION BOOKLET

The results achieved with the "HEALTH SERVICE WASTE MANAGEMENT GUIDE CART", the educational technology for Environmental Health, built for the employees of H.P.S. "Dr. João Lúcio Pereira Machado" exceeded expectations. In addition to the printed material, were held on 30 and 31/10/2019, 04 Workshops for the presentation and delivery of the guidance booklet to employees and some users during the day and night shifts. We emphasized the delivery of the instrument in the sectors of Politrauma and Medical Clinic, having been requested by some collaborators that such actions were also performed in other sectors of the institution, and so we did.

During the presentation and delivery workshops of the Booklet for those interested, we asked 2 to 4 questions informally to some of those present if they had knowledge related to the content of the material. We obtained as a response the dissatisfaction of the majority of the employees questioned, alleging that the management of the unit does not show interest in training them for this issue. The knowledge of the risk potential of these residues was contradictory, but they showed interest in deepening their knowledge. Thus, we saw that the degree of orientation on the employees' RSS is still limited, as to the professional practice. It was observed that the legislation is not very well known by the professionals, and it was reported that there are no future projects committed to the issue of residues generated at the unit. This perception leads us to reflect that the motives are the critical financial issue, which crosses the whole state of Amazonas. We know that our educational material, Figure 2A and B, will contribute a lot to Environmental Education and Public Health. However, throughout all this work we have come to the conclusion through bibliographical research that investments are needed especially in infrastructure and permanent education in health units for the efficient management of RSS.



Fig.2: A and B: Cover and summary of edited material as an information and clarification tool. Source: authors' collection

IV. FINAL CONSIDERATIONS

The development of informative material in the form of a booklet, accompanied by lectures and workshops during its distribution, highlighted not only the lack of knowledge on this topic by a good portion of employees, especially outsourced companies, but also showed that this type of action can have a great importance for information, awareness and improvement in the process of management and disposal of RSS. The inadequate management of RSS can cause diseases, contaminate workers through accidents that can occur in the generating source where they are manipulated. This may happen due to waste, especially perforating, containing pathogenic organisms such as hepatitis B and C viruses and HIV, AIDS viruses. Improper handling may allow uncontaminated material to come into contact with contaminated material, including the volume of health care waste and common waste. For this reason, it is indispensable for educational guidance for correct management.

Most health units in the city of Manaus in Amazonas, especially the public ones, face great financial difficulties, which directly impacts the process of RSS disposal, among other problems. Let us admit that the topic of Health Service Waste is not clearly discussed, lacking a better clarification of the norms. The subject has great impact in the current times, it is important to bear in mind that the lack of knowledge can cause serious damage, from contamination of health employees, public cleaning professionals and environmental pollution.

With this study we conclude that the implementation of a Health Services Waste Management Plan is necessary and urgent. However, for this action to be outlined and planned, health professionals must be informed, informed and trained in relation to RSS, its generation, its adequate disposal, and the dangers related to this type of disposal. Actions of clarification and information can be a first step for the viability of larger interventions, with the intention of getting closer to the appropriate ways of dealing with this type of disposal, bringing benefits to society and the environment.

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Dental Caries: A Schoolchildren Epidemiological profile in a Seaside Town, brazil, 2017

Luiz Abel Ferreira de Souza Junior¹, Bruna Campos De Cesaro ¹,Paulo Antônio Barros Oliveira², Ronaldo Bordin¹

¹GraduateProgram in Administration - PPGA, Federal University of Rio Grande do Sul (UFRGS), Brazil ² Graduate Program in Collective Health, Federal University of Rio Grande do Sul (UFRGS), Brazil

Abstract —The objective of this study was to perform an analysis of the dental caries profile in preschool, kindergarten and first to fifth grade elementary school students in BalneárioPinhal, Rio Grande do Sul, Brazil. The experience of caries was described by the prevalence of caries, and the deft and DMFT scores, as described by the World Health Organization, and by the number of students requiring dental treatment. The mean deft at 5-years-old children was 1.54. The DMFT at 12 years-old was 0.53. Taking into account the diagnostic criteria recommended by the WHO, in which only the diagnosis of carious cavities is counted, the students of BalneárioPinhal presented a very low DMFT at 12 years-old. The most relevant components for determining the prevalence of dental caries were: teeth with caries, followed by filled and extracted teeth. The WHO target for the year 2000, that 50% of children between five and six years of age should be free of caries has been met. However, still in 2019, oral health care for BalneárioPinhal schoolchildren needs improvement in order to reach the WHO goal for the year 2010, and to meet students who need some kind of dental treatment for the consequences of caries disease.

Keywords — Dental caries, Epidemiology, Health Management, Public Health.

I. INTRODUCTION

At the end of the 20th century, there was a decrease in the prevalence of dental caries among industrialized countries and in some developing countries. Despite this decline, tooth decay persists as a public health problem, affecting 60% to 90% of school-age children and most adults [1], impacted on pain and tooth loss, restriction of school and work activities and the quality of life of those affected.

Factors associated with reducing the prevalence of caries are fluoridation of public water supplies, fluoridated toothpaste and preventive programs [2]. However, dental caries is influenced by several factors, whether behavioral, demographic and sociocultural, such as hygiene and dietary habits, age, sex, and the degree of development of the country and its investments in the health and education sectors [3].

In epidemiological studies, the most used indicator to measure the severity or intensity of this disease is the Index of Decayed, Lost and Missing Teeth in permanent dentition - DMFT [4]. The goals proposed by the World Health Organization (WHO) for the year 2010 were: DMFT index at age 12 less than 1 and 90% of 5-year-old children free of caries [2,5,6].

In Brazil, four epidemiological studies of oral health of national scope (1986, 1996, 2003, 2010) were carried out, of relevance for the construction of a consistent database related to the epidemiological profile of oral health of the Brazilian population. In 1986, the DMFT index was 6.7 at 12 years of age, with a prevalence of 96.3%. Ten years later, in 1996, there was a significant decrease in the severity of caries at age 12 with an average DMFT of 3.1 and a prevalence of 75% [7], approaching that recommended by the World Health Organization for the year 2000 (DFMT at 12 years of age less than or equal to 3.0).

In 2003, the Ministry of Health launched the National Oral Health Policy - Smiling Brazil Program [8]. The Smiling Brazil Program is a series of measures aimed at guaranteeing actions to promote, prevent and recover oral health among Brazilians, which is fundamental for the general health and quality of life of the population. Its main objective is to reorganize the practice and qualify the actions and services offered, bringing together a series of oral health actions aimed at citizens of all ages, with expanding access to free dental treatment for Brazilians

through the Unified Health System, the Brazilian public national health system (SUS, *in Portuguese*) [8].

The Unified Health System (SUS) offers universal coverage to more than 200 million inhabitants in Brazil, based on the principles of universal access, integrality of actions and equity, being free to the end user at all levels of a regionalized and hierarchical network health services. However, in most Brazilian municipalities, oral health is still a major challenge to these principles, especially with regard to universal access and equity of care. Within this context, dental caries is still one of the main problems to be addressed. Even so, significant reductions have been found in the prevalence and severity of dental caries [5,9]. In 2010, the prevalence reached 56%, a reduction of 41.8% in three decades [10].

In the municipality of BalneárioPinhal there is a Public-Private Partnership (PPP) with the Social Service of Commerce - Unit of the state of Rio Grande do Sul (SESC / RS), the program Smiling for the Future. This Program works to prevent risk factors common to chronic diseases, encouraging the adoption of lifestyles that promote health and well-being. In the sphere of oral health, it is proposed to carry out actions to strengthen primary care in oral health, with the monitoring of schoolchildren up to the 6th year of public elementary education [11].

In the oral health approach, the Smiling for the Future Program presents the following activities: training of teachers for oral hygiene instruction; educational activities in the classroom; presentation, meeting with parents and guardians explaining activities. Schools are visited by oral health teams when the oral health exam is carried out, on which the deft indicators for deciduous and DFMT for permanent dentition (predictive indicators of oral health) are used, and referral of students in need of clinical treatment. The collected data were the basis, in a second moment, for the epidemiological surveys of oral health of the students.

In this context, this study aims to describe the epidemiological profile of dental caries of students from early childhood education to the 5th year of elementary school in BalneárioPinhal schools, in 2017.

II. METHODS

The municipality of BalneárioPinhal belongs to the 18th Regional Health Coordination of Rio Grande do Sul, with an estimated population of 12,493 inhabitants in 2017 (20.2% up to 12 years old), demographic density of 120 inhabitants / km², GDP per capita of R \$ 11,425.17 (US \$ 3,578.19) and a percentage of the population in extreme

poverty of 6.3%.

In the municipality of BalneárioPinhal, the Smiling for the Future Program operated in 2017 with children enrolled in four early childhood schools and five elementary schools belonging to the municipal network, and a state school. There is no private school in the municipality.

The coordination of the Program in the municipality chose to make this program the model of Oral Health Policy for children in the municipality. Thus, the oral health teams of primary care carried out an epidemiological survey based on the deft and DFMT indicators, in students from public schools in BalneárioPinhal, from early childhood education to the 5th year of elementary school. The data obtained were delivered to the municipal health department and the municipal education department.

Thus, this study consists of an epidemiological survey of the target population of the Oral Health Program "Smiling for the Future", carried out in the municipality of BalneárioPinhal in 2017 [12].

For dental examinations, the combined method of the World Health Organization was used, referring to dental health conditions and the need for treatment in primary and permanent dentition [13]. Cavitation teeth were diagnosed as decayed. The examinations were carried out in the schools' classrooms, under indirect or direct natural light, using the visual evaluation method. The data collection team consisted of two dental surgeons (examiners) and two oral health assistants (note-takers), who previously participated in training and calibration. The calibration process took place in a daily session, at the annual event of SESC-Smiling for the future, and the methodology was explained to the examiners and note takers.

The data were organized in an electronic spreadsheet, using descriptive statistics to consolidate the findings. The following variables were inserted in the worksheet: gender, age, activity or not of caries, number of caries lesions (DMFT and deft indexes presented in the forms) and need for dental treatment.

The DFMT index is defined as the average number of permanent decayed, missing and filled teeth, at 12 years of age, in a given geographical space, in the year considered. The tooth decay corresponds to the ICD-10 code K02. This index estimates the present and past experience from the attack of dental caries to permanent dentition. The age of 12 is adopted internationally as a basic parameter for the use of the indicator. The index values correspond to the following degrees of severity: very low (0.0 to 1.1), low (1.2 to 2.6), moderate (2.7 to 4.4), high (4.5 to 6.5) and very high (6.6 and more). High values indicate poor oral health conditions in the population, often associated with unfavorable socioeconomic conditions, difficulty in accessing services and harmful habits, such as high sugar consumption. It can also indicate limited access to fluoride [14].

The data were available in the participating schools and also filed with the education and health departments of the municipality of BalneárioPinhal. As they are publicly available data, there was no need for referral to an ethics committee.

III. RESULTS AND DISCUSSION

From a total of 1208 enrolled in early childhood education to the 5th year of elementary education in the public school system in the municipality, 983 (81.4%) students gave informed consent with parental authorization to participate in the Smiling for the Future project in 2017.

Of these, 93 were transferred to another school during the project, 140 were not present on the dates of the prescheduled exams with the schools, 147 students had problems filling in their data in the clinical records and two students refused to participate in the exams. Thus, the total sample was composed of 601 (49.7%) students.

Of the 601 students participating in the study, 318 (52.9%) were male and 283 female (47.1%); the ages varied between 4 and 18 years of age, with 26 students with 5 years of age, 75 with 6 years of age and 15 students with 12 years of age, ages used for calculating caries injury rates.

The percentage of caries-free children was 50.25% (302 cases). The prevalence of caries was defined as the percentage of individuals with at least one tooth decayed, lost due to caries or restored (deft \geq 1 and DMFT \geq 1), being 49.75% (299 cases) (Table 1). There was no statistically significant difference between the distribution of students according to caries experience and sex (p = 0.054).

	Students without caries experience n (%)	Caries prevalence, students deft≥1 and DMFT≥1			
		n (%)	n (%)		
Sex					
Female	152 (25,29)	131 (21,80)	283 (47,09)		
Male	150 (24,96)	168 (27,95)	318 (52,91)		
Total	302 (50,25)	299 (49,75)	601 (100,0)		

Table 1. Sample distribution, student without caries and prevalence of caries

The most relevant components for determining the prevalence of dental caries were: decayed teeth (83.1%), followed by filled (9.1%) and extracted (7.8%). At 5 years of age, decayed teeth represented 92.9% and at 12 years of age they were responsible for 100% of the prevalence of caries. A study carried out in several municipalities in the state of São Paulo pointed out that the most relevant components for determining the prevalence of dental caries were: decayed teeth (73.4%), followed by filled (23.4%) and extracted (3, 25%). In permanent dentition, the most relevant components for determining the prevalence of the index were: filled teeth (60.8%), followed by decayed teeth (37.8%) and missing teeth (1.4%) [15].

Of the 601 students in the sample, 331 (55.1%) did not need treatment for caries, with 270 (44.9%) lacking this type of care, with no difference between genders (p = 0.06).

Students, at 5 years of age, have deft = 0.61, caries prevalence is 42.3% and 54% of students do not have any need for treatment. Considering the ages of 5 and

6 years, the prevalence of caries is 47.5%. At 12 years of age, they have DMFT = 0.53, a prevalence of caries of 33.3% and 93.3% of students with a maximum of three decayed, missing or filled teeth.

The deft / DMFT ratio was 1.54 at 5 years of age, decreasing to 0.53 at 12 years of age. In other words, the population of schoolchildren studied had a low caries experience at 5 years of age with an average deft of 1.54, which is less than the national average of 2.43 and the average for the South Region of Brazil, of 2.49 [16].

The studied student population had a low caries experience at 12 years of age, with an average DMFT index of 0.53, which corresponds to the population's level of caries severity as being very low (0.0 to 1.1). This value is less than the national average of 2.1 and the South Region average of 2.06 [16]. When compared to world data, this index is lower than that observed in several developed countries and than the world average of 1.67 at 12 years (data grouped from 189 countries) [17]. The WHO target for the year 2000, that 50% of children between five and six years of age should be free of caries has been met (52.47%). However, the target for 2010, of 75% of children free of caries in this age group [18] has not been reached. In addition, the goal that at 12 years of age each child should have a maximum of three decayed, missing or filled teeth - DMFT [19] has not been fully achieved, reaching 93.3%.

This study found 50.2% of schoolchildren free of caries and DMFT at 12 years of age 0.53, very different from that found in 9 municipalities in the interior of the state of Goiás two decades ago, of 4.4% and 5.19, respectively [20]. And, as expected, better values than those observed in a series of studies carried out in municipalities in several Brazilian states in the first decade of the 2000s [2,5,7,9,15,16,21-25].

The polarization of caries disease has been observed in many countries, where the decline in caries experience is found to be uneven and more evident in privileged groups in society. The World Health Organization has set a target for the year 2000 of a 50% prevalence of caries-free children aged 5-6 years old. The implementation of early care programs is a viable alternative since its positive results, in relation to the reduction of dental caries, have been clearly demonstrated in the literature [26], characterizing that oral health care has been effective in BalneárioPinhal in the strip age between 5 and 6 years old with 52.47% of the caries-free participating students.

Other more recent studies in the South Region also show that the data from BalneárioPinhal represents a low prevalence of caries and good performance of oral health care for its students [27,28,29].

In addition, comparing Brazil with countries with the same degree of development in Europe and America, the Brazilian average is at an intermediate value. Within South America, only Venezuela has an average DMFT at age 12 similar to that of Brazil (2.1). The other countries have higher averages, such as Argentina (3.4), Colombia (2.3), Paraguay (2.8), Bolivia (4.7) and Peru (3.7). The results of the SB Brasil 2010 Project indicate that, according to the classification adopted by the WHO, Brazil moved from a condition of average prevalence of caries in 2003 (CPO between 2.7 and 4.4) to a condition of low prevalence in 2010 (DMFT between 1.2 and 2.6) [16].

Similar indexes were also found for the deft at 5 years old, in the cities of the interior of Rio Grande do Sul (2.56), in Porto Alegre (1.71), in the South region (2.49) and in the country (2.43). The same occurred with the indexes at 12 years for the DFMT, in the interior cities of

Rio Grande do Sul (2.17), in Porto Alegre (1.49), in the South region (2.06) and in the country (2.07) [16].

As for the SESC Smiling for the Future Program throughout Rio Grande do Sul, in 2017 205 partner municipalities participated and over 175 thousand children from 1,764 schools were assisted; 86 thousand students were evaluated. The data indicated a 1.86 reduction in the number of decayed primary teeth with an average DFMT in 2017. In 2018, it decreased to 1.59, with a total of 184,546 thousand students, from 206 municipalities and 1,746 schools [11].

IV. CONCLUSION

The WHO target for the year 2000, that 50% of children between five and six years of age should be free of caries has been met (52.47%). However, in 2019, attention to the oral health of schoolchildren from BalneárioPinhal needs improvements in order to reach the goal for 2010, of 75% of children free of caries in this age group.

The students from BalneárioPinhal have a better average of the deft index at 5 years old when compared to the average of these indexes in schoolchildren in the municipalities of Rio Grande do Sul, in the South region and in Brazil, and it is similar to the averages of the state capital, Porto Alegre. The same with the DFMT index at age 12.

The study showed that 44.92% of students in early childhood education in the 5th year of elementary school need some type of dental treatment for the consequences of caries disease.

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Environmental Awareness in the Educational Field with the use of Information and Communication Technologies

Claudia De Barros Camargo¹, Antonio Hernández Fernández², Maria Selma Lima do Nascimento³, Marcus Vinicius Sandoval Paixão⁴

¹University of Granada-España, Brasil
 ²University of Jaén- España, Brasil
 ³University of Paraíba, Brasil
 ⁴Federal Institute of Espírito Santo, Brasil

Abstract— The general theme of this article is environmental awareness in the educational field with the use of ICTs. Our problem is whether teachers use and recognize technology as a partner in the process of environmental awareness? The objective is to analyze the use of technology as an environmental awareness process for the teacher in the investigated school, seeking to verify the use of educational technologies in the process of environmental awareness, and also to identify their developed activities and educational practices. As for the method, we used data collection with a likert scale, with 552 teachers and validated with a factorial analysis. Research was carried out in Elementary Schools in Goiânia, Brazil. In the main conclusions we highlight that teachers use the technological resource in their classes in order to raise environmental awareness, favoring an interdisciplinary educational work with innovative practices.

Keywords— Environmental Education; Technological Education; Innovative Practices.

Resumo— O tema geral desse artigo é a conscientização ambiental em âmbito educativo com o uso das TICs. Nossa problemática é saber se os professores utilizam e reconhecem a tecnologia como parceira no processo de conscientização ambiental? Objetivo é analisar o uso da tecnologia como processo de conscientização ambiental para o professor na escola investigada, buscando verificar o uso das tecnologias educacionais no processo de conscientização ambiental, e também identificar suas atividades desenvolvidas e suas práticas educativas. Quanto ao método utilizamos a coleta de dados com uma escala likert, com 552 professores e validamos com uma análise fatorial. Pesquisa realizou-se nas Escolas de Ensino Fundamental em Goiânia, Brasil. Nas principais conclusões destacamos que os professores utilizam o recurso tecnológico em suas aulas com fim de conscientização ambiental, favorecendo um trabalho interdisciplinar educativo com práticas inovadoras.

Palavras-chave— Educação Ambiental; Educação Tecnológica; Práticas Inovadoras.

I. INTRODUCTION

Nowadays, the concern with the environment is very significant due to the global repercussion of this issue. Many nations try to solve the problem of environmental degradation by promoting some strategies or new alternatives of knowledge and preservation. Environmental education, which is a challenge for all of us," arises from this theme, as these discussions go beyond education and involve professionals from other sectors of society who are constantly trying to reverse these problems (LEFF, 2017, p.74). Regarding this theme, Environmental Education emerges as a great ally in this contemporary challenge, because it is innovative and effective in the face of discussions on environmental issues that go beyond education, other professionals and other sectors of society in an attempt to reverse this process. In view of the above, it is evident that the problem arises from the need to understand whether teachers use and recognize technology as a partner in the process of environmental awareness. And in this sense, this study has the general objective of analyzing the use of technology in the process of environmental awareness by teachers of Municipal Elementary Schools in Goiania-Brazil. The specific objectives are: to verify the use of educational technologies in the process of environmental awareness. And following this line of investigation we seek to understand the challenges faced by teachers in the process of using technology in environmental education. To identify the practices developed by teachers involving technology and environmental education.

The fundamental purpose of environmental education is to ensure that individuals and citizens as a whole understand the complex nature of the environment (resulting from the interaction of its different aspects: social, cultural, economic, etc.). And along the same lines, environmental education is an educational process of a dialectic and systemic nature that should be developed basically at school, due to the social responsibility given to preparing children, adolescents, youth and adults for life. Therefore, we have to develop attitudes in students and in society, based on the acquisition of social values and interest in the environment.

For Ayes (2015), Environmental Education has a great relevance in the process of environmental awareness, the school is an ideal place for this achievement in defense of nature.

Thus, Ayes (2015), refers to that:

(...) "Teaching environmental discipline is an important factor in the teaching-learning process, so it establishes a relationship between environment and society. Therefore, it is essential to develop practices of conservation, preservation and sustainability. Thus, sustainable development encompasses environmental education, social education in the broader context of sociocultural factors, as well as in the political and democratic sector (...)".

ENVIRONMENTAL AWARENESS IN THE EDUCATIONAL FIELD.

According to Sato (2004), it was in 1972, through an International Conference, that significant advances were made, because the United Nations (UN) integrated man as that primordial being in the process of raising awareness about the importance of nature for the life of living beings and for nature. In 1992, the United Nations Conference on Environment and Development (CNUMAD), also known as Rio-92, was held in Rio de Janeiro, Brazil, with the objective of promoting discussions on environmental issues. The scientists discussed the social dimension of the environmental problem because, before, man was considered the most important being of this awareness. Now, however, this conception is seen in a broader way and refers to man as the being that belongs to a society, from that moment on the term "socio-environmental" appears, all changes have the objective of solving or alleviating the problem (MENDONÇA, 2002).

A lot of change has been added, all approved by a large majority of speakers: Non-governmental organizations, civil society, researchers, influential people in the media and society - all defended the principles of respect and care for the environment. The value of education in the awareness process, society's responsibility, social and economic justice, respect, ecological aspects and quality of life for everyone on the planet were discussed.

At the same time the Global Forum-92 Rio/1992 took place, in this opportunity they prepared a document called "Earth Charter", in this document Environmental Education is defined as a dynamic process, conscious, individual and especially social transformation. Nongovernmental organizations, civil society, researchers, influential people in the media and society participated and all defended the principles of respect and care for the environment. With this, they made a document called "Agenda 21", dealing with a primordial agreement between nature and society (MENDONÇA, 2002, p.98).

To know the concept of Environmental Education is important, because it is not easy to define it, because it is a multidisciplinary issue and depends on various contexts in society, history, economy, law, geography, tourism, finally of important and fundamental details in this process. Therefore, we find expressed in the law that establishes the National Policy of Environmental Education, as we see in Article 1 of Law No. 9.795/99 (BRAZIL, 1999):

> Art. 1 Environmental education is understood as the processes through which the individual and the community build social values. knowledge, skills, and attitudes competencies directed towards the conservation of the environment, an asset for common use by the people, essential to a healthy

quality of life and its sustainability (BRAZIL, 1999).

The principles of education are also present in Article 1 of Law No. 9,795/99 (BRAZIL, 1999) mainly when there is mention of the principle of citizenship, where the development of the learner in maintaining a good quality of life and make a propagation of good attitudes to make an environmental education of quality.

Thus, Environmental Education aims to preserve the most precious heritage that one has that is nature and everything that surrounds it. Its goal is to seek the various solutions from the social, ethical, economic, ecological and environmental point of view. This is a task that also awakens in society the concern and care with what can cause damage to nature, such as: deforestation, soil degradation, air and water pollution, garbage. Today these concerns occur in several nations in the world, because it is a collective problem encompassing several countries and all with similar characteristics.

ENVIRONMENTAL EDUCATION PRACTICES

Thus, the environmental proposal in basic education rescues some paradigms, values and new pedagogical practices that will transform conscious subjects and citizens with an important role to change a reality.

According to the Environmental Education Law (EA) Law No. 9,795 of April 27, 1999, in Article 9, the EA must develop in the institutions the processes of primary, media and higher education within the curriculum, involving all segments through education. From basic education to higher and professional education.

And in Article 10 of that law, it ensures that it must intervene in education through activities, in schools, through awareness and changes to ecologically transformative thinking. It is not necessarily a discipline, but it easily facilitates the interaction of the curriculum in schools by adapting to all areas of knowledge.

For Alkimin et al. (2019), in order to carry out a work of environmental awareness in the school space, it is pertinent to go through the teacher training, whether initial or continued, "these spaces are rich in the art of researching, investigating and using creativity in the teaching-learning process" (ALKIMIN et al, 2019, p.68).

Thus, "practices in environmental education comes to collaborate through science and technology an awareness of sustainability. For this, teachers' knowledge in historical, socio-environmental, political, economic processes in defense of this process are relevant (BRAZIL, 2012).

TIC PRACTICES

The speed with which information reaches its destination is impressive, it transcends the information and changes of all sectors of today's society, especially reflected in the health, education, politics and customs of all involved in this reality. And from this perspective, according to Cabero (2016), in the face of the great revolutions in humanity in terms of communication, technology is undoubtedly the most current at this time.

In fact, defining technology goes beyond a simple concept. In reality, it is to say something very innovative, current and necessary in contemporary society. Thus, Hernández and De Barros (2016), as far as ICTs are concerned, can help in several aspects in society, such as: improving learning, innovating practices, exchanging organizations (HERNÁNDEZ and DE BARROS, 2016, p. 58).

For these authors, policies to incorporate technologies in schools favour innovative practices in general, but it is also necessary to reflect on the performance of teachers and their competence to use them for learning purposes. Asseveram Hernández and De Barros (2016) que: "The training of teachers is essential in the process of building innovative practices as well as the appropriate use of information and communication technologies (ICTs) in education" (HERNÁNDEZ e DE BARROS, 2016, p. 288).

Therefore, for Belloni (2001), there are several reasons for the use of technology in education, because used in a cognitive approach, it allows the student to codify, acquire knowledge, opine and transform reality. Education always constitutes a process of communication, beyond information and education. It defends that technology gives the student the opportunity of a new world vision, being the school a perfect space to accumulate new knowledge and change reality. And in this sense, the use of technology reinforces a paradigm that allows an interaction between information and the opinion of acquired knowledge. The school has a great challenge to work with such important themes and present in society, so it is good to know how teachers live and experience this theme at school.

Social and technological advances are providing changes in several areas, implying the need to rethink the ways in which education operates. Thus, the school requires changes in values, attitudes and actions in the way it interacts with nature and existence. It is essential to respect differences, but to create more opportunities for social permanence among all individuals every day. And this transformation is based on being structured in such a way as to stimulate the exchange and appreciation of ideas, the respect for contradictory points of view and the appreciation of plurality and difference and participation in actions that value the environment.

In this way, it implies taking on new ways of perceiving the world that extrapolate the idea of conservation and involve a direct relationship between feeling, living, thinking and being, each one taken into consideration with a view to protecting and expanding life on the planet. The driving force in working on environmental awareness in the educational field is to create in school, an environment capable of submerging everyone involved in the educational process and also society to collaborate through science and technology for an educational awareness.

Historical, socio-environmental, political and economic knowledge in defense of this process is relevant. Due to this indigence, we realize the importance of working on some legal frameworks, which are also expressed in the Federal Constitution (1988 pg. 103), where it states in Art. 225 that "Everyone has the right to an ecologically balanced environment, a good for the common use of the people and essential to a healthy quality of life, imposing on the public power and the collectivity the duty to defend it and preserve it for present and future generations". In subsection VI, it indicates that one should "promote environmental education at all levels of education and public awareness for the preservation of the environment" (BRAZIL, 1999).

II. METHODOLOGY

In the words of Pérez Ferra (2009), the method is the procedure to achieve the objectives and the methodology constitutes the study of the method. For him, the reference is the classification given, which focuses on the fact that research methods may be oriented either to obtaining basic knowledge or to obtaining knowledge applied to decision making and actions for the exchange of knowledge (25).

We conducted a quantitative research, because according to Hernández and De Barros (2018) it is an investigation that has as its primary objective to study the properties and quantitative phenomena and also the relationships that provide the revision of existing theories.

As a tool we use the likert scale application. The population researched includes all the teachers of the Municipal schools who work with environmental awareness and innovative practices, totaling five hundred and fifty-two (552) participating teachers. Thus, the show coincides with the population. A matrix of operation was used for the construction of the instrument, observing the objectives, variables, dimensions, indicators, items and units of measurement (MEJÍA, 2005, p.67). We designed our scale, Likert type, composed of 25 items, grouped in four dimensions (extracted from the specific objectives): being them: A (Environmental Education), B (Technologies), C (Educational Process), D (Awareness), E (Practices). The reliability of our scale was calculated through Cronbach's alpha, and the value obtained was excellent (864).

The factorial analysis technique that we apply in our research follows the following steps:

First it became necessary to study the correlation matrix to see if our data is adequate to perform a Factorial Analysis. For it, such a matrix must have a certain structure. To prove this, if it was used the Kaiser-Meyer-Olkin measure of show adequacy (KMO coefficient), in our case the value is 0.704, following Kaiser (1974) the value is acceptable, and we continue with the analysis of the collected data.

In a second moment, the factors are extracted with the SPSS program, which gives us different methods that differ in the interactive algorithm that uses the extractions. The SPSS brings by default the Main Components method which starts with the total of communalities (whose value is one) in the common factors and, therefore, the final value of communalities at the end of the interactive process is an indicator of the quality of the extraction in the sense that the variables with low final communalities values are poorly explained by the model. In good extraction, these values should be high (the closer to a better one) in all variables (KAISER, 1974, p. 98).

III. RESULTS AND DISCUSSIONS

Factorial analysis was performed because it is a data reduction technique that serves us to find groups of variables that correlate with each other from a group of variables. In Graphic 1 below we demonstrate the communalities, better and less represented, and in these results show us only that there is an item with value, 667 in the rest has a value superior to 500, we say nevertheless we do not eliminate this item.

As we can see in the Graph 1, C13 is the best represented item, with 0 (0,920). "The use of the Internet develops the knowledge process related to environmental education". However, E23 is the worst represented item (0,698). "Projects involving environmental education should be developed in all schools".



Graph 1- Major and minor communalities represented

Source: own.

In the sequence we carry out the rotation of the factors, using the Varimax rotation that optimizes the most extreme factor loads possible in the factors (high and low), which indicates those that we have to keep of the main components whose own values are greater than the unit, although the most used criterion is to observe the percentage of total varianza explained by each component or factor, and when this reaches a cumulative percentage considered high of factors (KAISER, 1974, p.95).

Then in the Graph 2 below we show the initial representative eigenvalues:

Graph 2 - Presentation of initial eigenvalues



Source: own

Component		Initial values			
-	Total	% change	cumulative %	Total	cumulative %
1	6,662	26,649	26,649	6,662	26,649
2	4,037	16,147	42,796	4,037	42,796
3	2,766	11,064	53,860	2,766	53,860
4	2,535	10,139	63,999	2,535	63,999
5	1,834	7,336	71,335	1,834	71,335
6	1,419	5,674	77,009	1,419	77,009
7	1,133	4,531	81,539	1,133	81,539

 Table 1 - Total variation explained.

Source: own

In our case, these are the first 7 factors, which explain an 81.532% cumulative variation.

Also, we conducted a study of factor scores. This gives us the value that each item of the display gets in each

factor in the component matrix below, which are estimated by different methods since it is not possible to obtain them exactly. Calculating the component matrix, we finally have 7 factors left (Graph 3).

Graph 3 - Component Matrix. (Extraction method: Principal component analysis).



Source: own.

After demonstrating the graph 3 we extracted the corresponding items for the different factors. As we demonstrate in the Chart1.

Factor	Name	Items integrated into each factor in the questionnaire.
I	A ENVIRONMENTAL EDUCATION	A2The knowledge about environmental problems is relevant in the teaching-learning process.
		A4 It is important to keep informed about current environmental problems.
		A5Environmental education helps to solve environmental problems.
	B -TECHNOLOGY	B6The use of technology favors the knowledge about environmental problems.
	DTECHNOLOGI	B7The use of technology stimulates the teaching-learning process.
		B8 It is important to use technology in the context of teaching learning.
		B9The use of technological resources stimulates the awareness of environmental problems.
		B10A school favours the use of technological resources in the process of learning about environmental problems.
		C11 - There is a relationship between technology and environmental education.
	CEDUCATIONAL PROCESS	C14The blog and the educational platform are technological resources used in the process of environmental awareness.
	D. AWARENESS	D17The use of the school's technological resources favors the dynamics of environmental awareness.
		E23 - Projects involving environmental education should be developed in all schools.
		E24 - In the school context, working on environmental education in an interdisciplinary way helps in the process of environmental awareness.
	EPRACTICES	

Chart 1- Factors and items.

Source: own.

As the Chart 1shows, in the original scale we had 25 items, and it is reduced by 13 items with a higher reliability than the original scale according to Cronbach's alpha which gave us a value of 0,881.

The descriptive analysis was done by analyzing the most significant data offered by the Likert scale according to the dimensions of the research. Remembering that the dimensions of the descriptive analysis are related to the following dimensions: Dimension A- Environmental education, B-Technology, C-Educational process, D-Awareness, E-Practices. Thus, on dimension A- Environmental education, the descriptive analysis of this dimension gives us some information to highlight. Thus, the teachers interviewed think that environmental education is important in the current context, which stimulates the preservation of the environment, they also think that it is important to keep informed about current environmental problems, also most of them think that environmental education helps in solving environmental problems. The results show that, in Table 1, in view of the Environmental Education dimension, teachers mostly agree that Environmental Education stimulates the preservation of the environment, because it points to a totality of communality of results of (1,000) and extraction of (0,915). These data point to a good performance related to the choice of teachers, with emphasis on A3.- Environmental education stimulates the preservation of the environment. In view of the above, we turned to Mendonça (2002) to emphasize that Environmental Education in the globalized perspective of education guides the awareness of the process of sustainability.

In the continuation of the research, on the B-Technology dimension, it results that the interviewed teachers agree many times that the use of technology favors knowledge about environmental problems, also the use of technological resources stimulates the awareness of environmental problems, the teachers agree that there is a relationship between technology and environmental education, as well as that the Internet or technologies develop knowledge about environmental education. Regarding the Technology dimension in table 1, most teachers agree that the use of the Internet develops the knowledge process related to environmental education demonstrated in the result of communality of (1,000) and extraction of (0,923), these results give emphasis to C13.-The use of the Internet develops the knowledge process related to environmental education. As mentioned by Cabero and Cejudo (2006), technology is an important resource that provides many transformations in various sectors and here, especially in education, it is an innovative resource in contemporary times.

About the third dimension of the descriptive analysis, C.-Educational process, this dimension tells us that teachers agree that the use of technological resources favors the dynamics of environmental awareness, as well as that it is important to discuss environmental education at school. It is noted that in the Educational Process dimension in table 1, teachers mostly agree that it is important to discuss environmental education at school, being represented by the result of data communality in (1,000) and extraction of (0,900), giving emphasis to the answer of C15.-It is important to discuss environmental education at school. As mentioned by Leff (2002), this theme in the educational process worked in an interdisciplinary way will value and reinvigorate significant values and attitudes.

Regarding the fourth dimension, D.-Consciousness, it results that teachers agree that the teacher is prepared to work on the subject of environmental education, but they do not agree that environmental education should be worked only in science classes. Regarding the Awareness process, table 1, teachers chose to highlight the use of technological resources in the awareness process, resulting in a communality of (1,000)

On the last dimension, E.-Practices, in this dimension teachers are very much in agreement that it is important to discuss the subject of environmental education in the classroom, as well as to develop projects on the subject, and to carry out interdisciplinary work on environmental education. It is noted that referring to the practical dimension in table 1, the teachers recognize that it is important to discuss the theme on environmental education in the classroom, resulting in communality of (1,000) and extraction (0,916) in face of the answer of E22.- It is important to discuss the theme on environmental education in the classroom. Besides agreeing in its majority that, in the context, working on the subject of environmental education in an interdisciplinary way helps in the process of environmental awareness, the result is exposed by the communality of (1,000) and extraction (0,876). Proving the response of E24. -In the school context, working on environmental education in an interdisciplinary way helps in the process of environmental awareness. The statements corroborate the objectives of environmental education, according to Article 13, meeting the need to update the curriculum in the manner of environmental education. Thus, the Factorial Analysis was made to give validity to the scale, because we do not intend to make the scale just to investigate, but to make a scale validated in its construction in a scientific way, so that it is a valid instrument for the scientific community. The original scale has 25 items, and we managed with factor analysis to validate it and reduce it to 13 items with the greatest reliability.

IV. CONCLUSIONS

Projects involving environmental education should be developed in all schools, as this challenge arises from the lack of structure in some schools to develop this skill.

When identifying the activities developed by teachers involving technology and environmental education, we realized that the predominant use of blog, platform, internet as technological resources within the process of environmental awareness, because they believe there is a representative relationship between technology and environmental education.

The educational practices of teachers in the field proposed by the research, include that the use of projects and interdisciplinary work on environmental education are important as resources to be used in classroom dynamics.

It is clear that teachers in their entirety appreciate this issue, believing that technology and environmental education are in fact partners in the awareness process, and that the school in question is inserted in this context of using technology for this purpose.

Environmental awareness is present in teachers' actions in the face of an extremely important issue such as environmental education, as well as the use of technologies for innovative practices. All teachers have demonstrated a methodological look to achieve the challenges of education, and this shows us that they are responsible and dynamic professionals in their practice. Another factor to be taken into account is that they show that they develop practices with a preservation character to the environment, where it reveals us that they are concerned with the quality of life of all, considering that in face of this challenge the teacher and student are the main agents.

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Sustainable development and competitiveness: A study focused on the doctrinal environmental aspect

Carlos Navarro Fontanillas

Federal University of Rio de Janeiro, Brazil

Abstract— The goal of this paper is to describe the evolution of environmental thinking, demonstrating the laws, regulations and the specific norms and addressing issues directly related to the benefits that organizations can get. The research methodology used for the development of this work consisted of a systematic review of the literature (SMR) based on scientific articles published before 2017 and available in renowned databases. This paper result is an analysis of the state-of-the-art in the research field on the relationship between sustainable management and competitiveness. The research was based on three keywords: "Management, Sustainability and Competitiveness", limiting the investigation. The relevance of this study is to show the relationship between competitive advantage and sustainability within a social and economic scenario.

Keywords— Environmental Management, Sustainable Development, Sustainability, Competitiveness.

I. INTRODUCTION

After the Industrial Revolution, the world has changed in many aspects, much faster than in previous centuries. Along with the revolution came the globalization, computerization, information overload and environmental imbalance (Salvado et al, 2015). The growth of consumer goods industries, led to increase of production, and thus to the use of more resources, generating more waste, and causing environmental imbalances. The pollution from chimneys, sewage systems and companies' toxic wastes increased global warming, raising society's concern with their impact on the environment, which was never seen before in history (Hicks and Dietmar, 2007; Govindan, 2014).

Sustainable development has become prominent and a requirement of public interest for companies, due to demands coming from employees, customers and shareholders. In this context, environmental management appears as a new focus of business practices, which seeks to adapt production processes to a wider scope of development, in harmony with both the environment and the demand. In this point, Novaes (1992) explains that Eco 92 has important history and developments from the scientific, diplomatic, political, social and communication points of view. And it still requires a specific understanding from a Brazilian reality.

In addition, sustainable development involves other issues, especially the economic and social dimensions that are addressed in this paper. Considering this, the main question that this study will try to answer is:

- Which is the state-of-the-art of the relationship between sustainable development and competitiveness of organizations?

The following sections describe the following topics: in section 2 a literary revision is made, with a contextualization of the global evolution of the theme and, later, an evaluation of the Brazilian scenario. Section 3 describes the research methodology developed for this study. The state-of-the-art of knowledge on research is outlined in Section 4; and the conclusions are presented in Section 5.

II. LITERATURE REVIEW

The concept of eco-development was initially established in 1983, when the United Nations (UN) created the World Commission on Environment and Development as an independent body. In 1987, the prime minister of Norway and various international leaders in sustainable development coined the term sustainability. The result of this summit was the report "Our Common Future", also known as the Brundtland Report. Thus, the members of this summit conceived the most accepted definition of sustainable development, which is the "development that meets present needs without compromising the ability of future generations to meet their own needs" (Brundtland, 1987). The concept was finally incorporated during the UN Conference on Environment and Development, Earth Summit 1992 - ECO-92, in Rio de Janeiro. On this occasion, the Agenda 21 was formulated, a document that is a bold attempt to promote worldwide a new pattern of development, combining methods of environmental protection, social justice and economic efficiency.

Only in 1996, almost 50 years after the foundation of the International Organization for Standardization (ISO), the first ISO 14000 series of standards was launched. Based in Geneva, Switzerland, ISO has the main goal of developing international standards for manufacturing, commerce and communication. The ISO 14000 series addresses environmental issues, such as waste and its impact on the environment. It was launched, seeking to establish guidelines for the implementation of environmental management systems in various economic activities. For Kraemer (2003, p.6): "sustainable development introduces an ethical and political dimension when understanding development as a process of social change, with consequent democratization of access to natural resources and equal distribution of costs and benefits". Chart 4 compares the industrialist and sustainable paradigms:

Cartesian	Sustainable	
Reductionist, mechanistic, technocentric	Organic, holistic, participatory	
Facts and values not related	Facts and values strongly related	
Ethical disconnected from everyday practices	Ethics integrated into daily life	
Separation between objective and subjective	Interaction between objective and subjective	
Humans and ecosystems separated by a relationship of domination of ecosystems	Humans inseparable in a relationship of synergy	
Compartmentalized knowledge and empirical	Knowledge indivisible, empirical and intuitive	
Linear cause and effect relationship	Non-linear cause and effect relationship	
Understood as a discontinuous nature, the whole formed by the sum of the parts	Nature understood as a set of interrelated systems, the whole greater than the sum of the parts	
Well-being assessed by relationship of power (money, influence, resources)	Well-being judged by the quality of the interrelationships between environmental and social systems	
Emphasis on quantity (per capita)	Emphasis on quality (and quality of life)	
Analysis	Summary	
Centralization of power	Decentralization of power	
Specialization	Transdisciplinarity	
Emphasis on competition	Emphasis on cooperation	
Little or no technological limit	Threshold defined by technological sustainability	

Chart 4. Industrialist paradigm versus sustainable paradigm

Source: Almeida, 2002: apud Kraemer, 2003.

Ecological ethics, compliance with laws and improving the company image motivates environmental management. Increasingly, business owners understand and participate in structural changes in the relative strengths of issues related to economic, social and environmental perspectives.

Each company has its own system of pollution control, since each one cause different impacts on the environment. Environmental management is part of the formulation of strategic planning, and serves as a guide, defining plans and programs, which converge to common objectives (Rao and Holt, 2005). Among the advantages of sustainable production are: a reduction of fines for breaking the law, a better product acceptance in the market and a differential among other companies, once the market opens space and provides benefits to those who adhere to this new production concept.

Moreover, sustainable development became important to build a lasting relationship with shareholders, employees, customers, society, future generations and government.

The inclusion of environmental protection among the objectives of the organization is part of the modern management concept. Managers, executives and

entrepreneurs are introducing, for instance, recycling programs (Van Wie et al., 2004; Hurditch, 2005), energy saving (Ngowi, 2001; Schönsleben et al., 2010; Fazio and Monti, 2011), environmental measures (Lee and Cheong, 2011) and other green innovations (Hsu et al., 2011; Marchi et al., 2013). By the spreading of these practices throughout the world, it has been possible to create a comprehensive system of ecological management. The company, considered as an open system of interrelated elements, generates goods and services, jobs, profits, but also consumes scarce natural resources and originates pollution and waste (Kraemer, 2003) (Figure 8).



Fig.8: The economic system and the environment Source: Tietenberg 1994: apud Kraemer, 2003.

According to Brooke and Elkington (1989 apud DONAIRE, 1999, p.50), the ten necessary steps for environmental excellence are:(1) Develop and publish an environmental policy; (2) Set goals and continue to evaluate the gains; (3) Clearly define environmental responsibilities of each area and the administrative staff ; (4) Promote internal and external policies, objectives and goals and responsibilities; (5) Get adequate resources; (6) Educate and train staff, and inform consumers and the community about environmental responsibility; (7) Monitor the environmental situation of the company and make audits and reports; (8) Monitor the evolution of the discussion on environmental issues; (9) Contribute to the environmental programs of the community and invest in research and development applied to the environmental area; (10) Help to reconcile the different interests of all concerned: businesses, consumers, community and shareholders. Therefore, organizations must increasingly incorporate the environmental variable in the exploration of their scenarios, to support decision-making, and maintain a responsible attitude towards this issue.

Brazil's scenario

Much is said about the economic development in Brazil, as an emerging nation. Unlike economic growth, which relates only to the continued growth of overall GDP, economic development also relates to how wealth is distributed throughout the social sectors of the society. Da Fonseca (2005, p.29) points out:

companies However, not only clung to legal determinations. On the contrary, they came to see the environmental issue, opportunities to improve quality and competitiveness, especially because the Brazilian industries are subject to a new and broader competitive environment result of the economic liberalization initiated in the 1990s.

The environment is the big underdog in the development scenario, because of disregard or mere ignorance of environmental issues. The challenge lies upon finding solutions that are capable of ensuring sustainability as well as economic development. This has generated many efforts already felt throughout the economy, the society and even the environment (Ageron, 2012; Vachon and Mao, 2008; Chih et al., 2010).

However, making a Cleaner Production should be a priority, especially in emerging countries, to prevent the cycle of

degradation and remediation (Canal Vieira, 2017). In this effort, the Brazilian stock market pioneered into investment funds and stocks of sustainable enterprises, in order to increase the value of companies concerned with the environment. In 2005, it created the corporate sustainability index (ISE). This index established a group of companies that were socially responsible, profitable and strong enough to take economic, social and environmental risks, ensuring long-term return to shareholders.

Environmental issues both internal, such as care in the production process, management and rational use of raw materials, and external, such as logistics and advertisements were analyzed and used as criteria to prevent some companies to compose the ISE. Any company was eligible to participate of ISE standards, except weaponry, pornography and tobacco industries.

The criteria used to determine the ISE are policies, management practices, performance, compliance with statutory obligations concerning economic efficiency, environmental balance, social justice, nature of product and corporate governance.

Through Figure 9 and Chart 5 it is possible to compare the profitability of companies' portfolios that comprise the ISE and the Bovespa (stock exchange index). From the analysis of data, it is possible to note that on average the ISE index performs better than the Bovespa index. Since its inception in 2006 until 2016, the ISE index only showed evolution below the Bovespa index in the period between 2009 and 2010. Even when in fall, the ISE has shown better results. When evaluating the profit generated by the two indexes during 2011, the period when both evolution curve begins to take off gradually, the ISE index showed superior results, with profit percentage about 20% higher than the Bovespa index, plus a monthly average profitability 0.18% higher.

-			
Chart 5.	ISE versus	Bovespa	profitability

			Promability			
Index	SEP/11	2011	12 MONTH	Accumulated	Monthly Average	Monthly Standard
писл	521/11		12 10010111	Accumulated	profitability	Deviation
ISE	-2,81%	-10,97%	-8,12%	85,83%	0,89%	0,068116
IBOV	-7,38%	-24,50%	-24,64%	63,94%	0,71%	0,068380

Source: http://www.ondeinvestirbylopesfilho.com.br/cli/ita/new/index.asp?newsletter = 514



Fig.9: Evolution of Bovespa and ISE from 2006 to 2016 (Source: http://exame.abril.com.br/mercados/cotacoes*bovespa/indices/BVSP/grafico*)

Investments in foreign countries are increasing eco responsibility due to requirements of environmental protection, legal obstacles and large investments pay back. Donaire (1999) states that the 'country cost' to receive foreign investment is increasingly linked to its international image associated with its environmental care.

Sustainability x Competitiveness

Companies generally seek to satisfy customer's needs to make profit. From the moment that customers define their expectations about what they want to acquire, whether products or services, the opportunity arises to create a competitive advantage. Actions to ensure sustainable development are becoming essential, and can provide many benefits to organizations. North (1997 apud SOUSA 2006) lists some of them:

- a) Improved corporate image;
- b) Renewal of product mix;
- c) Increased productivity;
- d) Greater employee commitment and better working relationship;
- e) Creativity and openness to new discounts;
- f) Better relations with public authorities, communities and environmental groups;
- g) Access to foreign markets;
- h) Easier to meet stricter environmental standards.

Sousa (2006) adds:

Strategically, cost reduction can generate a competitive advantage to the company, thus, the practice of pollution control may become a differentiation element because it can provide a reduction in production costs. Another form of differentiation occurs when customers are willing to choose environmentally sound products or produced by means of cleaner processes.

Nowadays, the doors of the market are closed to companies that flout environmental issues in an attempt to maximize their profits and socialize their losses. On the other hand, companies that do not pollute the environment or merely pollute less conquer a competitive advantage through its concern with the impacts generated by the production process. (Buhalis, 2000; Flanagan, 2007; Ngowi, 2001; Marchi et al., 2013).

Competitive Advantage

Michael E. Porter in his bestselling book "Competitive Advantage" presents the concept in which competitive success is determined and supported by the strategy adopted by the organization. According to Porter (2008), there are two types of competitive advantages: cost leadership and differentiation. These, together with the competitive scope, define the different types of generic strategies.

To increase their competitive advantages, many firms were encouraged to implement environmental management practices in their action plans. Gradually managers and entrepreneurs began to develop recycling programs, energy saving or waste recovery projects, among others (Ngowi, 2001; Van Wie et al., 2004; Hurditch, 2005; Rao and Holt, 2005; Pusavec, Krajnik and Kopac, 2010; Schönsleben et al., 2010; Fazio and Monti, 2011; Lee and Cheong, 2011; Lee and Cheong, 2011; Ageron et al., 2012; Hsu et al., 2011; Marchi et al., 2013). However, the methodology also considered the tools to support content analysis and the stakeholder management system, such as GRI and ISO 26000 (ABNT, 2010; GRI, 2013), in this way Marques et al. (2018) reports that the survival of organizations depends on a response to the challenge of their sustainability. In 1989, Georg Winter created a program called integrated environmental management, known as "Winter model", where companies with an environmental orientation should save environmental resources. Through environmental management, companies would gain market opportunities with quick economic growth and a decrease of risk regarding environmental damages. Moreover, they would have opportunities to reduce costs and improve self-esteem among employees. Donaire (1999) indicates the benefits of implementing environmental management focused on sustainability (Chart 6):

Chart 6. Benefits of environmental management

Economic Benefits

Cost savings; reduction of water consumption, energy and other inputs; recycling, waste sale and use, decrease of wastewater; reduction of fines and penalties related to pollution.

Increase revenues; increase the marginal contribution of "green products" that can be sold at higher prices; increase of market share due to product innovation and less competition; new lines of products for new markets; demand increase for products that contribute to pollution decrease.

Strategic Benefits

Improved corporate image; renewal of the product portfolio; increase of productivity; high commitment of staff; improvement in working relationships

Source: Adapted from Donaire, 1999

Much can be saved with the implementation of a responsible environmental management, especially by reducing the consumption of production inputs. A company can reuse water to wash their facilities, saving power by turning off lights in rooms when there is no work-shift, re-use the printouts as draft or even sell their discarded papers to recycling companies. Another possibility is to produce new products coming from by-products or waste. Increased "green" range of products offered to customers might bring increasing levels of a company market share. These new lines of environment friendly products can also reduce pollution, because of the biodegradable and recyclable materials used in their composition.

Idea generation programs are essential in this process, as they stimulate employees to give important suggestions that can be implemented in the company's environmental programs. Andrade et al. (2006) show the importance of feedback from employees and customers especially when he says that, "the organization is driven by its own internal criteria and feedback, but is ultimately driven by feedback from its market."

Creativity is the most significant element in environmental management. Adapting and creating products that fit this kind of management practice is not easy. The search for alternatives could go far beyond the gates of the company. Firms could also integrate this process to determine what they want to consume, as sustainability is the company's commitment to the society and the environment.

III. METHOD

This paper seeks to explain the relationship between sustainability, environmental management and competitiveness, based on scientific articles published before 2017. It is a descriptive and explanatory study, because it intends to reveal the evolution of the research subject over time.

A limitation related to data collection is the process of selecting the most relevant information on scientific basis.

One of the limitations of data treatment is the difficulty of maintaining focus on the primary subject of analysis, due to the proximity and relation with other topics, such as the social responsibility of organizations.



Fig.1: Research design. Source: The authors themselves.

In order to achieve the research goals proposed by this study, a systematic literature review (SLR) was performed. It was structured into 5 steps (Figure 1): question formulation (i), definition of the research sample (ii), selection of articles (iii), analysis and synthesis (iv) and result organization (v).

IV. RESULTS AND DISCUSSION

In order to chart the state-of-the-art of the research field on the relationship between sustainable management and competitiveness, a systematic review of the available scientific literature was developed. In the first step of the SLR, a survey was conducted over Scopus base, which served as a documental structure for this article. The Scopus base was chosen because it is the largest abstract and citation of peer-reviewed literature. It has twice as many titles and over 50% more publishers listed than any other A&I database. The primary search was conducted in Mai, 2016 the following structure: (TITLE-ABS-KEY using (Management) AND TITLE-ABS-KEY (Sustainability) AND TITLE-ABS-KEY (Competitiveness)). We found 633 documents related to the research topic that will be analyzed through this section.



Fig.2: Record distribution by year of publication. Source: The authors themselves.

Figure 2 shows the number of records related to the relationship between sustainability and competitiveness distributed by year of publication. Through this analysis, it is possible to notice a progressive increase in the number of documents published on the theme, reaching its higher volume in 2015 with 85 records. It is also important to note that, although this subject has been studied for more than twenty years, the interest in this field expanded more significantly in the last decade. It is possible to identify in Figure 2 that the records in the last five years (including 2016) represent 49.29 % of the knowledge generated on this field.

This crescent can be explained by two outlooks. The first is related to the increasing availability of knowledge that occurs due to the use of information technology and the creation of new channels for global distribution of publications. But this phenomenon can also be analyzed by the perspective of a growing interest of organizations in structuring a model of sustainable development, mainly due to cultural changes experienced by the society.

The first two articles written on the subject have two interesting and, in the period they were published, revolutionary perspectives. The oldest (BUCKLEY, PASS and PRESCOTT, 1988) addresses the composition of the metrics used to evaluate competitiveness in a broader way, considering different levels (national, industry, firm or product), and also a more holistic point of view, showing concern in the identification of measures that ensure the long-term sustainability of these levels. The second document (SIMMONDS, 1989) covers the competitiveness of organizations for the most qualified professionals, since sustainable and health quality programs could influence their preference when selecting a job.



Fig.3: Record frequency by type. Source: The authors themselves.

Figure 3 presents the frequency of records by type and it is possible to identify a predominance of articles, accounting for 58% of all the records on the evaluated theme identified in the survey. When the articles published in electronic channels but not yet printed by publishers (Article in Press) are included, this frequency is even higher, reaching 60% of the total.

Studies published in conferences also proved to be significant for this field, representing 26% of the records, which shows the importance of these meetings for the scientific production related to the theme. Overall, articles and conference papers represent 86% of all published scientific production on the subject.

Author	Records
Gunasekaran, A.	4
Egbu, C.	3
Lee, K.H.	3
Azevedo, S.G.	3
Gunay, Y.	3
Renukappa, S.	3
Wagner, M.	3

Chart 1. Authors with the highest number of publications

Source: The authors themselves.

The analysis performed allowed to verify a high dispersion of the documents between the 159 authors identified, given that 96% of the authors published two documents or less. Of 633 documents surveyed, 19(12%) were published by the seven authors with the highest number of publications (Chart 1).

Source	Records
Journal of Cleaner Production	22
IFIP Advances in Information and Communication Technology	11
Journal of Business Ethics	5
Wit Transactions on Ecology and the Environment	5
Acta Horticulturae	5
Sustainability Switzerland	5
Business Strategy and the Environment	5

Chart 2. Journals with the highest number of publications

Source: The authors themselves.

Chart 2 presents the seven journals with the highest volume of publications. The Journal of Cleaner Production appears first with 22 publications, 100% more than the journal in second place. This can be explained by the large volume of annual publications of this journal and its concern with sustainability for society and regions that goes beyond pollution control.

It is also possible to observe a high dispersion of publications among the sources, once 94% of the sources published four or less studies on the field and the difference

between the number of publications of the source with the highest volume and the one in the third place is more than 400%.

It can be noticed that, of the first seven sources with the higher number of publications, four are directly related to the subject of Environmental Science. Of these four, one also deals with business and another with social science. Only one source is related just to social science and another to decision sciences (Figure 4).







Fig.5: Countries with the highest number of publications. Source: The authors themselves.

Figure 5 lists the countries with the highest number of publications on the surveyed topic. Only countries with ten or more records identified were included in the chart. The United States appear as the country with the highest volume of studies, with nearly 10% of all the scientific production and 50% more than the country in the second place (United

Kingdom). The five countries with the highest number of publications together represent 32% of all the scientific production, and present amplitude of 39 records: (i) United States, (ii) United Kingdom, (iii) Italy, (iv) Germany and (v) Brazil.



Fig.6: Tag cloud of titles and keywords. Source: The authors themselves.

In this study, an analysis of the words present in the titles and keywords of the 633 documents identified by the systematic review of the literature was also conducted. We identified 2,405 tags, of which 30% (709) were only mentioned once. Through this analysis, it was possible to identify the 150 words most often cited by the authors. They are presented as a tag cloud structured so that the size of the words is directly related to how often they are cited in the text (Figure 6).

An initial analysis identified that the three key terms used in the survey appear highlighted in the tag cloud: Management, Sustainability and Competitiveness. Looking at the absolute frequency of the twenty most quoted tags; we can note that "Management" and "Sustainability" are the two terms most frequently cited by the authors, but they have a significant variation in frequency, with a difference of 23% between the second and the first place. This variation is more significant when comparing the first and fifth most mentioned tags, which have a variation of 173%, or when comparing the first and twentieth tags, which have a variation of 525% (Figure 7).

The tag "Competitiveness" appears as the fifth most cited term, standing behind "Sustainable" and "Development". It must be emphasized that the frequency of appearance of the twenty most cited terms represent 22% of the total, considering the frequency of the 2,405 evaluated tags. Of the twenty most cited terms, only four are directly related to sustainability (Sustainability, Sustainable, Environmental and Social) and three to competitiveness (Competitiveness, Innovation and Competitive), but several terms, such as Management, Development, Performance, Strategy, Knowledge, Policy and Business, are related to the management of organizations, which shows the importance of their practical application in the organizations.



Fig.7: More frequent tags in titles and keywords. Source: The authors themselves.

Author	Title	Year	Citation
Buhalis	Marketing the competitive destination of the future	2000	611
Rao and Holt	Do green supply chains lead to competitiveness and economic performance?	2005	542
Tukker and Tischner	Product-services as a research field: past, present and future. Reflections from a decade of research	2006	211
Hassan	Determinants of market competitiveness in an environmentally sustainable tourism industry	2000	171
Gnansounou and Dauriat	Techno-economic analysis of lignocellulosic ethanol: A review	2010	170
Pusavec, Krajnik and Kopac	Transitioning to sustainable production - Part I: application on machining technologies	2010	137
Ageron, Gunasekaran and Spalanzani	Sustainable supply management: An empirical study	2012	121
Buckley, Pass and Prescott	Measures of international competitiveness: A critical survey	1988	117
Vachon and Mao	Linking supply chain strength to sustainable development: a country- level analysis	2008	99
van Kleef and Roome	Developing capabilities and competence for sustainable business management as innovation: a research agenda	2007	80
Keller	Managing grapevines to optimize fruit development in a challenging environment: A climate change primer for viticulturists	2010	66
Tseng and Chiu	Evaluating firm's green supply chain management in linguistic preferences	2013	63
Lahmar	Adoption of conservation agriculture in Europe. Lessons of the KASSA project	2010	60
Al-Oqla and Sapuan	Natural fiber reinforced polymer composites in industrial applications: Feasibility of date palm fibers for sustainable automotive industry	2014	58

Chart 3. Most cited papers

Closs, Speier and Meacham	Sustainability to support end-to-end value chains: The role of supply chain management	2011	57
Fazio and Monti	Life cycle assessment of different bioenergy production systems including perennial and annual crops	2011	54
Iverson et al.	Thinning, fire, and oak regeneration across a heterogeneous landscape in the eastern U.S.: 7-year results	2008	51
Khalilian et al.	Designed for failure: A critique of the Common Fisheries Policy of the European Union	2010	50
Vera Rebollo and IvarsBaidal	Measuring sustainability in a mass tourist destination: Pressures, perceptions and policy responses in Torrevieja, Spain	2003	50
Batish et al.	Crop allelopathy and its role in ecological agriculture	2001	48

Source: The authors themselves.

Chart 3 presents the twenty documents that have the highest number of citations among the 633 surveyed documents. It is noteworthy that most of them are relatively new, with only one document published before the 2000s. Of the other 19 documents, 10 were published between 2009 and 2014. Of the authors with higher volume of publications, only one paper (Gunasekaran, A.) appears as the most cited, the other six authors do not appear in the most cited papers. Journal of Cleaner Production stands out not only as the only source with more than one document among the most cited, but it also represents 30% of the twenty most cited records, with 6 documents.

V. CONCLUSIONS

By performing a systematic review of the literature, it was possible to better understand the existing knowledge on the relationship between sustainable development and competitiveness. To perform an analysis over the 633 documents initially found in Scopus base, bibliometric indicators were used: (i) Records distribution by type, (ii) Records frequency by type, (iii) Authors with the highest number of publications, (iv) Journals with the highest number of publications by subject, (vi) Countries with the highest number of publications, (vii) Tag cloud of titles and keywords, (viii) More frequent tags in titles and keywords and (ix) Most cited works.

Many of the results of expenditures on environmental management implementation, such as audits, employee training, and other adjustments, take place in medium and long term. However, increasingly, these issues are becoming vital for the companies to remain competitive in the market. The growing number of the so-called 'green' products bring aperture of markets domestically and abroad. These new 'eco lines' contribute to reduce pollution, while providing companies with an increase of their market share. The improved corporate image in society due to the company's commitment to the environment also motivates employees to devote themselves to their activities. The development of researches to identify sustainable alternatives for a company brings a challenge, because of the need to integrate creativity and commitment to environmental preservation.

Many companies are taking strategic measures to meet environmental requirements, according to their economic sector. Therefore, both, entrepreneurs and shareholders are increasingly committed to environmental issues by Financial markets gradually open to sustainable business investment. The crescent carbon trading and the environmental indexes must be highlighted. Thus, the commitment to the issue of sustainability is becoming essential for companies to prevail on the market. In addition, if the actions in this direction are well designed, they can provide firms with competitive advantages, as demonstrated by the research.

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NANDA International Nursing Diagnoses for Children with Kidney Disease on Hemodialysis

Paula Sousa da Silva Rocha¹, Hannar Angélica de Melo Alverga², Maria Gillyana Souto Pereira Lima³, Maria de Nazaré da Silva Cruz², Thalyta Mariany Rego Lopes Ueno³, Joici Carvalho Barata², Ewellyn Natalia Assunção Ferreira⁴, Aryelle Christie Gomes Leston⁵, Ingrid Melo de Menezes⁵, Ana Carolina Marinho Pinheiro⁶, Charles Carvalho dos Santos⁴, Sandra Maria Pinheiro Nogueira⁴, Eliane Moura da Silva⁷, Antonia Gomes de Olinda⁸, Susi dos Santos Barreto de Souza⁹,Viviane Ferraz Ferraz de Aguiar⁹, Dayara de Nazaré Rosa de Carvalho²

¹Federal University of Pará and Evandro Chagas Institute (PPGBPA / UEPA / IEC). Belém, Pará – Brazil.

⁹Federal University of Pará (UFPA). Belém, Pará – Brazil.

Corresponding Author: Dayara de Nazaré Rosa de Carvalho

Abstract— Objective: To identify the nursing diagnoses of NANDA international in children with kidney disease undergoing hemodialysis. Methods: Cross-sectional and descriptive study, carried out with 16 patients, at a pediatric renal therapy reference center in a city in northern Brazil. For data collection, the interview form was used together with data collection in the patients' medical records from January to March 2016. Results: 21 nursing diagnoses were identified, the most frequent of which were: risk of infection (100%); risk of vascular trauma (100%) and excessive volume (68.75%). Conclusion: The most frequent diagnoses are included in the domains security / protection and nutrition, referring to specific interventions and strengthening nursing practice in hemodialysis.

Keywords— Nursing Diagnosis; Pediatrics; Pediatric Renal Dialysis

I. INTRODUCTION

The occurrence of a systemic disease implies, for a child, the need to cope with various changes in lifestyle, especially those caused by restrictions resulting from the disease, by the therapeutic and clinical control needs, as well as the possibility of recurrent hospitalizations. Renal Disease (DR) is one of these conditions, and consists of progressive and irreversible damage and loss of kidney functions^[1].

Studies^[1,2] demonstrate that technological innovations have brought significant improvements for the treatment of RD, however, this disease still has great repercussions for its patients, especially due to the limitations and the abrupt change in the child's routine for the effective treatment, which it is supported by diets, medicated drugs and some types of dialysis.

Hemodialysis stands out among the treatment modalities for kidney disease. This modality consists of the extraction of toxic nitrogenous substances from the

²Pará State University. (UEPA). Belém, Pará – Brazil.

³Amazonas State University (UEA). Manaus, Amazonas - Brazil.

⁴University of the Amazon (UNAMA). Belém, Pará – Brazil.

⁵University Center FIBRA (FIBRA). Belém, Pará – Brazil.

⁶Metropolitan University Center of the Amazon (UNIFAMAZ). Belém, Pará – Brazil.

⁷Evandro Chagas Institute (IEC). Belém, Pará – Brazil.

⁸Faculty of Patos. Dourados, Mato Grosso do Sul. Brazil

blood and the removal of excess fluids accumulated in the body's tissues^[2].

The implementation of the Nursing Process (NP) in a pediatric hemodialysis sector is of fundamental importance, since this instrument supports nurses in the development of a specific care plan, covering the identification and monitoring of the adverse effects of treatment, patient care, complications resulting from the disease, in addition to the possibility of developing educational actions for promotion, prevention and treatment^[3].

The NP consists of stages that vary according to the established theoretical framework. Among its stages, the Nursing Diagnosis (DE) stage stands out, as it directly interferes with the success of the other stages of the nursing process. NDs are conceptualized as clinical judgments of the individual, family and / or community's responses to real or potential health problems and vital processes. They are scientific interpretations of the data collected, used to guide nursing planning, implementation and evaluation^[4].

Thus, with the objective of providing assistance aiming at a better adaptation of the child with kidney disease to the treatment of hemodialysis, and also to strengthen the professional care practice of nurses, this research aimed to identify the nursing diagnoses of NANDA International in children with hemodialysis kidney disease.

II. METHODOLOGY

A descriptive and cross-sectional research was carried out, with a quantitative approach, interviewing those responsible for the children seen at a referral center for renal therapy in a public hospital in the State of Pará and collecting data from the medical records of these children. The total sample of the research was composed of 16 children diagnosed with kidney disease and submitted to hemodialysis at the renal therapy center during the research period.

The inclusion criteria for data collection in the medical records were: child registered and submitted to hemodialysis in the referred renal therapy unit, being under treatment in the unit for at least 6 months, aged between 0 and 12 years. The exclusion criteria were: patients over 12 years old, children with mental disabilities and diagnosed with HIV and hepatitis B. For

the interview with those responsible for the children, the inclusion criteria were: Being responsible for a child included and having more 18 years old. The exclusion criteria were: caregivers with mental illness, who do not communicate by speech and under 18 years old.

For data collection, an instrument divided into 3 cores was used: the first refers to socioeconomic aspects, the second refers to clinical aspects and the third refers to the adaptive problems proposed by Sister Callista Roy. The collection was carried out in a reserved room at the renal therapy center, before the beginning of the hemodialysis session of the child under the responsibility of the adult, between the months of January to March 2016.

For the structuring of the data, an individual process of clinical judgment of the nursing diagnoses was carried out, carried out in two phases: the analysis, which includes categorization of the data and the identification of gaps; and the synthesis, which is formed by grouping, comparing, identifying and relating the data^[5]. Then, a database was built in the Microsoft Excel application, in which diagnoses were recorded and statistics were generated for data analysis.

Respecting the rules of Resolution No. 466/2012 of the National Health Council, this research was approved by the Research Ethics Committee of the University of the State of Pará and the Santa Casa de Misericórdia do Pará Foundation, under opinions number 1,384,495 and 1,035,923, respectively. The guardians of the children signed the Free and Informed Consent Form and the head of the Renal Therapy Center signed authorization for access to the medical records. The study was financed with the researchers' own resources.

III. RESULTS

The identified nursing diagnoses - which are distributed by frequency in Picture 1 - had an average per child of 7.8; median of 8; standard deviation of \pm 2.32; maximum value of 12 and minimum of 5 per child.

Chart 1: Distribution of nursing diagnoses according to the international NANDA for children on hemodialysis. Belém / PA, 2016.

	Gift		Absent		Total	
Diagnostics	n	%	n	%	n	%
Risk of infection	16	100	0	0.0	16	100
Vascular trauma risk	16	100	0	0.0	16	100
Excessive liquid volume	11	68.75	5	31.25	16	100
Arrangement for improved self-	7	43.75	9	56.25	16	100
Arrangement for improved methods familiar	7	43.75	9	56.25	16	100
Acute pain	7	43.75	9	56.25	16	100
Improved arrangement for coping	6	37.50	10	62.50	16	100
Activity intolerance	6	37.50	10	62.50	16	100
Low situational self-esteem	6	37.50	10	62.50	16	100
Anxiety	5	31.25	11	68.75	16	100
allergic response risk	5	31.25	11	68.75	16	100
Impaired gas exchange	4	25	12	75	16	100
Electrolyte imbalance risk	3	18.75	13	81.25	16	100
Fatigue	3	18.75	13	81.25	16	100
Arrangement for improved relationships	3	18.75	13	81.25	16	100
Fear	3	18.75	13	81.25	16	100
Volume of poor liquid risk	2	12.50	14	87.50	16	100
Unbalanced nutrition: less than body requirements	2	12.50	14	87.50	16	100
Impaired physical mobility	2.	12.50	14	87 50	16	100
Sleep deprivation	2	12.50	14	87.50	16	100
Disturbed sleep nattern		6.25	15	93.75	16	100
Disturbed sleep pattern	1	0.25	15	25.15	10	100

Source: research authors, 2017.

Due to the number of NDs identified, Fig. 2 exposes all related factors / risks and all the defining characteristics of the nursing diagnoses identified with frequency above 50%.

Chart 2: Nursing diagnoses, related factors / risks and defining characteristics above the relative frequency of 50%, according to NANDA International, for children on hemodialysis. Belém / PA, 2016.

Diagnostics	Related Factors / Risks	defining characteristics
Infection Risk	Invasive procedures Chronic disease	
vascular trauma risk	Insertion time duration	
	Width of the catheter	
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	Type catheter	
Excessive liquid volume	Regulatory mechanisms compromised	Edemahemoglobina decreased
		Change in urine density
		oliguria

Source: research authors, 2017.

IV. DISCUSSION

Present in 100% of the sample, the nursing diagnosis Risk for Infection is defined as an increased risk of invasion by pathogenic microorganisms. This diagnosis is present in domain 11 (safety / protection), class 1 (infection) of the international NANDA^[4].

For hemodialysis, vascular access is necessary for the patient. In general, this access occurs through a catheter or arteriovenous fistula. Nursing and patient care are required to maintain access. Thus, although it is not possible to avoid multiple injuries (which increases the risk of infection) the nursing team must monitor the integrity of the vascular access, keeping alert to possible phlogistic signs that indicate infection^[6].

The diagnosis Risk of vascular trauma was also present in the entire sample. This diagnosis is found in domain 11 (safety / protection), class 2 (physical injury) of NANDA international. It is defined as risk of damage to the vein and surrounding tissues, related to the presence of catheter and / or infused solutions^[4].

It is true that, over the years, intravascular catheters have improved and new products have emerged. However, it is recommended that the team is always attentive, regardless of the type of catheter, to the relationship between its caliber and the vessel caliber, as the external caliber of the catheter close to the vessel caliber reduces the pericateter blood flow and intensifies friction between both. Therefore, the greater its variation, the better it will be to avoid phlebitis of physical origin triggered by contact. Another risk factor for vascular trauma is the time the catheter remains in the same insertion site. It is common to prolong this time in patients undergoing hemodialysis, which increases the chances of developing phlebitis, thrombophlebitis and infection ^[7].

The excessive volume of liquids in the nursing diagnosis is defined as greater isotonic fluid retention. It belongs to the international domain 2 of NANDA (nutrition), class 5 (hydration)^[4].

The excess of fluids in renal patients undergoing hemodialysis can cause complications such as hypotension and cramps, due to the withdrawal of fluids and electrolytes, in addition to severe and irreversible cardiovascular changes. Therefore, it is essential that the nursing team has a different view for patients with excessive fluid volume^[8].

V. CONCLUSION

21 NANDA international NDs were identified, namely: Risk of infection, Risk of vascular trauma, Excessive fluid volume, Improved disposition for selfconcept, Improved disposition for family processes, Acute pain, Improved coping disposition, Intolerance to activity, Low self-esteem Situational, Anxiety, Risk of allergic response, Impaired gas exchange, Risk of electrolyte imbalance, Fatigue, Improved relationship disposition, Fear, Risk of deficient fluid volume, Imbalanced nutrition: less than bodily needs, Impaired physical mobility, Deprivation of sleep, Impaired sleep pattern.

The identification of NDs in children undergoing hemodialysis makes it possible to strengthen care practice, since the diagnoses lead to specific interventions. It can be highlighted that the identification of nursing diagnoses affirms nursing as a science, since diagnosing human responses to real or potential health problems is an essential practice of the profession.

The limiting factor of this study was the fact that it was carried out considering only the stages of investigation and nursing diagnosis of NP. Thus, the suggestion of carrying out research that covers all stages of the NP is valid, with a view to carrying out specific interventions and achieving results, aiming at a better quality of life for children with kidney disease undergoing hemodialysis.

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Effect of Sodium lignosulphonate-based Cement Retarder on the Free Fluid Property of Cement Slurry

Ipeghan Jonathan Otaraku and John Vitus Anaele

Department of Chemical Engineering University of Port Harcourt, Nigeria

Abstract— This study was carried out using API recommended practice 13B-2 in a cement laboratory, and the essence was to establish the effect of sodium lignosulphonate-based retarder on the free fluid of cement slurry. The test was carried out at different temperatures of 80°F and 100°F and retarder concentrations of 0.01 gal/sk, 0.03gal/sk, 0.05 gal/sk, 0.07 gal/sk, 0.09 gal/skand 0.10 gal/sk. The test results obtained showed thefree fluid of sodium lignosulphonate-based retarder at concentrations of 0.01gal/sk, 0.05gal/sk, 0.05gal/sk, 0.07gal/sk, 0.09gal/sk and 0.10gal/sk ere 0.8%, 1.2%, 1.46%, 1.75%, 1.92% and 2.12% at 80°F respectively; similarly at 100°F the free fluid were 0.79%, 1.21%, 1.56%, 1.72% 1.91% and 2.22%. The results it meant that concentration play a major role in adjusting the free fluid property of cement slurry while temperature has no significant effect on it.

Keywords— Free Fluid, sodium lignosulphonate cement retarder, Temperature.

I. INTRODUCTION

Cementing operation involve the cement slurry placement in the oil well annulus and casing to provide proper zonal isolation. The main aim is to completely prevent fluids in the well from interacting from one part to another, provide support or point of attachment for the casing, prevent corrosion of the Casing, prevent shock loads during drilling, prevent blowouts, plug off vugular zones and for abandonment. A key and essential part of the wellbore construction process is cementing (Lootens, 2004). The integrity of the oil well construction depends, to a large extent, on the quality of cement formulation and slurry (Ridha et al., 2010) and this is to ensure the safety of the well and durability (Pourafshary et al., 2009; Ershadi et al., 2011). The incomplete isolation of the zone has been linked to the alteration of the production capacity and efficiency of the oil well operation. If it is ineffective cementing, production below optimum is bound to occur (Calvert, 2006). Poor cement slurry design and poor cementing operations are key factors that can affect the performance of the well efficiency and could result in a reduction in oil production. Environmental damage from oil spillage is the side effect of poor cementing and poor slurry design (Lootens, 2004) that

causes death to aquatic lives and land pollution, causing low production of agricultural produce, making the environment inhabitable to human and animal life as it causes some respiratory diseases. The spills also result in the loss of oil that is a part of the useful global oil reserve. Temperatures are a key factor of cement slurry formulation. Oil well cement experience different pressure ranges downhole from pressures within atmospheric pressure to higher pressures of about 1360 kPa, in wells over 10000 ft (Joel, 2009). Apart from high temperature and pressure encountered in wells, the slurries are formulated to take care of the weak or vugular formations and reactive fluids. Successes achieved in the formulation of slurry have been linked to researches, discoveries and findings from additives account for various conditions experienced during cementation operations. Additives are introduced for the adjustment of the slurry system, making it more efficient for obtaining the objective of successfully separating the formation from the casing in order to ensure proper zonal isolation during production. To achieve high-quality slurry for a good cementation operation, an additive known as retarder is usually added in the slurry system to delay the time the cement sets so as to allow adequate time for the operation to come to an end.

1

Cementing operations are carried out at high-temperatures and high pressures (HTHP) in oil well bores and this can be quite challenging. This requires cement formulations that are good technically. Free fluid is the amount of fluid that separates from the cement slurry at the top of the cement column after placement but before setting. This study is to evaluate the effect of sodium lignosulphonate-based retarder concentration on the free fluid property of cement slurry.

II. MATERIALS AND METHODOLOGY

A series of experiments were performed at different concentrations and temperatures to evaluate the effectof sodium lignosulphonate-based retarder concentration on the free fluid property of cement slurry. All tests were conducted in line with the specification for materials and testing for oil well cements (Anon,1997 and 2013).

(a) Slurry preparation

The slurries were prepared according to the API specification 10A standard using a class G Dyckerhoff grade cement, and the free fluid test was carried out at the various concentrations and Temperature of 80°F and 100°F.

b) Free Fluid Test

After blending, the slurry was conditioned using atmospheric Consistometer which has 190°F as the highest temperature see Plate 1.The slurry was exposed to 80°F and 100°F, for conditioning, after the conditioning, the slurry was then transferred into a 250ml cylinder and was left on standing for 2 hours. The slurry was then checked for any free fluid above the cement column. This free fluid was poured out using a

syringe to determine the percentage of free fluid, considering the 250ml volume as a basis. The test was repeated for sodium lignosulphonate concentrations of 0.01 gal/sk, 0.03gal/sk, 0.05gal/sk, 0.07gal/sk, 0.09 gal/sk and 0.1gal/sk and the results were recorded. The free fluid was estimated using the formula:

$$free fluid = \frac{vol of free fluid measured(ml)*100}{250(ml)}\%$$



Plate 1: Ofite Atmospheric Consistometer for slurry conditioning

III. RESULTS AND DISCUSSION

The graph below shows the relationship between the sodium lignosulphonate-based retarder concentration and the free fluid.



Fig.1: Effect of concentration of sodium lignosulphonate-based retarder on free fluid at 80°F



Fig.2: Effect of concentration of sodium lignosulphonate-based retarder on free fluid at 100°F

IV. DISCUSSION

It is observed as shown in figures 1 to 2 that as the sodium lignosulphonate-based retarder concentration increases, there is a corresponding increase in the free fluid which is in agreement with the findings of Joel(2009). The free fluid at sodium lignosulphonate based retarder at concentration of 0.01gal/sk, 0.03gal/sk, 0.05gal/sk, 0.07gal/sk, 0.09gal/sk and 0.10gal/sk are 0.8%, 1.2%, 1.46%, 1.75%, 1.92% and 2.12% at 80°F respectively, similarly at 100°F the free fluid are 0.79%, 1.21%, 1.56%, 1.72% 1.91% and 2.22%. This increase in free fluid may be due to the dispersing ability which the sodium lignosulphonate-based retarder has shown to have according to Anaeleetal, (2019). Also, the resultshad shown that temperature may not be a significant factor to consider when free fluid property of cement slurry is to be adjusted as there is no clear difference in the free fluid at 80°F and 100°F as shown in figures 1 and 2 respectively.

V. CONCLUSION

The study revealed that:

(1) Increase in sodium lignosulphonate-based retarder concentration leads to increase in the free fluid property of the cement slurry.

(2) Temperature does not have a significant effect on the free fluid property of cement slurry.

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Financial Behavior of Indonesian Moslem Students Scholarship Recipients: The Role of Locus of Control and Financial Knowledge

Rika Dwi Ayu Parmitasari¹, Muslimin Kara², Lince Bulutoding³, Zulfahmi Alwi⁴, Marwan Sriwijaya⁵

^{1,2}Department of Management, Universitas Islam Negeri Alauddin Makassar, Indonesia
 ²Department of Islamic Economics, Universitas Islam Negeri Alauddin Makassar, Indonesia
 ³Department of Accounting, Universitas Islam Negeri Alauddin Makassar, Indonesia
 ⁴Department of Islamic Family Law, Universitas Islam Negeri Alauddin Makassar, Indonesia

Abstract— In terms of financial, each individual has its own variables that determines their decision making. Based on the previous researches, individual financial behavior was impacted by internal factors of individual. Those internal factors are locus of control and financial knowledge. Those factors have role for individual in performing financially. This study aimed to determine the effect of locus of control and financial knowledge on financial behavior. This type of research was quantitative research. According to the level of clarity, this research used associative problem formulation. The sample in this study were 246 respondents. While the types of data used were primary and secondary data, with data collection techniques using a questionnaire. Data had passed the validity and reliability test before the process of data analysis. The data analysis technique used was the classic assumption test, multiple linear regression analysis, and hypothesis testing. Data passed all the requirements of classical assumption in order to proceed multiple regression analysis. The results of this study indicated that locus of control and financial knowledge simultaneously affected financial behavior. The results also showed that locus of control and financial knowledge partially affect financial behavior.

Keywords— Financial Behavior, Financial Knowledge, Locus of Control.

I. INTRODUCTION

Indonesia is a developing country that has the fourth largest population in the world. With a large population, Indonesia must be able to be selective in choosing products or services offered by the market and smart in dealing with financial problems (Budiono, 2015). One way to address financial problems is how individuals especially youngsters control their personal financial spending. When expenses are continuous and unlimited in number, individuals will have difficulty controlling finances. This is important because financial difficulties and financial dissatisfaction in individuals can lead to stress and depression (Parmitasari, 2017).

According to research conducted by the Indonesian Kadence International Institute, the result is that many Indonesians are in debt (Andrew and Nanik, 2013). Based on information from Financial Services Authority (OJK), the level of financial knowledge of Indonesian people is still low at 28% while Malaysia is 66%, Singapore reaches

98%, while Thailand reaches 73% (Kusuma, 2014). One of the factors causing low level of financial knowledge is the geographical condition of Indonesia, which is generally around 60% located in rural areas (Kusuma, 2014).

A survey conducted by the Financial Services Authority (OJK) in 2013 showed that Indonesia is a country that has a low level of financial knowledge among the surrounding countries. Evidenced by the results of a national survey of financial knowledge conducted by the Financial Services Authority (OJK) in 2013 in 20 provinces with 8,000 respondents showed the level of financial literacy of the Indonesian people at 21.8% with a utilization rate of 59.7 percent (Financial Services Authority, 2016).

With the lack of financial knowledge, people could act or behave wrongly and ultimately experience shortfalls. The large number of people who do not understand financially causes many people to suffer losses, either due to a decline in economic conditions and inflation or because the development of an economic system that tends to be wasteful because people are increasingly consumptive (Ida and Dwinta, 2010). Many people taking home loans and credit cards experience losses or frequent differences in calculations between consumers and banks because of lack of knowledge. Many people could not access the capital and financial markets because they do not have enough knowledge about it. The existence of financial knowledge can make changes in the mindset and perceptions of an individual in the financial (Parmitasari Bulutoding, and Alwi, 2020).

Research on financial behavior that has been done by (Perry and Morris, 2005) states that self's control influences financial behavior. Locus of control is the way someone views on an event whether someone can or cannot control the event that happened to him. Locus of control orientation can be divided into two, namely internal locus of control and external locus of control (Robbins, Millet and Marsh 2008). Internal locus of control is a person's belief that he has a great potential to determine his own destiny, regardless of whether his environment will support or not support. External locus of control is an individual whose external locus of control is high enough to easily surrender and give up if at any time a difficult problem occurs (Rotter, 2000). The locus of control variable is thought to affect a person's financial behavior psychologically (Hilgert, Hogart, Keown et.al, 2011). Several studies have examined a lot of problems in the financial sector both in the corporate sector and the public financial sector, but there is still little research at the University that discusses personal finance, especially in Indonesia (Nidar and Bestari 2012).

Several previous studies (Xiao el.al, 2009; Mandell and Klein, 2009) concluded that the best way to improve behavior in adulthood is to teach good behavior since childhood, including financial behavior. Financial behavior has become an interesting and much discussed issue lately. Financial behavior is very closely related to individual or community consumption behavior. Financial behavior is an important thing done in achieving one's financial goals so as to have the desired level of financial satisfaction (Parmitasari, et.al, 2018).

Individual with a luxury lifestyle will have many needs, and vice versa with a lifestyle that is not luxurious, individual will have fewer needs as well. It is shown in (Parmitasari, Alwi dan Sunarti, 2018) that lifestyle or hedonism has positive impact on individual financial management. Nevertheless, there is a possibility that individuals with good income are able to show more responsible financial behavior, because it would give them the opportunity to act responsibly (Ida and Dwinta, 2010). Hilgert et al (2003) showed that respondents with lower incomes might pay their bills less on time compared to individuals with higher incomes.

Financial behavior is a person's ability to manage (planning, budgeting, checking, managing, controlling, searching and storing) daily financial funds. The emergence of financial behavior, is the impact of the magnitude of a person's desire to meet their needs in accordance with the level of income (Kholilah and Iramani, 2013). Behavior towards the use of money is often interpreted as motivation for the money they have. The explanation above explains that each individual who has money will have a different treatment, because it is influenced by his desire to shop. Many things can affect a person's behavior in managing finances including formal education factors, age factors, gender factors, income factors, and employment factors, as well as other factors related to one's environmental situation (Yulianti and Silvy, 2013).

Research conducted by (Chotimah and Rohayati, 2015) at Surabaya State University obtained the reality in the field that many of the scholarship recipients were experiencing financial problems. These financial problems are caused by the inability of students to control personal money (monthly money from parents runs out impulsively), not getting used to compiling financial plans, lack of financial control from parents, and the habits of students who hang out with friends every month just to gather. or a walk, culinary activities, watching, and so forth. Many students' lifestyle are contrary to the financial condition of their families, but they force themselves to be comparable with others around them who may be financially established (Parmitasari, Alwi and Sunarti, 2018).

Students who are familiar with the pattern above and make these activities a bad habit. This has become one of the factors in the swelling of monthly student spending, where there is no budget for hangout activities in monthly money. Behavior presented by a person is very dependent on the environment (Parmitasari, Alwi and Sunarti, 2018). When the social environment makes it a routine matter while in college as a burst of fatigue and fatigue. On the other hand, it affects the management of monthly money from parents if the activity is carried out every month or even often every week and the money runs out before the specified time period, and parents must send money back (Yulianti and Silvy, 2013).

II. OBJECTIVES

Based on the above argument, this study aims to: 1. Explore the role of locus of control and financial knowledge on financial behavior of Moslem's students scholarship recipients in Indonesia; 2. The role of locus of control on financial behavior of Moslem's students scholarship recipients in Indonesia, 3. The role of financial knowledge on financial behavior of Moslem's students scholarship recipients in Indonesia.

III. THEORETICAL-CONCEPTUAL REVIEW

Behavioral Finance first appeared in the 1990s. Behavioral finance emerges in line with the demands of the development of the business and academic world. Behavioral Finance theory begin to address the aspects or elements of behavior in the financial and investment decision making process. Behavioral Finance provides a space in studying the psychology of financial and economic actors by taking cognitive and behavioral points to answer the reasons for making irrational decisions in the capital market (Lovric et al. 2008, Barberis et al., 1998, Ezama et. al, 2014 and Shafi, 2014).

Behavioral finance is a theory that is still relatively new but has grown rapidly in the development of behavioral knowledge in the field of finance (Parmitasari et.al, 2019). Behavioral finance theory is the study of the impact of psychology on the behavior of financial participants and their effects on the market (Sewell, 2010). Moreover, Behavioral finance theory also defines how psychology effects financial decision making on financial markets with an open-minded financial way (Konstantinidis, et.al, 2012; Thaler, 1985, Fishbein and Ajzen, 1975).

Behavioral finance is a science that studies how humans react and react to information in an effort to make decisions that can optimize the rate of return by taking into account the inherent risks that are the elements of human attitudes and actions are the determining factors in investing (Lintner, 1998). These behaviors are not only related to existing financial theory and economic law principles, but tend to be influenced and / or based on psychological factors. Behavioral finance combines both economics and psychology (Thaler, 1999). Behavioral Finance overcomes inconsistencies through explanations based on human behavior both individuals and groups (Parmitasari et.al, 2018).

3.1 Financial Behavior

Financial behavior is a study that studies how psychological phenomena affect financial behavior (Shefrin, 2002). Financial behavior is the study of how Mainly, Financial behavior is divided into three factors (Kholilah and Iramani, 2013). The first factor is consumption or expenditure by households on various goods and services (Mankiw, 2003). The second factor is savings or a portion of income that is not consumed by a household in a certain period (Case and Fair, 2007). The third thing is investment or the allocation or addition of current resources with the aim of getting benefits in the future (Noor, 2009). In other words, financial behavior is a person's ability to manage including planning, budgeting, searching, storing, examining, managing, and controlling financial funds in their daily lives.

3.2 Locus of Control

The concept of locus of control was first proposed by Rotter (1966), an expert on social learning theory. Locus of control is a person's perspective on an event whether he feels able or not to control the behavior that occurs to him. Locus of control is also seen as a concept that refers to an individual's belief regarding the events that occurred in his life (Larsen and Buss, 2002).

Locus of control illustrates well how far someone looked at the relationship between actions undertaken with consequences and outcomes. Locus of control is defined as someone's perception of the causes of success or failure in carrying out their work (Yulianti and Silvy, 2013). Meanwhile, Ajzen (2002) defines locus of control as the degree to which a person accepts personal responsibility for what happens to them.

Locus of control (*mujahadah an-nafs*) in the Islamic view is an attitude of earnest struggle against the selfish nature and personal lust for everything, including locus of control in terms of managing money or property. This struggle is carried out because lust has a tendency to seek various pleasures and ignore obligations. Ibn Katsir said "that lust always leads to evil except the lust which Allah cares for from evil". Indeed, the human desire to always orders something he wanted, even if he wanted to take something that is not blessed by God, unless God has mercy on whom He wills. Verily, Allah Almighty is able to forgive sins for those who repent of those sins without harming them (Translate Al-Maragi Juz 13: h. 2).

3.3 Financial Knowledge

Financial knowledge is built from internal individuals and the surrounding environment. Previous studies have shown that financial knowledge has a role in behaviour (Parmitasari, Bulutoding and Alwi, 2019; Jacobs-Lawson & Hershey, 2005; Robb, 2011; Robb & Woodyard, 2011). Financial knowledge could be varied for each individual. The level of financial knowledge is different between individual and would impact on their financial decision making. There are various types of financial knowledge from capital market investors and different financial knowledge will encourage investors to behave differently in utilizing online or offline investment facilities (Pellinen et.al, 2011).

To have good financial knowledge, it is necessary to develop financial skills and learn to use financial tools. Financial skills are a technique for making decisions in personal financial management. Prepare a budget, choose. There are various sources through which knowledge can be obtained, all at various levels of quality or reliability. This includes formal education, such as high school programs or lectures, seminars and training classes outside of school, as well as informal sources, such as from parents, friends, and work (Ida and Dwinta, 2010).

3.4 Research Model and Hypothesis

The research model of this study is shown on the below picture.





Based on the explanation of theory and research model, several hypothesis could be drawn, which are:

- H1: Locus of control and financial knowledge have positive and significant effect on financial behaviour
- H2: Locus of control has positive and significant effect on financial behaviour
- H2: Financial knowledge has positive and significant effect on financial behaviour

IV. RESEARCH METHODOLOGY

The approach used in this research is quantitative approach. Data in this study were scholarship recipients at Islamic universities in eastern Indonesia. Data was collected within 4 months starting from January-April 2017. This study used primary data collected through a questionnaire. The sample used in this study was 246 respondents. Samples are taken based on random sampling, where researchers provide equal opportunities for each element of the population to be chosen to be a member of the sample which is carried out randomly without regard to strata that exist in the population itself.

The analytical method used in this study is multiple linear regression analysis. This regression analysis aims to obtain a comprehensive picture of the relationship between the independent variable and the dependent variable both partially and simultaneously. Before conducting multiple linear regression tests, the validity and reliability tests of the research instruments were carried out. Before carrying out multiple regression analysis, the method requires to test the classical assumptions. The classic assumption test consists of a normality test, a multicollinearity test, a heteroscedasticity test and an autocorrelation test.

V. RESULTS AND DISCUSSION

5.1 Validity and Reliability Test

Validity and reliability test of the instrument was using the SPSS 21 program with 246 respondents. The results showed that data was valid and reliable.

5.1.1 Validity test

A question is said to be valid if the value of rcount which is the value of the corrected item-total correlation bigger or higher than the value of r-table. The result showed on the next tables.

No	Item	r-count	r-table	Status
1	P1	0,514	0,138	Valid
2	P2	0,597	0,138	Valid
3	P3	0,585	0,138	Valid
4	P4	0,641	0,138	Valid
5	P5	0,498	0,138	Valid
6	P6	0,572	0,138	Valid

Table 5.1 Validity Test Result of Locus of Control

Source: Data processed, 2017

 Table 5.2 Validity Test Result of Financial Knowledge

No	Item	r-count	r-table	Status
1	P1	0,625	0,138	Valid
2	P2	0,580	0,138	Valid
3	P3	0,698	0,138	Valid
4	P4	0,645	0,138	Valid

Source: Data processed, 2017

Table 5.3 Validity Test Result of Financial Behaviour

No	Item	r-count	r-table	Status
1	P1	0,513	0,138	Valid
2	P2	0,596	0,138	Valid
3	P3	0,613	0,138	Valid
4	P4	0,629	0,138	Valid
5	P5	0,487	0,138	Valid
6	P6	0,565	0,138	Valid

Source: Data processed, 2017

Based on the above table, all instruments are valid to be used as instruments or statements to measure the variables.

5.1.2 Reliability Test

Reliability test is a test used to measure a questionnaire which contains indicators of a variable. A questionnaire is said to be reliable if the answer to the question is consistent from time to time. A variable is said to be reliable if the Cronbach Alpha value is higher than 0.6. The results showed on the below tables.

Table 5.4 Reliability Test Result of Locus of Control

Reliability Statistics			
Cronbach's Alpha N of Items			
.723	7		

Source: Data processed, 2017

Table 5.5 Reliability Test Result of Financial Knowledge

Reliability Statistics			
N of Items			
5			

Source: Data processed, 2017

Table 5. 6 Reliability Test Result of Financial Behaviour

Reliability Statistics				
Cronbach's Alpha N of Items				
.723	7			

Source: Data processed, 2017

Based on the above table, all variables have Cronbach's Alpha > 0,60. Conclusively, all instruments are reliable to

be used as instruments or statements to measure the variables.

5.2 Classical Assumption Test

Once the data has been confirmed to be valid and reliable, the data will be tested using classic assumptions as a prerequisite in conducting multiple regression analysis.

5.2.1 Normality test

Normality test aims to test whether the regression model, or residual confounding variables have a normal distribution. To determine the level of significance of data whether or not a normal distribution, it can be done by non-parametric statistical tests Kolmogorov-Smirnov (K-S) (Ghozali, 2013). From the below table, it is shown that locus of control, financial knowledge and financial behavior have Z scores are higher than 0,05 and it is indicated that all variables have normal distribution.

Table 5.7 The results of Normality Test One-Sample Kolmogorov-Smirnov Test

		Locus Of Control	Financial Knowlodge	Financial Behavior
Ν		246	246	246
Normal	Mean	18.62	11.62	18.23
Parameters a,b	Std. Deviation	4.455	3.216	4.380
Most	Absolute	.085	.123	.063
Extreme	Positive	.054	.123	.054
Difference s	Negative	085	064	063
Kolmogoro	v-Smirnov Z	1.331	1.936	.993
Asymp. Sig	(2-tailed)	.058	.001	.278

a. Test distribution is Nor.
 b. Calculated from data.

Source: Data processed, 2017

5.2.2 Multicollinearity test

Multicollinearity aims to test whether the regression model found a correlation between independent variables (Ghozali, 2013: 103-104).

Table 5.8 The Result of Multicollinearity Test FinancialKnowledge

Model	Collinearity Statistics		
	Tolerance	VIF	
(Constant)			
Locus Of Control	.949	1.054	
Financial Knowlodge	.949	1.054	

Coefficients^a

a. Dependent Variable: Financial Behavior

Source: Data processed, 2017

The multicollinearity test results showed that the VIF value for the Locus of Control variable was 1.054 with a Tolerance of 0.949, VIF for the Financial Knowledge variable was 1.054 with a tolerance of 0.949. Because the values of two variables Tolerance were higher than 0.10 and VIF of two variables were lower than 10, multicollinearity did not exist on both independent variables. Thus, the above model has been freed of their multicollinearity.

5.2.3 Autocorrelation test

Autocorrelation test is a test of the assumptions in the regression where the dependent variable is not correlated with itself. The purpose of correlation with oneself is that the value of the dependent variable is not related to the value of the variable itself, either the value of the previous variable or the value of the period afterwards. The basis of decision making are: (1) If du $\langle DW \rangle \langle 4$ -du, then there is no autocorrelation. (2) If du $\leq DW \leq du$ or 4-du $\geq DW \geq 4$ -dl, then no conclusions can be drawn. (3) Dw $\langle 4$ -dl, then autocorrelation is positive. (4) DW> 4-dl, then autocorrelation is negative.

Table 5.9 the Result of Autocorrelation Test

Model Summary ^b							
Model	R	R Square	Adjusted R	Std. Error of the	Durbin-Watson		
		_	Square	Estimate			
1	.479 ^a	.229	.223	.22819	2.215		
a. Predict	a. Predictors: (Constant), Financial Knowlodge, Locus Of Control						
b. Depen	dent Vari	able: Financi	al Behavior				

Source: Data processed, 2017

From the results can be output above in 2215 with sig value DW of 0.05 and the amount of data (n) = 246 and k = 2, where k is the number of independent variables. Then the value obtained dl (Lower Limit DW) = 1.78012 and du (Upper limit DW) = 1.79685. Because the value of du<Dw<4-du, then it can be concluded that there is no autocorrelation, so that the autocorrelation test is met.

5.2.4 Heteroscedasticity test

To detect heteroskedasticity in this study, the Glejser Test method was used which was generated from the output of the SPSS version 21 program. The results of heteroskedasticity testing showed that none of the statistically significant independent variables influenced the dependent variable Absolut Ut (AbsUt). This can be seen from the probability of significance above the 5% confidence level. With so, it can be concluded that the regression model does not contain heteroskedasticity. Heteroskedasticity test results can be seen below.

Table 5.10 The Result of Heteroskedasticity Test
Coefficients ³

Model		Unstandardized	Unstandardized Coefficients		t	Sig.
				Coefficients		
		В	Std. Error	Beta		
	(Constant)	1.314	.186		7.076	.000
1	Locus Of Control	.406	.058	.407	7.046	.000
1	Financial Knowlodge	.159	.053	.175	3.031	.003

a. Dependent Variable: Financial Behavio

Source: Data processed, 2017

5.3 The Results of Multiple Regression Analysis

Regression analysis is used to test hypotheses about the effect of partially and simultaneously independent variables on the dependent variable. A good regression equation model is one that meets the requirements of classical assumptions, including all data normally distributed, the model must be free from the symptoms of multicollinearity, free from autocorrelation and free from heteroskedasticity. From the previous analysis proves that this research is considered good.

This study uses regression analysis to predict how far the change in the value of the dependent variable of financial behavior of students receiving a university scholarship program in eastern Indonesia, if the value of the variable independent financial knowledge and locus of control changes. The results of the SPSS are used as an analysis tool, the results of multiple regression are as follows:

Table 5.11 The Results of Multiple Regression Analysis

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients		
		В	Std. Error	Beta		
	(Constant)	1.314	.186			
1	Locus Of Control	.406	.058	.407		
1	Financial Knowlodge	.159	.053	.175		

a. Dependent Variable: Financial Behavior

Source: Data processed, 2017

5.3.1 The Equation of Multiple Regression

From the table above, the results of the calculation of independent variables can be arranged in the following equation:

$$Y = 1.314 + 0.406 X1 + 0.159 X2$$

Y = Financial Behavior

$$X1 = Locus of Control$$

X2 = Financial Knowledge

The results of the analysis can be interpreted as follows:

- 1. The above constant value of the equation of 1,314 indicated that if X1 (Locus of Control), X2 (Financial Knowledge) is constant or X = 0, then the Financial Behavior is 1,314.
- X1 (locus of control) showed a coefficient value of (0. 406). This means that if there is an increase in the locus of control factor by 1%, the locus of control will also increase by the multiplier variable 0. 406 assuming the other independent variables are considered constant.
- 3. X2 (financial knowledge) showed the coefficient value of (0.159). This means that if there is an increase in the financial knowledge factor of 1%, the financial behavior will also increase by the multiplier variable 0.159 with the assumption that the other independent variables are considered constant.
- 5.3.2 Coefficient of Determination

The coefficient of determination (R^2) basically measures how far the model's ability to explain variations in the dependent variable (Ghozali, 2009). The coefficient of determination is between 0 (zero) and 1 (one). A small R2 value means that the ability of independent variables to explain the variation of the dependent variable is very limited. A value close to one means that the independent variables provide almost all the information needed to predict variations in the dependent variable (Ghozali, 2009).

Table 5.11 The Results of Coefficient of Determination

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.479 ^a	.229	.223	.22819

a. Predictors: (Constant), *Financial Knowlodge*, *Locus Of Control*

b. Dependent Variable: Financial Behavior

Source: Data processed, 2017

Based on the table above, the adjusted R2 value was 0.229, this meant that 22.9% of financial behavior variables could be explained from both the locus of control and financial knowledge variables, while the rest (100% - 22.9% = 77.1%) was explained by other causes outside model.

5.3.3 Hypothesis Test

5.3.3.1 F-Test

Simultaneous testing (F Test) is testing together coefficient locus of control and financial knowledge to financial behavior. If the calculated F value> F table then the independent variable (X) affects the dependent variable (Y). If the calculated F value < F table then the independent variable (X) has no effect on the dependent variable (Y). If the Sig value < 0.05 then the independent variable (X) has a significant effect on the dependent variable (X) has no significant effect on the dependent variable (X) has no significant effect on the dependent variable (X) has no significant effect on the dependent variable (X) has no significant effect on the dependent variable (X) has no significant effect on the dependent variable (Y).

Table 5.12 The Resuls of F Test

ANOVA ^a						
Model	Sum of Squares	df	Mean Square	F	Sig.	
Regression	3.761	2	1.880	36.11 4	.000 ^b	
Residual	12.653	243	.052			
Total	16.414	245				

a. Dependent Variable: Financial Behavior

b. Predictors: (Constant), Financial Knowlodge, Locus Of Control

Source: Data processed, 2017

Based on the output above, it could be seen that the calculated F value> F table value (36.114> 3.88) with a probability of 0.000 (significant level of 0,000). Therefore, it can be concluded that the locus of control (X1) and financial knowledge (X2) variables if tested together or simultaneously have a significant effect on financial behavior variables (Y).

5.3.3.2 t-Test

Partial test also called the t test in multiple linear regression analysis aimed to determine whether the independent variable (X) partially or each of the variables significantly influence the dependent variable (Y). If the value of t count> t table then the independent variable (X) affects the dependent variable (Y). If the value of t count < t table, then the independent variable (X) has no effect on the dependent variable (Y). If the Sig value < 0.05 then the independent variable (Y). If the Sig value > 0.05 then the independent variable (X) has no significant effect on the dependent variable (X) has no significant effect on the dependent variable (Y).

Table 5.12 The Resuls of t-Test

		Co	efficients ^a			
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		В	Std. Error	Beta		
	(Constant)	1.314	.186		7.076	.000
1	Locus Of Control	.406	.058	.407	7.046	.000
	Financial Knowlodge	.159	.053	.175	3.031	.003

a. Dependent Variable: Financial Behavior

Source: Data processed, 2017

Based on the output above, it could be seen that the value of the t variable X1 was greater than the value of t table (7.046>1.65251) with a significant level below 0.05, 0.000 and the calculated variable (X2) was greater than the value t table (3.031>1.65251) with a significant level below 0.05 which was 0.003. Based on that, it can be concluded that the locus of control variable (X1) partially influences the financial behavior (Y) and the financial behavior (Y)

5.4 Discussion

Based on the results of the analysis above, a discussion would be conducted which provided some detailed information about the results of the study and how the effect of each variable on other variables. The independent variables in this study were the locus of control (X1) and financial knowledge (X2) variables, while the dependent variable was financial behavior (Y). Furthermore, the discussion of each hypothesis is carried out as follows

5.4.1 The influence of locus of control (X1) and financial knowledge (X2) simultaneously on financial behavior (Y)

Based on the analysis of the locus of control and financial knowledge variables simultaneously influence the financial behavior. This locus of control consists of several indicators, namely the ability to solve personal problems, is more easily influenced by the environment, has initiative, self-confidence, is powerless in dealing with problems in life, and self-control. Meanwhile, financial knowledge consists of the term interest rates, credit terms, personal financial statements and investments. Statistically, these two variables can influence financial behavior because F-count> F-table (36.114> 3.88) with a probability of 0.000 (significant level of 0,000).

This result suggests that locus of control and financial knowledge are important factors that determine whether financial behavior is good or not. The higher the locus of control, the better the financial behavior will encourage. Conversely, if the locus of control is low, then financial behavior will also decrease (bad). Likewise with financial knowledge, the higher the financial knowledge, it will encourage the higher / better financial behavior. Conversely, if the locus of control is low, then financial behavior will also decrease. The results of this analysis accept the H1 hypothesis that locus of control (X1) and financial knowledge (X2) simultaneously influence financial behavior (Y).

This research is supported by the statement of Perry and Morris, (2005) suggesting that there are three factors that influence financial behavior or also called someone's financial behavior including: first, a person's self-control over whatever happens in his life or called the locus of control; Second, a person's financial knowledge of matters relating to money or also called financial knowledge; Finally, knowledge of finance influences a person's behavior in managing his finances. This is in line with the opinion of Orton (2007) that financial knowledge (financial knowledge) becomes an inseparable thing in life, because it is a useful tool for making financial decisions.

Islam also emphasizes that a student (individual / community) must always manage and spend money (assets) properly, effectively and efficiently. In addition, Islam strictly forbids wasting money (wealth) and wasteful. This is confirmed by the word of Allah in the Qur'an surah Al-Furqon verse 67:

Translation:

67. and those who when they spend (property), they are not excessive, nor are they (miserly) miserly, and are (the expenditure) in the midst of such (Department of Religion of the Republic of Indonesia, 2010).

The affirmation of this verse explains that a Muslim student must be good at managing money (wealth) according to their needs and not being stingy about themselves and their families. (Translation of Tafsir Al-Maraghi Juz 19: p. 51). Financial planning (assets), is very important influence in the main aspects of student life.

5.4.2 Partial influence of locus of control (X1) on financial behavior (Y)

Based on the analysis it is concluded that the locus of control (X1) variable has a partial effect on financial behavior (Y). Locus of control consists of several indicators, namely the ability to solve personal problems, easily influenced by the environment, initiative, self-confidence, powerless in dealing with problems in life, and self-control. Statistically, this could affect financial behavior because t-count locus of control (X1) is greater than the value of t-table (7.046> 1.65251) with a significant level below 0.05 which is 0.000.

This result suggests that locus of control is one of the factors that plays an important role in determining the pros and cons of increasing financial actors. The higher the locus of control, will encourage better financial behavior. Conversely, if the locus of control is low or bad, then financial behavior will also decrease. The results of this analysis accept H2 hypothesis that locus of control (X1) influences financial behavior (Y).

This finding is supported by the results of Khalilah and Iramani (2013) research that locus of control affects financial behavior in the people of Surabaya. The result was also supported by Fitra, Rasyid and Susanti (2018) that locus of control influenced investment decision. Rotter (1996) distinguished the orientation of the locus of control into two, namely the internal locus of control and external locus of control. Internal locus of control is a person's belief that there is a great potential to determine one's own destiny, regardless of whether the environment will support it or not and external locus of control is an individual whose locus of control is high enough to easily surrender and surrender if at any time occurs difficult financial problems (Rotter, 1996).

Descriptive results of this study also obtained the results that the locus of control does affect Financial Behavior. This is also in line with the previous discussion about the locus of control of the Islamic perspective, as confirmed in the Word of Allah SWT Al-Quran surah Yusuf verse 53 as follows:

Translation:

53. And I do not free myself (from error), because Truly lust always leads to evil, except lust that is given a grace by my Lord. Verily, my Lord, Forgiving, All-Forgiving (Department of Religion of the Republic of Indonesia, 2010).

Ibn Kathir said "that is (lust always tells to evil) except lust that Allah guarded (from evil)". Indeed, human lust always commands to something that he wants, even though he tells to something that is not blessed by Allah SWT, except Allah SWT gives mercy to whom He wants. Verily Allah Almighty forgives of sins for those who repent of these sins by not torturing them (Translation of Tafsir Al-Maraghi Juz 13: p. 2).

Locus of control is perceived by researchers as a psychological variable, so that it is predisposed, a person has two possibilities, they tend to have an internal locus of control and an external locus of control. Therefore, to improve or enhance financial behavior, things that need to be considered and improved are the ability to solve personal problems, not more easily influenced by the environment, the need to have initiative, must have selfconfidence, avoid being helpless in dealing with problems in life and have a high level of self-control.

5.4.3 Effect of financial knowledge (X2) on financial behavior (Y)

Based on the results of the analysis of financial knowledge variables (X2) partially effect on financial behavior (Y). This financial knowledge consists of several indicators, namely the term interest rate, the term credit, personal financial statements and investment. Statistically, this could affect financial behavior because t-count financial knowledge (X2) was greater than the value of t-table (3.031 > 1.65251) with a significant level below 0.05, which was 0.003.

Most people are looking for a quality life and financial security. Student financial management is also determined by the financial knowledge possessed by each individual. The public wants to be able to make smart decisions about how to manage spending and investment and ultimately obtain a wealth of wealth. This practical approach to achieving this goal involves learning about the specific financial activities faced, namely recording and budgeting, banking and using credit, savings and loans, paying taxes, making major expenses such as houses and cars, buying insurance, investing, and retirement plans.. To handle personal finances systematically and successfully, knowledge is needed.

To have financial knowledge it is necessary to develop financial skills and learn to use financial tools. Financial skills are a technique for making decisions in personal financial management. Setting up a budget, choosing an investment, choosing an insurance plan, and using credit are examples of financial skills. Financial tools are forms and charts used in making personal financial management decisions such as checks, credit cards, debit cards (Ida and Dwinta, 2010). There are various sources through which knowledge can be obtained, all at various levels of quality or reliability. This includes formal education, such as high school or college programs, seminars and training classes outside of school, as well as informal sources, such as from parents, friends, and work (Ida and Dwinta 2010).

Financial knowledge is the basis of a critical factor in financial decision making. Even though many consumers may have a strong capacity to manage impulsive purchases and care deeply about post-financial well-being, people may still lack the knowledge and insight needed to make wise financial decisions. The better the knowledge of finance the better the financial management. This implies that financial knowledge is one of the factors that play an important role in determining the merits of managing a student's finances. The higher the financial knowledge will encourage the better also in managing finances. Conversely, if financial knowledge is low, financial management will get worse too. The results of this analysis accept the hypothesis H3 that financial knowledge (X2) has a partial effect on financial behavior (Y).

The results of this study are consistent with statements made by Parmitasari, Bulutoding and Alwi (2020), Tang and Baker (2016) and Robb and Woodyard (2011). Research conducted by Parmitasari, Bulutoding and Alwi (2019) said that financial knowledge impacts individual financial behavior. While Robb and Woodyard (2011) stated that in behaving financially requires financial knowledge. A similar statement stated by Cummins, Jenkins and Haskell

(2009) said that a person's ability to manage finance is one of the important factors for achieving success in life, so knowledge of good and correct financial management is important for members of the public, especially individuals / students. The research of Jacobslawson & Hershey (2005), Grable et.al (2009), Ida and Dwinta (2010), Robb (2011), Robb & Woodyard (2011) and Parmitasari, Bulutoding and Alwi (2020) stated that there are financial influences knowledge of financial behavior.

The same statement was stated by Ida and Dwinta (2010) that financial knowledge possessed by someone influences financial management. This statement is reinforced by research by Andrew (2014) which suggests that there is a significant relationship between financial knowledge and financial behavior where the higher a person's financial knowledge will tend to be wiser in managing their finances. This statement is also supported by Parmitasari, Bulutoding and Alwi (2020) said that every individual has financial knowledge, but each individual has a different level of financial knowledge and will influence decision making in behavior.

Islam also views that financial knowledge is very important for a student as an individual. Islam also teaches humans to be fair and not go beyond limits. Because everything that goes beyond limits is bad. Even Muslims are also called *Ummatan Wasatho*, which means the people who are in the middle. In addition, the teachings have a wonderful way to lead people not to get caught up in this wasteful nature, because people who are wasteful and squander money (property) are friends with the devil. This is confirmed in the Word of Allah SWT Al-Qur'an surah Al-Isra verse 27 as follows:

Translation:

27. Surely the wasters are devoted brothers and devils are very disbelievers to their Lord (Department of Religion of the Republic of Indonesia, 2010).

The affirmation of this verse explains at the same time gives a warning to students that Allah, does not like people who are wasteful, to the last warning, God calls people who are wasteful and like to spend money or property as people who are friends with the devil.

VI. CONCLUSION

Based on the results of research, it could be indicated that the increase in financial behavior was not inseparable from the ability of students to understand the self-control and level of financial knowledge. With the high locus of control and financial knowledge possessed, it would be wiser in terms of improving financial behavior of students scholarships recipients.

The hypothesis test shows that locus of control and financial knowledge if tested simultaneously will affect financial behavior. Those internal factors was proved to influence financial behavior. Without locus of control and financial knowledge, university students could behave recklessly in terms of financial. Moreover, the research also showed that each of those internal factors could also impact financial behavior partially. Based on the results of hypothesis testing shows that if tested partially, locus of control will affect financial behavior, as well as financial knowledge, if tested partially, it will affect financial behavior.

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An Adaptive Edge Detecting Method for Satellite Imagery Based on Canny Edge Algorithm Mrs. N. Sasikala¹, Ch. Shruthi², A. Mohana³, M. Harika⁴, S. Supriya⁵

¹Associate Professor, Department of ECE, Kamala Institute of Technology & Science, Singapur, Huzurabad, Telangana, India ²³⁴⁵⁶Students, Department of ECE, Kamala Institute of Technology & Science, Singapur, Huzurabad, Telangana, India

Abstract—Satellite images are unclear and it is very difficult to get information from them. This paper deals with the detection of edges of a satellite image. Here, edge detection is the fundamental tool of image segmentation. Image segmentation is a process of dividing an digital image into set of pixels, it is used to identify the objects and boundaries un an image. A set of connected pixels which forms boundary between two disjoint regions defines an edge, which is very important to acquire information from an image. There are many segmentation techniques like threshold, clustering, PDE, ANN based techniques, of all these methods edge based technique is the most optimum one. Canny edge detection algorithm is used to detect a wide range of edges in image uses multi-stage algorithm. Low error rate, good localization and single response are the main features of this algorithm.

Keywords— Image segmentation, Canny edge detection technique, satellite images.

I. INTRODUCTION

Image processing is used to analyze and manipulate the images based on different purpose, the output of the image processing may be the image or any characteristic of that image. Edge detection is one of the well-developed field in image processing .This includes a variety of mathematical methods which are used to identify the points in digital image.There are many edge[3] detecting techniques like clustering, thresholding, compression based methods etc.,Most of the information about images will be found in detecting the edges. So, we detect the edges in image using filters which enhances some areas of image which contain edges, thereby sharpness of the image[1] will increase and image will appear clear.

IMAGE SEGMENTATION:

Image segmentation is a process of dividing the digital image into very smallest parts called pixels or image objects. If the pixel of an image is high, the higher the quality of the image. The three basic categories[9][10] of image segmentation are

A. Structural segmentation techniques: This technique relies upon the required region which is to be segmented.

B. Stochastic segmentation techniques: These techniques works on the discrete pixel values of the image

C. Hybrid techniques: These techniques uses discrete pixel and structural information together[11].



Fig.1: A segmented left human femur. Red colour indicates the outer surface, Green colour indicates the surface between compact bone and spongy bone, Blue colour indicates the surface of the bone marrow.

There are many image segmentation techniques[12] namely:

- 1. Edge based methods
- 2. Threshold method
- 3. Clustering[8] based method
- 4. PDE based method
- 5. ANN based method

EDGE BASED METHODS:

Edges are the most significant part of an image[2], it is the primary source of recovering information from images.Most of the information about an image lies in edges.It works by detecting discontinuities in brightness.Edge detection is the abrupt change in image intensity. There are basically two types of edges namely horizontal and vertical edges .An edge operator is a neighborhood operation which determines the extent to which each pixel's neighborhood can be partitioned by a simple arc passing through the pixel. Pixels in the neighborhood on one side of the arc have one predominant value and pixels in the neighborhood on the other side of the arc have a different predominant value .Edge detection operator needs to be chosen to be responsive to gradual change[4].

Applications of edge detection include:

- Fingerprint detection
- Satellite images edge detection
- Robotics vision
- Medical science



Fig.2: Image showing edge detection of a flower. Types of edge-based methods:

- Robert's edge detection,Sobel edge detection ,Prewitt edge detection,Krish edge detection,Robinson edge detection, LoG edge detection and Canny edge detection.
- Prewitt edge detection method: In this by using difference between corresponding pixel intensities of an image edges are calculated.
- Sobel edge detection method: This operator is same as prewitt operator the major difference is that the coefficients of masks are not fixed.

CANNY EDGE DETECTOR:



Fig.3: Block diagram of canny edge detector.

BLOCK DIAGRAM DESCRIPTION:

Step 1: Computing the horizontal (Gx) and vertical (Gy) gradient of each pixel in an image.

Step 2: Using the above information the magnitude (G) and direction (of the each pixel on the image is calculated.

Step 3: In this step all non-maxima's are made zero and suppressed.

Step 4: The high and low thresholds are measured using the histogram of the gradient magnitude of the image.

Step 5: To get the proper edge map hysteresis thresholding [5-7] is employed which will link between the weak and strong edges. The weak are taken into consideration if and only if it is connected to one of the strong edges or else it is eliminated from the edge map.

SATELLITE IMAGES:

- Satellite images give a good representation of what is happening at every point in the world, especially overoceans where large gaps in data occur. Color images are due to the grey level [13].
- The resolution of satellite images varies depending on the instrument used and the altitude of the satellite's orbit.
- Earth's surface at various spectral, temporal, radiometric, and increasingly detailed spatial resolutions as is determined by each collection system's sensing device, and the orbital path of its reconnaissance platform are depicted by satellite imagery.





Fig.5: RGB to gray converted image



Fig.6: Adjusting the direction to nearest 0,45,90 or 135 degrees



Fig.7: Calculation of magnitude and non-maximum value suppression



Fig.8: Thresholding using 8-connected components



Fig.9: Original satellite image



Fig.10: RGB to gray converted image



Fig.11: Adjusting the direction to nearest 0,45,90 or 135 degrees



Fig.12: Calculation of magnitude and non-maximum value suppression



Fig.13: Thresholding using 8-connected components



Fig.14: : Original satellite image



Fig.15: RGB to gray converted image



Fig.16: Adjusting the direction to nearest 0,45,90 or 135 degrees



Fig.17: Calculation of magnitude and non-maximum value suppression



Fig.18: Thresholding using 8-connected components



Fig.19: Original satellite image



Fig.20: RGB to gray converted image



Fig.21: Adjusting the direction to nearest 0,45,90 or 135 degrees



Fig.22:Thresholding using 8-connected components



Fig.23: Thresholding using 8-connected components

III. CONCLUSION

In this paper, we have seen different edge detecting techniques among them canny edge detector gives better results compared to others.

It is adaptive in nature, less sensitive to noise, resolved the problem of streaking, provides good localization and detects sharper edges as compared to others.

Canny edge detection technique is used in license plate reorganization system finds practical application in traffic management, public safety and military department.

Satellite images are not very clear and information can be easily obtained from detecting the edges by using canny edge detection algorithm which is a part of segmentation process.

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Use of two inpainting Techniques to Restore Partially detected Cartographic Features

Ana Luisa Chaves Figueira¹, Erivaldo Antonio da Silva², Maurício Araújo Dias¹, Breno Strogueia Maia da Cruz¹, Guilherme Pina Cardim²

¹Dept. of Mathematics and Computing, UNESP, Presidente Prudente, São Paulo, Brazil ²Dept. of Cartography, UNESP, Presidente Prudente, São Paulo, Brazil

Abstract— The continuous use of methodologies to extract cartographic features of digital images have been of great importance in the area of cartography. Many techniques can be used by features extraction processes, however, the results obtained by these techniques usually have partially detected features, culminating in loss of quality of the extraction process. To keep searching for better results, it is possible to use techniques based on inpainting, that has as its main purpose image restoration and removal of occlusions. Therefore, the main objective of this article is to show a methodology of reconstruction of partially detected features using two inpainting techniques proposed by [1] and [2], aiming to improve the quality of results in the process of extraction of cartographic features and digital images. Observing the final analysis of the results obtained with the techniques in three entry images, the technique of [1] showed an improvement of 0.61% compared to the extracted feature. While the technique of [2], an improvement of 6.82%. The good results obtained regarding the improvement of the quality of the process of extraction of partially detected cartographic features will be of great use in the area of cartography.

Keywords— Remote Sensing, Inpainting, Digital Image Processing, Cartography, Partially Detected Features.

I. INTRODUCTION

The continuous use of methodologies to extract cartographic features of digital images have been of great importance in the area of cartography. These processes have as focus the identification of existing targets in the terrestrial surface and its changes, which are required to update cartographic products. Many techniques can be used by features extraction processes, however, the results obtained by these techniques usually have partially detected features, culminating in loss of quality of the extraction process. To keep searching for better results, it is possible to use techniques based on inpainting, that has as its main purpose image restoration and removal of occlusions. It operates by gathering information around the damaged area and making a subtle junction of this information with the area of interest. Thus, based on what has been said, the main objective of this article is to show a methodology of reconstruction of partially detected features using two inpainting techniques proposed by [1] and [2], aiming to improve the quality of results in the process of extraction of cartographic features and digital

images. Both techniques are compared, in order to understand which one provided better results.

A. Bertalmio et al. [1] Inpainting Algorithm

This algorithm is mainly based on nonlinear partial differential equations and the imitation of techniques of artists specialized in restoration of museum paintings.

Being A the region in which the inpainting process will be carried out and bA its boundary, the isophote lines that focus on bA will be prolonged, maintaining its incidence angles. After this procedure, it is defined the contour of the area that will be inpainted. This area will be filled from the extent of the regions around A. The different regions contained in A, determined by the contour lines, will be completed by the colours that match the colours of bA.

The general equation of the algorithm is show in equation (1).

$$I^{(n+1)}(i,j) = I^{n}(i,j) + \Delta t I^{n}_{t}(i,j), \forall (i,j) \in A$$
(1)

where *n* is the inpainting time, *i* and *j* are the pixel coordinates, Δt is the rate of improvement, $I^n(i, j)$ is the

entry image and $I_t^n(i, j)$ is the improved version of the entry image.

Equation (1) shows that $I^{(n+1)}(i,j)$, which is originated from $I_t^n(i,j)$, will be an improved version of the entry image. As n grows, the algorithm tends to have better results.

To ensure the correct definition of the direction field, the diffusion process is intertwined with the inpainting process described, that is, the next step is the application of few iterations of image diffusion. This diffusion prevents the lines from crossing each other, resulting in a smoothing effect. [1] uses the anisotropic diffusion, determined by the following:

$$\frac{\partial I}{\partial t}(x, y, t) = g_{\varepsilon}(x, y)\kappa(x, y, y) \big(\nabla I(x, y, t) \big), \forall (x, y) \in A^{\varepsilon}$$
(2)

where A^{ε} is the dilation of *A* with a ball of radius ε , κ is the Euclidean curvature of the isophotes of I and $g_{\varepsilon}(x, y)$ is the smooth function in A^{ε} .

The only input parameters of the algorithm are the image to be restored and the mask that delimits the portion to be inpainted of the input image. The algorithm performs a pre-processing step where the entire original image goes through the smoothness process of anisotropic diffusion. After that, the image enters an inpainting loop, where only some values within A are modified. At each iteration, an anisotropic diffusion step is applied. This process is repeated until a stable state is reached.

In the restoration loop X inpainting steps occurs using equation (1), then Y diffusion steps with equation (2), and again X steps of equation (1), and so on. The total number of steps is T. This number may be pre-determined or the algorithm may stop when image changes are below the given limit. The value of T depends on the size of A.

B. Deng et al. [2] Inpainting Algorithm

The algorithm proposed by Liang-Jian Deng Ting-Zhu Huang, Xi-Zhao is not based on partial differential equations (EDPs). It fills regions of interest by copying and pasting the portions of the source regions, so that the texture of the image remains the same. The type of technique exploited by this algorithm is called exemplar-based.

Originally, exemplar-based algorithms are based on two attributes: a confidence term and a data term. The data term propagates the target region geometrically, and the term of confidence describes the dependence of the area of the patch to be copied and pasted in relation to the neighbouring pixels of the source region, that is, the texture propagation of the original image. If there are more pixels of the source region around a pixel p, the confidence term of p will get a higher value.

Equations (3) and (4) define the priority of a patch, so we select the one with the highest priority, and fill the target region with the patch from the source region that is most similar to it.

$$\begin{cases} C(p) = 0, \forall p \in \Omega \\ C(p) = 1, \forall p \in \omega \end{cases}$$
(3)

$$D(p) = -0.1, \forall p \in \Omega \cup \omega \tag{4}$$

where C(p) and D(p) is the confidence term and data term of a pixel, respectively, Ω is the area of interest and ω is the region that doesn't belong to the area of interest.

The similarity between two patches is measured by the following equation:

$$\gamma_p = \frac{argmin}{\gamma_q \in \Theta} d(\gamma_p, \gamma_q) \tag{5}$$

Each pixel *p* is filled with the corresponding pixel in γ_q , by using equation (6):

$$p' \in \gamma_p \cap \Omega \tag{6}$$

Then, the confidence term is updated to:

$$\mathcal{C}(q) = \mathcal{C}(p), \forall q \in \gamma_p \cap \Omega \tag{7}$$

All of these processes are repeated iteratively until the target region is completely filled. What differentiates the technique proposed by [2] from the common exemplarbased algorithms is a new definition of the priority of the patches taken and the similarity equation. The new priority definition is described in equation (8).

$$P(p) = \begin{cases} D(p), for the first phase \\ C(p), for the second phase \end{cases}$$
(8)

The first phase concentrates the geometric propagation of the target region, and the second, the propagation of the texture. The algorithm automatically estimates the number of iterations required for the execution of the first phase.

As for the similarity equation, it was changed to equation (9).

$$\gamma_p = \frac{\arg\min}{\gamma_a \in \gamma'_a} d(\gamma_q, \gamma_p) \tag{9}$$

where γ_p and γ_q are patches being compared, γ'_q is the largest patch with it's center being γ_q 's center and $d(\gamma_q, \gamma_p)$ is the sum of the quadratic differences of the pixels that already filled the two patches.

C. Quantitative Metrics

In [3], [4], [5] the lack of quantitative metrics to evaluate the results of an inpainting process is addressed. The reason why this happens is that there is usually no reference image, and because the content of the area to be rebuilt is unknown. Therefore, in most cases, a visual evaluation is used, where it is verified if the result is the appropriate one. However, visually analysed results are complex and unpredictable due to human factors that are difficult to control. Thus, an alternative is to use known quality metrics in the area of digital image processing, among them the most used ones are: MSE, PSNR and SSIM.

The MSE is the mean square error of an estimator, its value is always positive and the results close to zero are better.

The PSNR is a term for the relation between the maximum signal value and the maximum noise value that affects the fidelity of a representation. To calculate it, the MSE is needed.

SSIM is an index that predicts the quality of images and videos, when measuring the structural similarity between two images. SSIM was created as an enhancement of MSE and PSNR comparing methods.

The main difference between SSIM and its predecessors is that SSIM is a method based on visual perception [6], [7] and [11] reiterate that SSIM is more efficient when compared to MSE and PSNR methods. This is due to the latter not detecting distortions perceptible by the human visual system. The reason why both work that way is that they only consider the individual state of each pixel and not its structural information, contrary to how SSIM operates.

Also in [7], [8], [9] and [10] it is argued that MSE and PSNR are not suitable for binary images. In this case, the MSE represents the number of differences between two images, and the large number of different pixels does not always result in a large structural difference, because binary images do not have many texture details and their pixel distribution is simpler.

Thus, this work included the manual construction of a reference image, based on the original unprocessed image and applied the SSIM metric, to evaluate the quality of the results obtained. The metrics were applied in the entry images and in the inpainted results. When compared with the SSIM of the entry image, the results obtained after the application of the technique evidences the improvement of the quality of the process.

II. METHODOLOGY AND RESULTS

A. Images Used In The Tests

Three images containing partially detected features were used, those are presented in Figures 1, 2 and 3.



1. Test image 1.



2. Test image 2.





B. Softwares Used

The software used for the implementation was the Matlab R2017a, 64-bit version. The processing tests were made on an Intel Core i7 processor computer with an Nvidia GeForce 940MX 2GB graphics card.

C. Results

Figure 4 shows the test image 1, figure 5, the reference image, and in figures 6 and 7, the results obtained with the implementation of the inpainting algorithm of Bertalmio et al. [1] and Deng et al.[2] respectively.



4. Test image 4.



5. Reference image.



6. Result of the inpainting technique of Bertalmio et al. [1].



7. Result of the inpainting technique of [2].

Figure 8 shows the test image 2, figure 9, the reference image, and in figures 10 and 11, the results obtained with the implementation of the inpainting algorithm of Bertalmio et al. [1] and Deng et al.[2] respectively.



8. Test image 2.



9. Reference image.



10. Result of the inpainting technique of Bertalmio et al. [1].



11. Result of the inpainting technique of [2].

Figure 12 shows the test image 3, figure 13, the reference image, and in figure 14 and 15, the results obtained with the implementation of the inpainting algorithm of Bertalmio et al. [1] and Deng et al.[2] respectively.



12. Test image 3.



13. Reference image.



14. Result of the inpainting technique of Bertalmio et al. [1].



15. Result of the inpainting technique of [2].

In order to facilitate the visualization of the results obtained with the application of the technique of inpanting, table I presents all the results obtained, and Table II, the processing time of each technique.

Table I. SSIM comparison between original images andresults of the inpainting techniques.

Test Image	SSIM 1(%)	SSIM 2 (%)	
		[1]	[2]
1	77.21	78.94	96.11
2	88.77	88.91	98.67
3	93.02	93.75	97.30
Mean	86.33	87.20	97.36

SSIM 1 refers to the comparison between the entry image and the reference image, while SSIM 2, between the reference image and the result images of the corresponding techniques.

Table II. Processing time of each image for b	oth
techniques	

Test Image	Processing time(s) Bertalmio, 2000	Processing time (s) [2]
1	0.82	3.87
2	1.53	4.58
3	1.22	3.56

III. CONCLUSIONS

Observing the final analysis of the results obtained with the techniques proposed by [1] and [2] in the entry images, we can understand that the results were highly satisfactory.

The technique of [1] showed an improvement of 0.87% compared to the extracted feature. While the technique of [2] obtained an improvement of 11.03%. This difference may happen due to the first technique not fully allow removal of occlusions and incorrectly detected features. This type of removal is frequent in most study cases, as we

can see in the test images presented, which can be considered a weak point for [1] technique.

However, the processing time for each algorithm differs significantly considering the amount of regions to be inpainted, image's dimensions, and other attributes that may interfere in the restoration process. [1] technique proved to be faster than [2]. Also, [1] algorithm seems to be as useful as [2] to fill features with missing regions.

Therefore, we can say that the inpainting algorithm of [1] is more appropriate to restore images as long as there are few occlusions and incorrectly detected features, otherwise [2] for the removal process.

At any rate, the good results obtained regarding the improvement of the quality of the process of extraction of partially detected cartographic features can be used in the area of cartography, by supporting processes that update cartographic products.

ACKNOWLEDGEMENTS

The authors thank the Foundation for Research Support of the State of São Paulo - FAPESP (Process 2017/13029-8) and the National Council of Scientific Research - CNPq.

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Identification of the Ecosystem Readiness of Battery Based Electrical Vehicles in Indonesia -Preliminary Assessment

Agus Krisnowo¹, Ramos Hutapea², Solichah Vichy Budiwati²

¹Priciple Engineer, Center for The Assessment of Industrial in Manufacturing, Telematic & Electronic, BPPT Indonesia ² Specialist Engineer, Centre for The Assessment of Industrial in Manufacturing, Telematic & Electronic, BPPT Indonesia

Abstract— Identification has been made related to the readiness of the ecosystem development of the batterybased electric vehicle industry in Indonesia. The identification results show that the readiness of providing electricity is still quite safe, there is still a power reserve of more than 30% during peak load. To prepare the charging station still needs to be developed, the number of public electric charging station (SPLU), is still around 7000 units spread throughout Indonesia with a power of 5.5 kVA to 22 kVA, while the number of public electric vehicle charging station (SPKLU) is still around 13 units with a power of 22 kW to 150 kW, spread over 4 cities namely Jakarta, Tangerang, Bandung and Bali. Administrative, technical provisions & roadworthy test readiness, the regulation is now in the finalization stage, one of which is related to sound intensity and classification of electric motors. For two-wheeled electric vehicles and electric buses, currently there is a domestic industry that is developing, but for four-wheeled electric vehicles, there is still not formed, althaugh the drivetrain industry is ready. As for the battery and the handling of the industrial battery waste, it has not yet been formed, it is still in the development of research scale.

Keywords— Ecosystem, Electric Vehicle, Charging Station, Regulation, Battery.

I. INTRODUCTION

The increasing number of motorized vehicles every year results in demand for fuel oil continues to increase. In 2017, the number of car ownership in Indonesia was recorded at 25.51 million units, consisting of 15.49 million units of passenger cars and 10.02 million buses and trucks. While the number of two-wheeled vehicles has reached 113.03 million units ⁽¹⁾. This condition is certainly a burden on the government in terms of providing fuel oil.

Therefore, in line with the development of electric vehicle technology, the government is gradually planning to replace vehicles based on internal combustion engines (ICE) into battery based electric vehicles (BEV). This electric vehicle is considered to improve energy efficiency and have a positive impact on various sectors, one of which is reducing imports of fuel oil and reducing pollution due to emissions of ICE-based vehicles. Regarding energy efficiency, research shows that electric cars are 60-80 percent more energy efficient than conventional cars. Therefore, the Indonesian government through Presidential Regulation No. 55 of 2019 on August 8, 2019 concerning the Acceleration of the Battery-Based Electric Vehicle

Program, is committed to encouraging the development of the domestic electric car industry ^{(2).}

In Presidential Regulation (PERPRES) 55/2019 article 3 it is stated, the acceleration of the Battery-Based Electric Motorized Vehicle (KBL) program for road transportation is carried out through:

- a) Accelerating the development of the domestic KBL industry;
- b) Providing electricity charging infrastructure and regulating electricity tariffs for KBL;
- c) Compliance with the technical provisions of the KBL; and
- d) Protection of the environment.
- e) Providing incentives;

In the presidential regulation also stated stages of achievement of Level of Domestic Content (TKDN) which can be graphically seen in Figure 1.



Fig.1: TKDN stages of electric vehicles

Source : Perpres 55/2019 is processed by PPIMTE-BPPT

To be able to reach the stage of TKDN it is necessary to immediately prepare supporting facilities and infrastructure. In this paper, an assessment of the readiness of the battery-based electric motor vehicle ecosystem will be carried out in Indonesia and activities that have been carried out in an effort to achieve TKDN.

II. METODOLOGY

The method used in the assessment of ecosystem readiness for battery-based electric vehicles is by :

- Survey of drive industries (electric motors, inverter control systems)
- Survey of several universities involved in the Molina Program
- Focus group discussion
- invite speakers / experts
- and desk assessment

III. ELECTRIC VEHICLE ECOSYSTEM

The conceptual design in developing a battery-based Electrical Vehicle ecosystem in this case consists of:

- 1. Infrastructure readiness consisting of :
 - Power requirements,
 - The existence of a battery charging / exchange station,
 - Battery industry.
- 2. Readiness of the electric motor vehicle manufacturing industry, consisting of
 - Chassis & body industry,
 - Drive industry (electric motors, inverter control systems) and
 - Other component industries.

3. Readiness of policy instruments that can encourage the growth of the electric vehicle industry, which consists of fiscal and non-fiscal policies.

The diagram of the ecosystem of electric vehicles can be seen in Figure 2. $^{(3)}$



Fig.2. Electric Vehicle Ecosystem

Source : evercharge.net. To Win With EV You Need to Build an Ecosystem

3.1. Infrastructure Readiness for Power Needs

Power infrastructure readiness in this case can be seen from the national electricity program, where PT. PLN as a State-Owned Enterprise is given the authority to manage it. Judging from the electrification ratio until the end of 2018, it can be seen that the electrification ratio in Indonesia is already above 98.30% ⁽⁴⁾. Figure 3. below shows the achievement of the electrification ratio in semester III of 2018.



Source : PLN Presentation documents

Fig.3: Electrification Ratio in semester III 2018

Judging from the electrification ratio that has reached 98.30%, it can be said that the power requirements for the Batteray based Electrical Vehicle are considered to be quite safe, especially since the 35 thousand MW program launched by the government is not yet fully realized. Even now in some areas, especially Java, PT. PLN is overloaded.

So that the infrastructure needs for the power needs of KBL can be said to be ready.

Electrification ratio data and large electrical conditions during the highest peak load indicate that the readiness of PLN electricity supplies is still quite safe to anticipate battery-based electric motorized vehicles. Electrical conditions are divided into 3 categories, namely:

• The system is said to be normal if the power reserve is more than 30%

• The system is said to be standby if the power reserve is less than 30%

• The system is said to be defaoult if at the highest peak load the power is able to be less than the peak load.

The distribution of large system electrical conditions when the highest peak load in all regions of Indonesia can be seen in Figure 4. $^{(4)}$



Fig.4: The condition of the electricity system is large when the peak load is highest (2018)

Source : PLN Presentation documents

Figure 4. The condition of the electricity system is large when the peak load is highest (net able to January 2018. From Figure 4. It can be seen that the electrical condition of the system is large when the highest peak load is still mostly gray, a small portion is yellow and none is red. This shows that the net capable power at the highest peak load still has a power reserve of more than 30%.

3.2. Battery Charge / Exchange Station Infrastructure Readiness

In accordance with PERPRES 55/2019, the acceleration of the battery based KBL program is supported by the readiness of the electric charging infrastructure for electric vehicles, which includes battery recharging facilities and battery exchange facilities. Until now, commercial battery exchange stations still do not exist, while battery charging stations have been held in several locations in an effort to introduce / socialize the use of KBL. Some locations that have been installed by electric vehicle charging stations include Java, Sumatra, Sulawesi and Kalimantan. In DKI Jakarta 1661 units public electric charging station (SPLU) have been installed which are scattered and the total installed has reached 3000 points in the territory of Indonesia (Figure 3.12). BPPT itself has been installed in 3 (three) location, namely in the Central BPPT (Thamrin), in BPPT Puspiptek Serpong and in PT. LEN Bandung. What needs to be underlined is that all SPKLU facilities, the equipment is still obtained from imports. Currently BPPT is cooperating with PT. LEN has developed SPKLU products whose products are placed at the head office of PT. LEN Bandung.



Fig.5: SPLU distribution that has been built by PLN

Source : PLN Presentation documents

3.3. Battery Industry Readiness

Currently in Indonesia there is still no industry that develops / manufactures batteries for use in electric cars. Its development is still being carried out by universities in this case the Center for Business Development (Pusbangnis) of Solo State University (UNS). UNS Pusbangnis began the initiation of the development of electric car batteries when the national electric car R&D program was launched by the ministry of education and culture in 2012. The batteries developed by UNS are increasing the capacity of LFP and NCA Lithium batteries from 700mAH to 1100mAH. Research carried out in this matter covers material, design, energy storage and its standardization ⁽⁵⁾.

At present the lithium batteries produced consist of 2 types, namely:

- 1. Type LFP 18650 with a voltage of 3.2 volts and a capacity of 1400mAH
- 2. Type NCA 18650 with a voltage of 3.7 volts and a capacity of 2700 MAH

The battery product features that have been developed and produced by the UNS Pusbangnis, are claimed to have several advantages, including:

• It lasts longer with a usage life of up to 3000 cycles,

- Heat resistance where the battery can withstand temperatures of 70 degrees Celsius,
- Safe technology does not cause an explosion if there is a short circuit, economical and environmentally friendly.

In developing this battery, UNS is collaborating with Pertamina and is currently able to produce LFP batteries in the economic scale of a pilot plan with a production capacity of 1000 cells / day from Pertamina's target of reaching 5000 cells / day. UNS has not been able to meet all Pertamina's requests because when the production scale is increased, it turns out that the battery product produced has changed specifications (decreased spec). At present the Team continues to conduct R&D research to find the right formula for a larger scale of production. The batteries produced by UNS can now be applied to electric cars, electric bicycles / motorcycles, PJU lights, Notebooks, UPS and powerbanks.

The development of batteries themselves has also been carried out by various countries, one of the countries that consistently develops batteries is China. From a literature review, the price of batteries for electric vehicles from 2010 to 2019 has decreased but with improved quality ⁽⁶⁾. As seen in Figure 6.



Lithium-ion battery price survey results: Volume-weighted average

Fig.6: Bateray Pack Price of Electric Vehicle Batteries 2010 - 2019

Source : BloombergNEF

Associated with the percentage of local content, some of the constituent materials of batteries, can already be obtained from within the country namely Nickel and Cobalt. As for Lithium raw materials themselves, they are still imported. The results of calculations by selfassessment, TKDN for this battery product ranges from 50-60%. The competitors of Smart lithium batteries in Indonesia are Samsung and Panasonic where the company's production batteries are still more reliable than Smart lithium batteries because of the higher level of quality raw materials and technology. PT. Pertamina, as one of the players engaged in the supply of motorized vehicle fuel, should be able to act more quickly, pushing the results of the research scale to an industrial scale. because if the battery-based KBL successfully develops and replaces ICE-tech vehicles (by 2040), some Pertamina businesses in the supply of motorized vehicle fuel will become extinct and shift to the supply of batteries and charging stations.

3.4. Readiness of the battery-based electric vehicle industry

The difference between an Baterai based Electric Vehicle (BEV) and an Internal Combustion Engine (ICE) based vehicle is the drivetrain and the fuel as well as where it is stored.





BEV vehicles

Source : Robert Kochhan, et all.(2017)

From Figure 7 it can be seen that in battery-based electric vehicles, the drivetrain components consist of electric motors, inverters, vehicle control units, transmissions, onboard chargers / clooling systems and battery management systems, coupled with batteries for storing electrical energy ^{(7).}

In this paper, the discussion on the readiness of the electric vehicle industry will be limited to the drivetrain industry. industries that develop electric vehicle drivetrain systems are PT. Pindad and PT. LEN. PT. Pindad is currently one of the electric motor manufacturers in Indonesia. With its design, development and engineering capabilities, PT. PINDAD develops permanent magnet type 5 kV electric motor used in two-wheeled electric vehicles. PT. Len developed inverter and vehicle control unit. The order for electric vehicle inverters coming from PT. Fast Cooperation with Gesits begins at the end of 2018. Orders that come from PT Gesists are still based on a limited number of customized. Because the number of products produced by order is still small, the selling price becomes uncompetitive, this is partly due to the high purchase value of imported raw materials because they are purchased in units (due to a small quantity) and also due to the use of machines that cannot reach the value of optimization and efficiency in production is due to production that is not continuous. In other words, the calculation of production cannot be included in the economies of scale.

In addition to these two industries there are also universities that develop electric motors and control systems, namely ITS, ITB,UI, UGM dan UNS. National electric vehicle development is carried out under the coordination of the Director General of Higher Education. There are two types of motors developed, namely axial type busless DC motors by ITS and radial type brusless DC motors by ITB. Table 1 shows the development of the ecosystem in universities.

Table 1. The Development of The Ecosystem inUniversities

Componen	ITB	ITS	UNS	UGM
Drivetrain	Radial BLDC 30 KW	Axial BLDC 0,5 – 25 KW		
Battery			LiFePO4 SmartUNS Lithium Battery	
Battery Recycle				Dismantling Machine

In its application ITS has made several prototypes of twowheeled electric vehicles, four-wheeled vehicles and electric buses . ITS in collaboration with Garasindo Electric Scooter has succeeded in developing a twowheeled electric vehicle named GESITS ⁽⁸⁾.



Fig.8: ITS Electric Vehicle Prototype Source : sko.its.ac.id

The motor used in this ITB-1electric car is radial brushless dc (BLDC) motor type. A controller will be used to convert the dc source into ac for BLDC motor power source. BLDC motor 10 kW and its energy storage i.e LiFePO4 battery types, will be evaluated based on their performance result from the tests ⁽⁹⁾.

The UI National Electric Car Team has launched Molina UI-EV Bus, The EV bus is a vehicle with a capacity of 60 passengers with motor power of 120 kW and 300 Ah. For commercialization UI has conducted an MOU with Perum Damri and PT Indonesia Tourism Development ⁽¹⁰⁾



Fig.9: UI-EV Bus designed by the University of Indonesia. Source : https://www.ui.ac.id

UNS has developed a lithium battery based on the LiFePO4 cathode material. The battery, named SmartUNS-Lithium Battery, was developed with nano technology that can increase its energy density. The current prototype continues to be developed in the form of a battery pack so that it can be applied to electric motorcycles and electric cars. In the effort to downstream the industry, UNS cooperates with two companies, namely PT LEN Industri and PT NIPRESS. But in the course of commercialization of this battery product, UNS encountered obstacles in terms of standardization ⁽⁵⁾.

3.5. Battery Waste Processing Industry Readiness

In addition to research on electric vehicles, UGM also focuses on research into the development of battery recycle, whose research funding is sponsored by LPDP. Research carried out by the UGM Faculty of Chemical Engineering and Mechanical Engineering is research on the manufacture of dismantring machines (type 8165 battery disassembly machines to be recycled into sheet shapes) where this machine will break down battery packs and then take lithium. Then the lithium that has been released is specially formulated to be ready to use lithium with a purity level of 98%. This discovery itself has been patented and is currently being explored in collaboration with PT. Astra, which is currently in the lithium battery recycle business and has production facilities and infrastructure in Jakarta. In the future, it is planned that PT Astra will order 100 units of UGM dismantring machines at an early stage. At present, a business scheme negotiation process is underway between UGM and PT. Astra for the implementation of the business ⁽¹¹⁾.



Fig.10: Dismantling Machine, UGM Source : Survey Gajahmada University

This lithium battery recyle research is an internal research where there is no connection with other universities such as UNS which also develops lithium battery research. So far UGM itself has never cooperated and synergized with UNS in developing lithium batteries or lithium battery recycle.

3.6. Type Test Readiness

In preparation for entering the era of electric vehicles in Indonesia, the government said it would establish a new type of test facility center. This type of test is to determine whether an electric vehicle model is sold on the market or not. Broadly speaking, there are three important aspects in the test of types of electric vehicles, namely those related to batteries, speed, and charging. currently being explored various kinds of electric vehicle technology that is being developed at this time to determine the technology that will be used in a new type of test facility. Testing standards will adopt international standards, so that all brands can adjust. Construction of the type test facility will begin in 2019 and the target is 2021 completed.

Regulations related to electric vehicle type tests, have been summarized in Transportation Minister Regulation (Permenhub) No. 33 of 2018 concerning Testing of Motorized Vehicle Types. However, it still needs to be done in-depth related to what parameters will be tested. One of the parameters tested was the sound of electric vehicles. The rules governing the sound of electric vehicles are listed in Article 23 paragraphs 3, 4, and 5. This new regulation will also become a reference for controlling the sound of electric cars. Here are the details of Permenhub No. 33 of 2018 about the sound of electric vehicles:

- Electric motorized vehicles to meet safety aspects must be equipped with sound with certain noise levels and types of noise.
- (2) The noise level as referred to in paragraph (3) is at least 31 (thirty one) decibels and the highest does not exceed the threshold of a Motorized Vehicle that uses an ordinary combustion motor.
- (3) The noise level as referred to in paragraph (3) must be as follows:
 - a) at a speed of 10 (ten) km / h a minimum of 50 (fifty) decibels;
 - b) at a speed of 20 (twenty) km / h a minimum of 65 (sixty five) decibels;
 - c) to retreat a minimum of 47 (forty seven) decibels.

In addition, the regulation also includes provisions that sounds produced by electric vehicles do not resemble music, animal sounds, sirens or horns

IV. CONCLUSION

From the discussion above it can be seen that the level of readiness of Indonesia in welcoming the electric motor vehicle is still in the position of preparation. The issuance of Perpres 55/2019 is expected to accelerate the readiness of its ecosystem, mainly in terms of providing electricity, SPKLU, KBL feasibility testing facilities and the KBL industry.

In terms of electricity supply, with a 30% reserve at peak load, gradually need to be added. Likewise, the number of SPKLU fast charging needs to be added immediately, especially for potential areas. KBL eligibility test facilities also need to be developed immediately.

For the KBL industry, KBL research and development needs to be immediately pushed into the industrial scale, by cooperating with potential industries both in terms of the main component industry, as well as the vehicle manufacturing industry.

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Factor Analysis Applied in the Construction of the Socio-Environmental Performance Index (IDRSA) in the Guajará-Mirim Free Trade Area, Brazil / Bolivia Border

Carlos Alberto Paraguassu-Chaves¹, Fabio Robson Casara Cavalcante², Allan Kardec Duailibe Barros Filho³, Fabrício Moraes de Almeida⁴, Lenita Rodrigues Moreira Dantas⁵, Carlos de Andrade Macieira⁶, João Viana Fonseca Neto⁷, Charlles da Silva Barata⁸, Sorin Melgar Maciel Siqueira⁹, Ana Maria Morais da Fonseca Cavalcante¹⁰, Edmundo Machado Netto¹¹

²PhD in Sciences: Socio-environmental development - NAEA / UFPA. Professor at the Federal University of Rondônia – UNIR, Brazil. ³PhD in Information Engineering. Universidade de Nagoya – Japan; Post-Doctor. The Institute of Physics and Chemistry (RIKEN), Japan. Professor at the Federal University of Maranhão, Brazil.

⁴PhD in Physics (UFC), with post-doctorate in Scientific Regional Development (DCR/CNPq). Researcher of the Doctoral and Master Program in Regional Development and Environment (PGDRA/UNIR). Leader of line 2 - Technological and Systemic Development, and Researcher of GEITEC — Federal University of Rondônia, Brazil.

⁵Graduated and Specialist in Geography. Graduated in Law. Researcher at the Higher Institute of Health Sciences and Environment of the Amazon – AICSA.

⁶Graduated in Medicine - Federal University of Maranhão. Nephrologist at the University Hospital at the Federal University of Maranhão, Brazil.

⁷PhD in Electrica Engineering. Federal University of Paraíba, Brazil. Professor at the Federal University of Maranhão, Brazil.

⁸Master in Geography - Federal University of Rondônia. Researcher at the Higher Institute of Health Sciences and Environment of the Amazon – AICSA.

⁹Graduated in the Environmental Management Course. Federal University of Rondônia, Brazil.

¹⁰Master in Agronomy - Federal University of Pernambuco (UFPE). Researcher of the Institute of Health Sciences and the Amazon environment - AICSA.

¹¹Master in Regional Development and Environment - Federal University of Rondônia (UNIR), Brazil. Researcher of the Institute of Health Sciences and the Amazon environment - AICSA.

Abstract— Objective: to analyze the socio-environmental responsibility of commercial companies in the wholesale, retail, wholesale-retail and wholesale-retail sectors within the scope of the free trade area of Guajará-Mirim, Rondônia, Brazil / Bolivia border. Method: the Social and Environmental Responsibility Performance Index - IDRSA was calculated according to the Factor Analysis techniques presented by Hair et al 13, Santana 14,15 and Cavalcante 16. A questionnaire (created by Cavalcante and Siqueira 17) was applied to 32 companies in the ALCGM economic sector, based on a set of social, environmental, economic and free question variables. Results: The average of the results found for each of the analyzed parameters (social, environmental and economic) reaches the performance index of socio-environmental responsibility of the companies for each of the economic sectors surveyed in the free trade area of Guajará-Mirim. The wholesale-retail sector had the best performance among all sectors with an index (IDRSA 0.561), considered "regular" performance. The sector of retail and wholesale (IDRSA 0.470) and the retail sector (IDRSA 0.420) also display rankings with regular performance indexes. The wholesale sector (IDRSA 0.374) was classified as "bad". Final considerations: Although ALCGM emerged from a policy framed in the context of endogenous development theory, motivated by local forces or by interests of strategic economic sectors, benefited by tax incentives, revealed weakness in socio-environmental

¹PhD in Health Science – University of Brasília – UnB, Brazil; Post-Doctor in Health Sciences – UnB and Degli Studi D'Aquila University – IT. Professor at the Federal University of Maranhão, Brazil. E-mail: Carlos.paraguassu@gmail.com

aspects. What is expected is to contribute so that socio-environmental responsibility is defined and demanded as policies and practices in the companies that make up the ALCGM.

Keywords— Social and Environmental Responsibility. Free Trade Area.Factor analysis. Guajará-Mirim. Brazil / Bolivia border.

I. INTRODUCTION

Corporate social responsibility has been a topic debated and propagated by the global and Brazilian media and has acquired importance in a company's business strategies. Society no longer accepts that companies provide only quality, price and compliance with legislation; increasingly values companies that promote socio-environmental action practices ¹. In the contemporary world, consumers have a negative view of industries, considering degrading companies of natural resources and, consequently, also responsible for the increase of world poverty. To soften this view, many companies use marketing to sell their products, claim to be companies that manufacture their products in an environmentally and socially correct way¹.

With the sustainable development paradigm in the early 1980s, while organizations refined their purely economic views through strategic adjustments related to environmental pressures and ever-changing social transformations ².Sousa ³, reports that, over time, socioenvironmental requirements have been increasing and currently companies that do not meet them may be precipitating their exit from the market. It is necessary to assess how organizations can and should position themselves in a society that is increasingly demanding and aware of the issues that companies have in relation to the economy, the environment and society itself. In this context, it is essential that companies plan their strategies to take advantage of the opportunities they present and reduce the risks that all changes bring.

According to Senhoras, Takeuchi⁴, socially responsible companies are better prepared to guarantee business sustainability, as they are synchronized with new dynamics that affect society and the business world. Bush ¹, corroborates this view and includes the incorporation of socio-environmental variables as a business strategy that is necessary to guarantee the survival of companies in the competitive market of the contemporary world. According to Barbieri ⁵, the most demanding investors consider environmental issues in their questions, as they know what environmental liabilities are among the main factors that can cause damage to companies and company assets. The issues related to socio-environmental responsibility are global and, depending on the context, their understanding by companies and other institutions can happen in different ways, taking into account the impacts and influences of the economic, social and environmental challenges to be faced,

and international and national standards adopted as a reference for development in different countries 6 .

According to Jamali⁷, the responsibility for managing relations in relation to the environment and society has gradually evolved in theoretical and practical terms, since companies start to compose their analyzes under the assessment of the traditional economic function that uses (production, jobs, growth), but with the prerogative to observe and guarantee environmental conservation and consideration of the social impacts and well-being of human beings. Ethos ⁸ defines Corporate Social Responsibility as a form of management that defines the company's ethical and transparent relationship with all the audiences with which it relates and the establishment of goals applied to the sustainable development of society, preserving environmental resources and cultural for the future, respecting diversity and promoting the reduction of social inequalities.

According to Srour ⁹, social responsibility can be defined as an attempt to reconcile the interests and requirements of organizations and different stakeholders, referring to organizational citizenship, with regard to organizational citizenship, internally and externally in the implementation of social rights. Companies must be jointly responsible for solving social and environmental problems, as they have political power and the ability to mobilize financial and technological resources to develop actions that can be replicated by other social actors ¹⁰. According to Dias ¹¹, socio-environmental problems can only be solved with the help of everyone, especially companies, who play an intrinsic role in this process.

The issue of Social Responsibility, therefore, goes beyond the company's legal posture, philanthropic practice or community support. It means a change in attitude, from a business management perspective with a focus on adding value for all. Within this scope, one can see which are the two necessary complementary characteristics or the concept of Social Responsibility. On the one hand, it can be perceived as an instrument for managing and expanding the company, helping to make its image, product and brand recognized, its stakeholders and the community. On the other hand, it also means a form of exercise of citizenship and ethics by companies and, consequently, by their employees, as agents of development in the regions in which they operate ⁴.The relationship between companies and their stakeholders must be considered as a two-way street, in which companies influence and are influenced by social agents. If, on the one hand, companies can be driven to change the way they manage their business, companies can contribute to the dissemination of management practices of customer and consumer management practices, on the other hand and suppliers adopt the concepts of Sustainable Development Corporate Environmental and Social ³.

Senhoras, Takeuchi⁴ highlighted that the relationships built with internal and external audiences, formed the needs and interests, generated value for all stakeholders and guaranteed the long-term sustainability of the business, as they are synchronized with the new dynamics that affect the society and the business world. This involvement of the organization in the practice of social responsibility generates synergies, precisely with the publics on which the company depends, creating items of social responsibility throughout the productive and social structure, strengthening, as well as its microeconomic performance and local macroeconomic structure.

In the reality of the Amazon, free trade areas must be examples of socio-environmental responsibility, such as the Guajará-Mirim free trade area (ALCGM), in Rondônia, on the Brazil / Bolivia border. The Guajará-Mirim Free Trade Area began in 1991, with the publication of Law No. 8.210, of July 19, whose objective was to create an import and export free trade area, under the special tax regime with the use the promotion of the border region of Guajará-Mirim and increase bilateral relations with neighboring countries, according to the Latin American integration policy. This institutional device was regulated by Decree nº 843, of June 23, 1993, under the direct administration of Manaus Free Trade Zone Superintendence the (SUFRAMA) and in the same criteria as the Manaus Free Trade Zone.

In this perspective, Perroux ¹² shows that the development of a pole region leads to the development of secondary activities in other regions. According to Perroux ¹², the growth and development of a set of territories and populations will be achieved through the conscious organization of the means of propagating the effects of the development pole. It is the bodies of general interest that transform the growth of an industry or activity in the growth of a nation in the process of formation and anarchic developments in orderly development.

In view of the above, the present research was structured from the perspective of the ALCGM, having been motivated by the local peculiarities that ended up conducting a policy of fiscal incentives for a region of Rondônia's Amazonian border. For that, it became necessary to elaborate some epistemological questions of the research: a) what is the level of perception of socioenvironmental responsibility of the various economic sectors surveyed at ALCGM? b) is this scenario in line with the assumptions by which ALCGM must accept regarding socio-environmental aspects? In view of the above, it was established as a research objective to analyze the socio-environmental responsibility of commercial companies in the wholesale, retail, wholesale-retail and wholesale-retail sectors within the scope of the free trade area of Guajará-Mirim, Rondônia, Brazil / Bolivia border.

II. METHODS

The research was structured based on aspects of interdisciplinary research, given the complexity around the theme. This is a hypothetical-deductive study. Tables and graphs were constructed using SPSS, version 22, based on the primary research data. The Social and Environmental Responsibility Performance Index - IDRSA was calculated according to the Factor Analysis techniques presented by Hair et al¹³, Santana^{14,15} and Cavalcante¹⁶. The statistical tool SPSS (Statistical Package for the Social Sciences) was used, which enabled the application of mathematical knowledge and allowed the construction of IDRSA based on the results of the questionnaire created by Cavalcante and Siqueira ¹⁷ and applied in 32 companies in the sectors economic wholesale, retail, wholesale-retail and wholesaleretail assets of the Free Trade Area (ALCGM) of Guajará-Mirim, Brazil, on the border with the Republic of Bolivia from a set of social, environmental and economic issues.

2.1 Analytical Research Model

Method: Construction method of Social and Environmental Responsibility Performance Index - (IDRSA).

The method used in this study followed the logic of factorial analysis, which can be seen in the matrix form as in Dillon and Goldstein¹⁸:

$X = \alpha F + \epsilon X = \alpha F + \epsilon (1)$

Then:

X = is the p-dimensional vector transposed from observable variables, denoted by $X = (x_1, x_2, ..., x_p)$;

F = is the q-dimensional vector transposed from non-observable variables or latent variables called common factors, denoted by $F = (f_1, f_2, ..., f_q)$, where q < P;

 ϵ = is the p-dimensional vector transposed from random variables or unique factors, denoted by ϵ = (e₁, e₂,..., e_p);

 α = is the array (p, q) of unknown constants, called factorials loads.

According to Gama *et al*¹⁹, Santana²⁰, in the factorial analysis model it is assumed that specific factors are orthogonal, among themselves, with all common factors. Normally, $E(\varepsilon) = E(F) = 0$ and Cov $(\varepsilon, F) = 0$.

According to the authors, the initial structure used to determine the array of factorials loads, in general, may not provide a significant pattern of variable loads, so it is not definitive. This initial structure can be done by several methods of rotation of the factors, as Dillon and Goldstein ¹⁸, Johnson and Wichern ²¹. It was used the VARIMAX method of orthogonal rotation of the factors for this study.

The VARIMAX method is a process where the reference axes of the factors are rotated around the source until some other position is reached. The objective is to redistribute the variance of the first factors to others and to achieve a simpler and more theoretically significant factorial ^{13, 15, 18, 19, 20, 21}.

The choice of factors was carried out through the technique of latent root. So, the array of factorials loads, which measures the correlation between the common factors and observable variables, is determined by means of the correlation matrix, as Dillon and Goldstein ¹⁸.

For determining Social and Environmental Responsibility Performance Index - (IDRSA)it was used the matrix of factorials scores estimated by the orthogonal base factorial rotation process, as pointed out by Santana ²⁰. The factorial score puts each observation in the gap of the common factors. For each factor f_j , the i-th factor score extracted factorial score is defined by F_{Ij} , expressed as follows ¹⁸:

$$F_{IJ} = \mathbf{b_1} x_{i\backslash 1} + \mathbf{b_2} x_{i\backslash 2} + \mathbf{b_p} x_{ip}$$

$$F_{IJ} = \mathbf{b_1} x_{i\backslash 1} + \mathbf{b_2} x_{i\backslash 2} + \mathbf{b_p} x_{ip} (2)$$

Then:

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

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

i = 1.2,...N. *j* = 1,2,...,p.

To reach the equation that is the perception index ^{19, 20}, show the sequence evolution of the formulas from the previous equation. It turns out that even if the variable F_{Ij} is not observable it can be estimated through the factorial analysis techniques, using the matrix of observations of the

vector x of observable variables. In factorial notation, equation 2 becomes:

$$F_{(n \lor q)} = X_{(n \lor q)} b_{(p \lor q)} F_{(n \lor q)} = X_{(n \lor q)} b_{(p \lor q)}_{(3)}$$

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

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

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

$$F_{(n \setminus q)} = W_{(n \setminus q)} \beta_{(p \setminus q)}$$

$$F_{(n \setminus q)} = W_{(n \setminus q)} \beta_{(p \setminus q)} \beta_{(q)}$$
(4)

Based on equation 4, the beta weights matrix (β) with q standardized regression coefficients, replaces b, given that the variables are standardized on both sides of the equation. Pre-multiplying both sides of equation 4 by the **11**

value $\overline{nnw'}$, in which *n* Is the number of observations and *W* is the transposed matrix of *w'*, it makes it possible to reach the following equation:

$$\frac{1}{n} w'_{(p,n)} F_{(n,q)} = \frac{1}{n} w'_{(p,n)} w_{(n,p)} \beta_{(p,q)} = R_{(p,p)} \beta_{(p,q)}$$
(5)
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The Matrix $\overline{nn}w'w$, therefore is the matrix of intercorrelated variables or correlation matrix among the observations of the matrix *x*, designated by R. The Matrix $\frac{1}{k}w'F$ $\frac{1}{k}w'F$ It represents the correlation between the

 $\overline{k}^{W \Gamma} \overline{k}^{W \Gamma}$ It represents the correlation between the factorials scores and the factors themselves, denoted by Λ . With this, rewriting the equation 5, one must:

$$\Lambda_{(p \setminus q)} = R_{(p \setminus p)} \beta_{(p \setminus q)} \\ \Lambda_{(p \setminus q)} = R_{(p \setminus p)} \beta_{(p \setminus q)} \\ (6)$$

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

$$\beta = R^{-1}\Lambda \beta = R^{-1}\Lambda (7)$$

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

$$F_{(\mathbf{n}\setminus\mathbf{q})} = W_{(\mathbf{n}\setminus\mathbf{p})} R_{(\mathbf{p}\setminus\mathbf{p})}^{-1} \Lambda_{(\mathbf{p}\setminus\mathbf{q})}$$
$$F_{(\mathbf{n}\setminus\mathbf{q})} = W_{(\mathbf{n}\setminus\mathbf{p})} R_{(\mathbf{p}\setminus\mathbf{p})}^{-1} \Lambda_{(\mathbf{p}\setminus\mathbf{q})}_{(8)}$$

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

$$I\mathbf{P}_{i} = \sum_{j \mid =1}^{q} \left(\frac{\lambda_{j}}{\sum_{j} \Box \lambda_{j}} F\mathbf{P}_{ij} \right)$$
$$I\mathbf{P}_{i} = \sum_{j \mid =1}^{q} \left(\frac{\lambda_{j}}{\sum_{j} \Box \lambda_{j}} F\mathbf{P}_{ij} \right)_{(9)}$$

Then:

i = 1.2,...n.

 λ = is the variance explained by each factor;

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

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

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

It can be seen that $F_{\min}F_{\min}$ And $F_{\max}F_{\max}$ are the maximum and minimum values observed for the factorial scores associated with the parameters observed. It is based on this understanding that it was possible to calculate the Social and Environmental Responsibility Performance Index - (IDRSA)adopted in this study.

2.2 Scale Levels

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

Tabl	le I	:	Anal	ysis	scal	e ad	loptea	l by	the	resear	rch	•
------	------	---	------	------	------	------	--------	------	-----	--------	-----	---

Scale	Description %	Description IDRSA
0.801 a 1.000	81 a 100	Great
0.601 a 0.800	61 a 80	Good
0.401 a 0.600	41 a 60	Regular
0.201 a 0.400	21 a 40	Bad
0.000 a 0.200	0 a 20	Terrible

Source: Own Elaboration.

2.3 Parameters and Variables

The questionnaire used is structured with three parameters and 29 variables. The first parameter aimed to identify the practices of entrepreneurs in the company, with social aspects, the second to identify practices related to environmental aspects and the third to identify practices related to economic aspects.

Table 2: Parameters and variables (model of	created by
Cavalcante and Siqueira ¹⁷)	

Parameter	Variables				
	Does the company have rules of conduct and disclosure for employees?				
	Does the company work in a collaborative climate to promote changes?				
	Is there any kind of conscious participation by the employee as a corporate citizen?				
	Does the company include and adapt disabled people in its staff?				
Social	Does the company offer health and safety working conditions?				
Performance	Does the company develop social actions (donations, support for social projects, unique social projects)?				
	Does the company distribute its products or other products for social programs?				
	Are there employees who are not interested / unaware of sustainable practices within the company?				
	Are there few employees for many activities, new actions for social purposes and that end up overloading them?				
	Does the company use the selective waste collection system?				
	Does the company have a battery collection and disposal policy?				
	Does the company use non-toxic cleaning products?				
Environmental Performance	Does the company apply effective techniques to manage or use energy or use smart lighting?				
	Does the company work in partnerships with entities focused on the environment?				
	Does the company have accessories and devices to save water?				

	Does the company use waste disposal M processes?
	In the company, when a waste disposal process is used, is there a revenue generated by this procedure?
	Does the company receive incentives / government agencies to carry out selective collection?
	In all the company's production process, are there opportunities to reduce the environmental impact?
	Does a company have environmental certificates (for example: ISO 14000)?
	Are there priority in the company for suppliers that carry out sustainable practices?
	In the company, are there required us standards defined in contracts with o suppliers?
	Does the company require any type of certification from its suppliers?
	Does a company qualify its professionals to offer customers, clearly, the nature and content of the products and services offered?
Economic Performance	Does the company have defined forms of p after-sales relationship? c
I er for mance	Are there procedures in the company for assessing the quality of services provided?
	Does the company publicize its social or environmental programs to differentiate its brands and increase sales?
	Does the company fulfill its commitments to the government in an ethical and responsible manner (regular payment of taxes, ban on the supply of bribes of any kind)?
	Does the company have extra resources available for use in sustainable projects or donations?

Source: Own Elaboration.

2.4 Characterization of the research site

The Guajará-Mirim Free Trade Area (ALCGM) is limited to a continuous area of 82.50 km², located in the city of Guajará-Mirim, state of Rondônia, on the Brazil / Bolivia border. It represents 0.33% of the municipality of GuajaráMirim. In the city of Guajará-Mirim, 335 commercial companies, 11 service companies and 6 industrial companies were identified, which make use of the Free Trade Area incentives. The total number of companies operating in the municipality at the time of the survey was 691 units.

For the research, 54 companies were selected that use government tax incentives. Only 32 companies accept to participate in surveys, 19 from the retail sector, 10 in the wholesale sector, 2 from the wholesale-retail sector and a retail sector.

2.5 Characterization of economic activities using the National Classification of Economic Activities (CNAE) Parameter

he wholesale trade comprises activities of resale of goods f agricultural, extractive or industrial origin, at any level f processing (raw, processed, semi-prepared and ready for se) and in any quantity, predominantly for retailers, for ther wholesalers, for producing agents in general, stitutional and professional products. Wholesale trade ustomers are predominantly legal entities, agricultural, dustrial, commercial and service products, public and rivate institutions and self-employed professionals. The holesale trade comprises the usual manipulations of this ctivity, such as: assembly, classification and grouping of roducts on a large scale, conditioning and environment, edistribution to the recipients of the smallest scale, when erformed by the commercial unit itself. Retail trade omprises activities for resale of new and used consumer oods to the general public, mainly for the final consumer, or personal or family consumption. Commercial units that esell both to companies and to the general public should e classified in retail, as is the case with hardware stores nd building materials. The wholesale and retail trade omprises activities derived from the main wholesale and etail activities.

2.6 Ethical Aspects

The questionnaire was applied to manager, managing partner, administrative manager, financial manager, commercial manager, human resources manager, warehouse manager, owner, administrator, sales consultant, sales, administrative assistants, office clerk, secretary, workers in general, after signing the Free and Informed Consent Term - TCLE.

III. RESULTS AND DISCUSSION

To better understand the socio-environmental responsibility for sustainability in the Guajará-Mirim Free Trade Area, in the context of local development policies, support was sought in the epistemological theory of endogenous development.

To understand the consequences of planning for the development of a region is to understand the concept of development, which can affect economic growth. Growth can be synonymous with increased production, income and employment in a specific region, without economic and social development taking place. However, development presupposes a reduction in social and economic inequalities ²³. According to Oliveira ²⁴in Latin America and Brazil, for decades, as development policies emphasized for the need to promote product and income growth through capital accumulation and industrialization applied in the import substitution strategy. This strategy aimed to produce internally what was previously imported. To this end, domestic producers were protected from foreign competition through import duties and prices, in addition to a series of benefits granted by governments, which believed that industrialization was the key to development.

Penna²³ reported that, based on the economic development policy, Brazil was marked by the expansion of the process of industrialization and migration from the countryside to the city. Such policy, carried out through external financing, implements programs to modernize infrastructure, transport and energy, leaving companies like Petrobrás and Eletrobrás as inheritance. During this period, a country's development was thought of as a result of good state planning and the state's ability to implement its programs and projects. Therefore, development was thought through national guidelines and carried out by the central government. However, in the mid-1980s, the country suffered a break with this model of national development, as did the American and European countries. The external financing model caused by the debt crisis was alleged or exhausted, in the Brazilian case, associated with the deficits in the trade and payment balance of 1982^{23} .

Costa, Cunha²⁵ pointed out that with a crisis in the financing model and in the internationalization process of the economy, a new vision for the concept of development emerged, previously focused only on the economic one, also paying attention to the advances in quality of life, in democratization, citizen participation equity. and environmental protection. According to Martins²⁶, the current tendency to think and plan development is to endow it with a more human character and to consider man simultaneously as a subject and beneficiary. The author proposes the participation of people in the entire development process (action planning) and, even with results in effective improvements in material living conditions, they are not sufficient to guarantee the continuity of the process. The real local development differential does not meet its objectives (well-being, quality of life, endogeny, synergies, etc.), but in the posture that it attributes and guarantees to the community or the role of the agent and not just the beneficiary of development. This involves reviewing a participation issue.

Local participation means "giving people greater opportunities for effective participation" in development activities. This means providing conditions for them to mobilize their own potential, be social agents instead of liabilities, manage their resources, make decisions and control how activities affect their lives. The participatory approach involves people in the process of their own development. Considering local or community participation as a process means generating social and economic benefits, but it is not limited to just that, the participatory process that helps people to buy more effective control over their economies ²⁷.

According to Barquero ²⁸, the ability of a society to lead and drive its own regional development, conditioning it to the mobilization of productive factors available in its area and to its endogenous potential, reflects the form of development called endogenous. For this same author, two dimensions can be identified in regional development. The first dimension, the economic one, in which the local business society uses its capacity to organize the productive factors of the region. The second dimension, sociocultural, where local values and institutions serve as a basis for regional development.

The theory of endogenous development focuses on a regional issue, presents contributions to a problem of regional inequalities and policy instruments for its correction ²⁸. The model can be defined as bottom-up development or be part of the original socio-economic potential of the place, and not a top-down development model, that is, part of the planning and intervention carried out by the Brazilian State ²⁹.

According to Mazzali, Souza ³⁰, the actions of localities that adopt the dynamism of their economies must take into account the characteristics of the productive structure and the most favorable conditions, in order to promote the necessary internal articulations, accompanying and adapting to those in the socioeconomic environment in which it operates. The ability to interact with changes in the external environment and to positively (appropriably) revert to the municipality / region and the effects of these changes can have decisive weight for economic and social development. That is, obtain results that bring improvements in terms of job and income generation,

infrastructure, complementary products and services, which will translate into better local quality of life.

The concept of endogenous development, from a regional point of view, can be characterized as a process of economic growth that implies an expansion of the capacity to add value to production, as well as the absorption capacity of the region, which is to retain or reduce surplus produced in the region. local economy and therefore also attracts surpluses from other regions ³¹. The central theory of endogenous development is that a country, region or location with better human capital, science and technology, institutions, research and development can more easily increase the use of the production system, accelerate growth, increase product and allow better income distribution. Thus, it is an appreciation and incorporation of these new factors to the traditional theory that reside in the contribution of the endogenous growth theory to the theoretical and practical fields of regional / local development policies³².

Souza Filho³³, highlights that the main contribution of endogenous theory was to identify the decisive factors of production, such as social capital, human capital, knowledge, research and development, information and institutions, included in the region and not exogenously, as was understood until now. For this reason, it is concluded that the region endowed with these factors or strategically directed to the development of internal criteria, has better conditions to achieve an accelerated and balanced development.

3.1. Social and Environmental Responsibility Performance Index - IDRSA in the Free Trade Area of Guajará-Mirim, Rondônia, Brazil / Bolivia border

As already described in the research methodology, the socio-environmental responsibility performance index (IDRSA) was built from the application of a questionnaire prepared by Cavalcante and Siqueira ¹⁷.

3.1.1 Social Performance Index – IDS.

The average IDS presented a result considered a regular performance index (IDS 0.550), according to the scale adopted in the research. The highest index occurred in the wholesale-retail sector (IDS 0.613 good index), followed by the retail-wholesale sector (IDS 0.598 regular index) and the retail (IDS 0.540 regular index) and wholesale sectors (IDS 0.449 regular index). (table 3).

100% of companies in the wholesale and retail sectors have standards of conduct and disclose their social actions to their employees. The wholesale sector has a frequency of 80% and retail represents only a frequency of 27%. The retail and wholesale sectors and wholesale-retail account for 100% frequency of companies that work in a collaborative climate to promote changes according to social policies, followed by the retail sector with 73% and the wholesale sector with 50%. The retail-wholesale sector represents 100% frequency of conscious employee involvement as a citizen in the company's social actions, while the retail sector represents 68.42%, the wholesale-retail sector 50% and the retail sector represents only 40%.

Table 3: Social Performance Index - IDS.

Economic Sector	IDS	Description
Wholesale retail	0.613	Good
Retail-Wholesale	0.598	Regular
Retail	0.540	Regular
Wholesale	0.449	Regular

Source: Research results.

Only companies in the wholesale-retail sector showed 100% attendance with regard to the inclusion and adaptation of employees with physical disabilities. In the wholesale, retail and retail-wholesale sectors, there is no concern for the social inclusion of people with disabilities. Working conditions with health and safety are frequent 100% in the wholesale and retail and wholesale sectors. Only part of the economic sectors develop social actions (donations, support for social projects, exclusive social projects).Companies in all sectors do not have a policy of practices for distributing their products or surpluses for social programs. In other words, companies do not distribute their surplus to social programs or projects. There is no information on sustainable practices within companies. In general, all companies in the sectors have employees qualified for normal activities, and do not overburden, if the company is involved in new social actions.

3.1.2 Environmental Performance Index - EPI

The sectors of the wholesale-retail economy (EPI 0.583 regular index) and retailer-wholesaler (EPI 0.429 regular index) were the ones that presented the best performances. The retail sector (EPI 0.352 bad index) and the wholesale sector (EPI 0.259 bad index) were the economic sectors that had the worst performances. The average of the average EPI was 0.405 considered a regular performance index. (table 4).

Only a few sectors are concerned with a selective collection system, but, in general, companies are not concerned with this practice. 100% of the companies do not have a policy of collecting and disposing of batteries and other similar waste. Only the wholesale-retail sector and the wholesale-retail sector do not use toxic products.

Economic Sector	EPI	Description				
Wholesale retail	0.583	Regular				
Retail-Wholesale	0.429	Regular				
Retail	0.352	Bad				
Wholesale	0.259	Bad				

 Table 4: Environmental Performance Index - EPI.

Source: Research results.

In general, companies are not concerned with applying efficient techniques to manage or use electricity or smart lighting. Likewise, the research shows that companies are not concerned with partnerships with entities focused on the environment. Only the retail-wholesale and wholesaleretail sectors have the installation of accessories and devices to save water. In general, there are no policies or practices to save or waste water. It was observed that in all sectors there is no revenue generated in the waste disposal process.

There is no incentive from government agencies for environmental responsibility policies, as the municipality itself does not have selective waste collection. However, it is worth mentioning that ALCGM itself is aligned with a peculiar situation in the region, so that the development policy is characteristic of Guajará-Mirim, due to its environmental weight, a fact that does not observe other municipalities in Rondônia with this same institutional benefit.It is demonstrated that the needs of environmental policies and environmental sustainability management go unnoticed, both by the business sector and the public sectors, which end up not requiring actions aimed at stimulating the practice of socio-environmental responsibility at the local level.

Only the retail-wholesale sector has opportunities to reduce the environmental impact during the production process. The variable that draws the most attention is the fact that none of the sectors has environmental certification. This shows a lack of concern on the part of companies with regard to the environment.

3.1.3 Economic Performance Index - IDE

The wholesale-retail sector (IDE 0.485 regular performance index) and the wholesale sector (IDE 0.413 regular performance index) showed the best performances. The retail-wholesale sector (IDE 0.384 poor performance index) and the retail sector (IDE 0.369 poor performance index) had the lowest indexes. With an average IDE (0.412), the performance index for this sector is regular. (table 5).

Economic Sector	IDE	Description
Wholesale retail	0.485	Regular
Wholesale	0.413	Regular
Retail-Wholesale	0.384	Bad
Retail	0.369	Bad

Table 5: Economic Performance Index - IDE.

Source: Research results.

The only sector that prioritizes suppliers that use sustainable practices is the retail-wholesale sector. The wholesale and retail sectors are extremely negative. Only in the wholesale-retail sector (frequency of 100%) are there usage patterns applicable in contracts with suppliers. The other sectors remain with negative results, which means that there is no concern on the part of companies to define standardization of their contracts with their suppliers. The companies do not request any type of certification from their suppliers. There is no interest from companies in these sectors in knowing how the manufacturing process for products supplied by their suppliers works.

The companies that qualify professionals to serve customers, explaining the nature and content of the products and activities offered, with a 100% participation, are the wholesale-retail and retail-wholesale sectors. The wholesale and retail sectors have this frequency at 50% and 52%, respectively. 100% of the companies in the retail sector maintain forms of after-sales relationship. All sectors obtain a positive result, which indicates that there is interest on the part of all sectors in a good company x customer relationship. In other words, the company is concerned with customer satisfaction, as this means that the customer can buy again at the company.

The procedures for assessing the quality of services provided are present 100% in the retail-wholesale sector, 52% in the retail sector and 50% in the wholesale sector. The wholesale-retail sector was the only sector with a negative result. Only the retail-wholesale sector (100% frequency) discloses its social or environmental programs, using different brands and increasing its sales. All sectors fulfill their commitments to the government in an ethical and responsible manner (regular payment of taxes, ban on the supply of bribes of any kind).

The retail-wholesale sector (100% frequency) represents the only sector with extra resources available for application in sustainable projects or donations. These results demonstrate that companies are not interested in sustainable projects. It is the opposite of what should happen, as companies are located in Guajará-Mirim, where there is a high percentage of protected areas and also due to tax incentives in the area of free trade.

3.2.4 Social and Environmental Performance Index - IDRSA

The average of the results found for each of the analyzed parameters (social, environmental and economic) reaches performance index of socio-environmental the responsibility of the companies for each of the economic sectors surveyed in the free trade area of Guajará-Mirim. The wholesale-retail sector had the best performance among all sectors with an index (IDRSA 0.561), considered "regular" performance. The sector of retail and wholesale (IDRSA 0.470) and the retail sector (IDRSA 0.420) also display rankings with regular performance indexes. The wholesale sector (IDRSA 0.374) was classified as "bad". (table 6 and graph 1).

Table 6: Social and Environmental ResponsibilityPerformance Index - IDRSA.

Economic Sector	IDRSA	Description
Wholesale retail	0.561	Regular
Retail-Wholesale	0.470	Regular
Retail	0.420	Regular
Wholesale	0.374	Bad

Source: Research results.



Graph 1: Social and Environmental Responsibility Performance Index - IDRSA.

Source: Research results.

The overall average across all surveyed sectors resulted in IDRSA (0.456). Guajará-Mirim free trade companies have regular IDRSA. (table 6 and graph 5).

The Guajará-Mirim Free Trade Area (ALCGM) aims to define an import and export free trade area, under a special tax regime with the promotion or development of the Guajará-Mirim border region, in order to increase relations bilateral agreements with neighboring countries, in accordance with the Latin American Integration Policy. This institutional provision was regulated by Decree n° 843, of June 23, 1993, under the direct administration of the Manaus Free Trade Zone Superintendence – SUFRAMA¹⁷.

Table 7: Social and Environmental Responsibility Performance Index - IDRSA.

Área de Livre Comércio de Guajará-Mirim	IDRSA
Atacadista; Atacadista-Varejista; Varejista;	0.456
Varejista-Atacadista	

Source: Research results.



Graph 2: ALCGM's Social and Environmental Responsibility Performance Index.

Source: Research results.

The venture was born as an economic alternative for the city of Guajará-Mirim and region. The project aimed to rescue, in view of the transformations that occurred since the 1970s and 1980s, the commercial potential, eroded by the national economic situation and the loss of advantages of national products compared to products imported by the neighboring country, in Bolivia ³⁴. However, the opening of Brazilian trade to foreign products, at the same time, brings a severe blow to the region that already lives a long period of economic crisis ^{16, 35}.

The Free Trade Area presents its main possibilities for promoting development, considering that the incentive to trade expands markets, since the reduction of taxes and the reduction of prices, favors the possibility of greater sales. Consequently, it will be necessary to hire more people, reduce unemployment, increase income, corporate revenue, consumer well-being, as you will be able to buy more products at lower prices and, the growth of tax revenue, when analyzed with others taxes without tax incentives ³⁶.According to Albuquerque ³⁶, free trade areas were created as part of policies aimed at the development of the Amazon region. Os benefícios, concedidos por meio de incentivos tributários visam à melhoria da qualidade de vida de determinadas regiões. This is due to the increase in trade and the number of companies; the price reduction, which is also high due to the regions' logistical difficulties;

for the creation of new jobs and, consequently, for the formation of a virtuous economic circle.

The intentions of creating the Guajará-Mirim Free Trade Area were really good and focused on regional economic development, however, in the face of situations related to public and private management and with deficient policies to stimulate regional development, ALCGM succumbed. A large number of commercial houses, created under the motivation of the Free Trade Area, had to close like doors. Once again, the disastrous political action regarding the economic development of the city of Guajará-Mirim is evident ³⁷. What can be observed in the commercial sectors of Guajará-Mirim are the forms of tax treatment from the perspective of businessmen. According to Santos ³⁸, a tax competence consists of an authorization to exercise tax power, where a practice of preventing acts practiced is the action of each federative entity: Union, Federal District, States and Municipalities. A set of tax incentive tax laws were created to promote local and regional development in free trade areas, such as the Guajará-Mirim case. The operations destined for the Free Trade Area of Guajará-Mirim, are exempt from ICMS and IPI and taxed at zero rate (0) of PIS and COFINS 39.

According to Silva ⁴⁰, the Free Trade Areas defend Public Policies aimed at the development of frontier areas in the Brazilian Amazon, through tax incentives that encourage companies to produce and commercialize products in the Amazon, a precarious access region, creating new ones jobs and, consequently, bringing development. The studied region not only suffers from economic problems and physical isolation, but also verifies the lack of studies and scientific work from the economic, social and environmental perspectives. Among the few published studies on the subject in this border area of Guajará-Mirim, the research by Cavalcante and Alves 41 "Corporate Social Capital Index (ICSE) in the Free Trade Area of Guajará-Mirim, Rondônia: Uma analysis of the Theory of Endogenous Development and the study "Socioenvironmental Responsibility of Companies in the Free Trade Area of Guajará-Mirim, Rondônia (ALCGM) authored by Cavalcante and Siqueira¹⁷.

IV. FINAL CONSIDERATIONS

Although ALCGM arose from a policy framed in the context of the theory of endogenous development and motivated by local forces or by interests of strategic economic sectors, a reason for the establishment of this policy in the border region and in the green area of Rondônia demonstrates that the environmental aspect it was, in fact, the main condition for its effective

implantation in the Free Trade Area. Thus, a priori, this conditioner, at least, must be charged by the competent bodies to modify aspects of sustainable development. The survey results demonstrate the absence of environmental sustainability policies and practices, both by public agents and by ALCGM companies.

The "Wholesale" economic sector, which today represents the main strength of ALCGM, but has the lowest index of social and environmental responsibility (IDRSA = 0.374), stands out negatively.

The results of the survey reveal a fragility of companies that benefit from tax incentives in the Guajará-Mirim Free Trade Area in socio-environmental policies and practices.

It is hoped, with this work, to contribute to the issue of socio-environmental responsibility becoming part of the game of economic and political negotiations. That the discussion, implementation and management of socio-environmental activities be strengthened in ALCGM, and that companies fall within the focal objectives that justified the creation of ALCGM.

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The Problem of Unemployment among the Educated Women in Nagapattinam

Dr. A. Valliami¹, Mrs. D. Savithiri²

¹HOD/Associate professor, Department of Economics, A. D. M. College for Women (A), Nagapattinam, Tamil Nadu ²Assistant Professor of Economics, A. D. M. College for Women (A), Nagapattinam, Tamil Nadu

Abstract— Employment is a need or way of survival in today's growing world. people are not employed due to lack of qualification and unskilled. In our country women are highly educated but they are not paid enough, female are paid less compared to male. Many of the girls are getting a dead end degree which is of no use, some are married early. Therefore they end their careers. Even after getting married woman plans to get a job. Although India has nine months paid maternity leave still many of them get tired when they become pregnant. There is an inadequate college system brings out thousand of graduates every year but are not capable of providing placement, half of the colleges are not even making their students to have some Job Oriented Skills and remain unemployed.

Keywords— Educated Unemployment, Job Leaving, Job Loss, Job Search.

I. INTRODUCTION

The perfect woman, you see is a working woman; not an idler, not a fine lady but one who uses her heads and her heart for the good of others. There is no force more powerful than a woman determined to rise. A strong woman builds her own world.

Unemployment is difficult to estimate in India and most unemployment statistics are likely to underestimate the true level of unemployment, particularly for women.

The unemployment rate of women has increased in recent years in comparison with the unemployment rate of men. The worsening unemployed women have been interpreted as a trend associated with the rise in female labour force participation. Jobless women have difficulty in securing suitable work than jobless men, as it can be reduced from the fact that they tend to remain unemployed longer.

The optional level of women's employment obviously depends on a number of demographic factors such as the birth rate and the size of families which can markedly affect their capacity to engage in productive employment. The frequency of women working outside the home is clearly related to their age, marital status, residence and level of education.

II. STATEMENT OF THE PROBLEM

The main problem for an educated women in India is to choose either higher education or career on the one hand and marriage on the other.

There are also social, psychological and situational reasons for taking employment specially in case of women belonging to high class family. These reasons includes ambition for a career, charm of the position, utilization of leisure, proper use of higher education, willing away the time till marriage, escape from domestic work, freedom to mix with people and preference for out– door life.

The work available to educated women is often of a lower status. In many cases they have to accept job inferior to those of men with levels of education comparable or even inferior to their own. This may need to a pronounced "Status frustration" effect whereby many women who feel entitled to a certain level of income (Sometimes known as "Reservation aspiration level") withdraw from the labour force, then accept some lower paying, lower status job.

This tendency to withdraw is probably strongest for educated women whose husbands have high income, high status job.

Increasing of Women Unemployment

Unemployment job-leaving:

An employed worker following an income of maximizing strategy searches for another job, when the expected return exceeds the cost. The choice to leave and search from unemployment rather than to search while employed is motivated by a greater difference between the respective gain and cost of seeking a new job from unemployment than from employment.

Whether from employment or unemployment the male's return from searching for another job is likely to be greater than the female's. Two reasons, job length and distribution, provide men with a greater incentive to search then women and therefore increase men quitting.

The job interruption for household activities, the women spends less time in the market reducing the length of time over which she gains from search are received. In addition, discrimination that prevents women from entering higher paying jobs reduced the gain from alternative offers. The smaller incentive to search may reduce job leaving unemployment of women compared with men, her foregone wage is lower. In addition, the greater gains to time spent unemployed for women induce them to use unemployment search.

Job searching during unemployment is unlikely to be a continuous day long activity. The gains during unemployment include the use of interspread periods of search activity. The gains are greater for women for men, because a female can use the interspread periods in part time employment, in home work move productivity than males. The increased females productivity results from more experience and training in house hold activities such as cooking and child care. Despite men gain the large from search which cause them to search more, the relative levels of job leaving unemployment rates are uncertain because of the incentives for women to search from unemployment.

When employment rate increases, the returns from search decreases for both men and women because the average offered wage decreases and the search more frequently produces no offer. The decline in gains from search time is less for women than for men, since the value of women's periods of inactivity during search does not fall. Therefore, women's job leaving unemployment will be higher compared with men as the unemployment increases.

Unemployment-job loss:

Unemployment is due to of the loss of the previous job from involuntary separation. Involuntarily separated workers include discharged workers but are mainly lay-offs. The discharge rate and the resulting unemployment rates are assured to the same for males and females. The higher market productivity of male's compared with home productivity causes more male than female lay off's to continue job search. For a woman the value of home productivity is closer to her potential market earnings because she had more training for work in the home market earnings are reduced by the investment search required to locate market employment. The proximity of home and market productivities for women encourage more female lay-offs to work in home. As a result of this labour force withdraw, it is uncertain whether higher female lay off rates will result in higher job loss unemployment for men or for women.

Unemployment Entry and Re-entry:

Unemployment while seeking to find a first job among adult is expected to be greater for women than men. More teenaged males have work experience than teenaged females. Therefore, more of the adult – female labour force are new entrants. Since there is a large number of entrants in the female labour force. The unemployment rate of women is greater.

Unemployment while re-entering the labour force is also expected to be greater for females. Household activities related to marriage and child interrupt female labour force participation and are unequally shared with males. Since females re-enter the labour force more frequently than males, the re-entrants unemployment rate of women is greater.

Job leaving entry and re-entry unemployment are expected to rise more for women than for men, but women's job-less unemployment is expected to rise less than men.

The higher employment rate of women's is a persistent problem, but it is a symptom and not a cause of inferior labour market status.

OBJECTIVES:

- 1 To find out the extent of unemployment prevailing in the study area
- 2 To analyse the period of waiting for employment
- 3 To observe the mode of job search
- 4 To estimate the cost of job search
- 5 To study the factors influencing job aspiration

III. METHODOLOGY

The data collected for this study belong to two categories: primary and secondary sources. The primary data was collected with the help of a comprehensive and secondary data consists of published and unpublished materials in the form of books, reports, journals and periodicals related to women. A total of 50 unemployed persons were selected for the study.

CONCEPTS

Sen states that, "a person should be counted as unemployed so long as the nature of the job and the remuneration received by him fall below his expectations". In his numerical exercises, he counts among the unemployed all persons on the live registers of employment exchange including a large proportion who already have some job. He justified it on the ground that the fact of registration indicates that job held by these persons do not match their respective expectations.

EDUCATED UNEMPLOYMENT

Educated unemployed person is the one who is having educational qualification of matriculation standard and above but remaining unemployed. A study carried out by the YMCA of India, defined "Educated women as a woman with a first university degree that should equip her to choose her field of further study wisely. Continue her study, with the necessary field training, by herself, do her own reading, acquire her own expertise, and organize her own way of learning and living"

JOB ASPIRATION:

Job aspiration refers to the motivation of the unemployed person about the place and nature of the job preferred and the monthly salary expected. This depends on the family conditions and the annual income of the family.

WAITING PERIOD:

The period of lapsing from the date of registration in the Employment Exchange by the unemployed with her highest qualification till December. In the words of Metha, waiting period is defined as "The period lapsing between the obtaining of the last degree and the landing of the first job".

COST OF JOB SEARCH:

The cost of expenditure of the unemployed person during a year refer to the cost of application fee, postal expenditure, travelling expenses and expenditure on attending interview and other such expenditure.

MODE OF JOB-SEARCH:

The sources through which the unemployed persons are trying to get their jobs, such as Employment Exchange, Public Service Commission, Clerical Examination and Private Recommendations is called as the mode of Job-search.

PLACE OF WORK:

The place of work refers to the particular areas in which the women are willing to take their jobs, it they are provided. The places includes their Native Town / Taluk / District / States and nearby states.

THEPROBLEMOFEDUCATEDUNEMPLOYMENT IN INDIA:

Educated unemployment is a special problem in the Indian setting. A survey conducted by the Indian Institute of Public Opinion in 1972 indicated that, one in four of literate youth between 18-24 years of age group were unemployed. This gives for the whole country a literate youth unemployment figure of 7 million. On this assumption the total unemployed (literate and illiterate) aged under 24 was not likely to be less than 15 million and all unemployed not less than thirty million. This is grave enough as a base. The labour force growth is assumed to be 6 millions per year and jobs are available to the extent of only 2 million a year.

The backlog, therefore, of a 4 million is added every year. In the several plan periods the backlog of unemployment has been rising at enormous rates and so is the despair and frustration among the unemployed and particularly among the educated. On both counts female workers are affected in very large numbers. In 1987, here were 167.35 lakhs of educated unemployed from the registers of employment exchange. Among the educated unemployed the proportion of matriculates is falling and that of graduates and post-graduates is rising. It has risen from 9.5% in 1961 to 17% in 1987. Registration of unemployed shows that matriculation is not a terminal stage in the Indian educational system and that there is a tendency towards over education leading to a paradoxical man-power situation. The growth rates of educated job seekers are 12.4, 17.0 and 16.3 among that matriculates, higher secondary educated and graduates and postgraduates respectively.

Though agriculture offers part-time jobs for many more the educated employed can obtain only a few. The placement rate of employment exchanges is only a fourth of the new job seekers registered. An analysis of women unemployment is not available except for the total, and that for women have to be derived or assumed. Moreover, the data are in terms of stock of labour and not flow of man hours. Women's labour participation is either underestimated or ignored. Indian 'unemployment statistics' is, a reflection of the failure of the market to clear labour supply and the result of incomplete or nonavailable information on the part of job seekers regarding relevant alternatives they face.

The educated unemployed growth problem rests on the question of waiting period before entering a job. It is observed that in other developing countries as well as waiting time for school leavers is less than that of college graduates. A list of skills and areas of job– oriented courses available to girls and women is furnished. However it is to be noted that not only admission into these courses are restricted to women candidates and the number of women's polytechnics are very few considering the large number of school leavers.

CAUSES FOR THE EDUCATED UNEMPLOYMENT:

There has been an alarming phase of mass– unemployment among the educated youth. Post graduates and graduates are walking pillar to post in search of employment were there is slowdown in economy, there is surge in the number of uneducated unemployed people. Many educated people are knocking at the gates of offices just for the position of petty clerk and get disappointed when they read the words 'No Vacancy' on the gate. Numerous cases of suicide among the unemployed young men have been a feature of our time.

- 1 Defective expansion in the educational system which has led to a surplus of educated persons.
- 2 Imbalance between the rate of economic growth and capacity of the economy to absorb educated persons.
- 3 Lop-sided expansion in higher and technical education
- 4 Lack of work experience and social service which has failed to create the spirit of self – employment and self – confidence among the educated unemployed.
- 5 Lack of Network of Cottage Industries.
- 6 Mentality.

AN ANALYSIS OF JOB SEARCH BEHAVIOUR OF UNEMPLOYED EDUCATED WOMEN IN NAGAPATTINAM:

ANALYSIS OF THE UNEMPLOYED:

The unemployed persons are classified according to the languages known by them. It is shown in the Table . 1.

Table.1: Distribution of Respondents according to Languages Known

Languages Known	Number	Percentage
Tamil and English	36	72
Tamil, English and Telugu	06	12
Tamil, English and Hindi	05	10

Tamil, English and Urdu	03	6
Total	50	100

Table: 1 reveals that 36 unemployed women has knowledge of two languages and 14 have acquired the knowledge of three languages. Even the acquisition of many languages has not enabled to get a job for sample respondents.

Table.2: Number of the members of Households

S.No	Number of Households	Number of Respondents	Percentage
1.	2	05	10
2.	3	09	18
3.	4	12	24
4.	5	17	34
5.	6	04	8
6.	7	02	4
7.	8	-	-
8.	9	01	2
	Total	50	100

The table No. 2 reveals that nearly 5 of the respondents are drawn from households having 2 to 3 members and 12 of the respondents are drawn from households having 4 to 5 members.

Table.3: Number of Unemployed Educated Women in the
Family according to the Period of Unemployment

Period of unemployment	Number of persons	Percentage
Less than 6 Months	13	26
6 Months to less than 1 Year	06	12
1 Year to less than 2 Year	07	14
2 Years to less than 3 Years	09	18
3 Years and above	15	30
Total	50	100

Table.3. presented the educated unemployment respondents were asked to give details of their family. The

analysis of the reply furnished by them indicates that nearly 15 of them were unemployed for more than 3 years.

Table.4: Age of the Unemployed

Age	Number of Respondents	Percentage
15 - 20	05	10
20 - 25	15	30
25 - 30	10	20
30 - 35	13	26
35 - 40	07	14
Total	50	100

Data related to the age of unemployed in the sample household is tabulated as follows.

The age distribution of the unemployed provides a useful proof to the problem of absolute unemployment in the area. Long queue of the youngsters waiting for unemployment that is apparently inadequate to accommodate them all is brought into the focus by the age frequency of the unemployed women. The typical unemployed person is a young women less than 25 years standing on the facts increasing man powers and the tragically slow rate of growth of employment. It is clear from this table that 15 of the unemployed belongs to the age group of 20-25.

Table.5:	Distribution	of unemployed	according to their	Oualification	Observed (Values)	
1 0010.01	Distriction	oj unemproyea	according to men	Quangreanon	observed (vanies)	

Period of Unemployment (in months)	Post Graduate	Graduate	Non – Graduates	Total
0-1 Year	4	2	2	8
1-2 Years	2	3	-	5
2-3 Years	4	5	6	15
3-4 Years	1	2	2	5
Above 4 years	14	3	-	17
Total	25	13	10	50

The table No. 5 reveals that the period of unemployed in the case of Post Graduate is high 14 respondents in the category of Post Graduate are unemployed for above 4 Years. This shows higher the education higher will be waiting period.

EDUCATIONAL QUALIFICATION OF THE RESPONDENTS:

UNEMPLOYMENT OF THE BASIS OF EDUCATIONAL QUALIFICATION:

When the unemployed persons are classified according to the subjects, it is helpful to understand the magnitude of unemployment of the basis of degree and subjects.

Table 6.	Educational	Qualification	oftha	Dognondonta
Table.0.	Laucanonai	Ouanneanon	or the	Respondents
		2		

Subject	Number of Respondents	Percentage
M.A.,	7	14
M.Com.,	2	4
M.Sc.,	2	4
В.А.,	9	18
B.Com.,	8	16
B.Sc.,	10	20
Technical	5	10
H.Sc.,	4	8
S.S.L.C	3	6
Total	50	100

The Table :6 reveals that the 50 respondents taken are for the study of job search analysis. 3 persons have studied upto S.S.L.C, 4 persons have the qualification of H.Sc,5 persons have the qualification of Technical Education. 27 persons are Graduates and the remaining 11 persons have received the Post – Graduate degree.

TYPES OF EMPLOYMENT:

Acceptability of different types of jobs is a factor to be studies in this survey. Some important occupations like, Teaching, Clerical, Bank Jobs and Technical Jobs have been considered.

Table.7: Type of Employment

Occupation Desired	Number of Respondents	Percentage
Teaching	18	36

Total	50	100
Technical	5	10
Typist	6	12
Bank Job	11	22
Clerical	10	20

The Table 7 shows that the largest among them are willing to accept teaching jobs. The people acceptable in Bank and Clerical jobs are more or less equal.

It is essential to note the nature of relationship between educational qualification and to the salary expected. All the respondents expressed their normal expectation of salary according to their qualifications.

Table.8: Minimum Salary (Per Month)

Enrolments	Post Graduate No.	Graduate No	H.Sc No	S.S.L.C No	Technical No	Total
0 - 1000	-	-	-	-	-	-
1000 - 2000	1	5	3	5	3	17
2000 - 3000	2	7	5	3	4	21
3000 and above	7	3	2	-	-	12
Total	10	15	10	8	7	50

From the Table. 8 it is to be noted that there is an educational qualification has the correlation between the salary acceptable.

ATTITUDE TOWARDS SELF - EMPLOYMENT:

The respondents were asked to express their view about the prospects of their own self – employment in view of the difficulties of getting a job. Only 18% of them are willing to explore self – employment opportunities and the rest 82% are not willing to avail such opportunities due to the following reasons.

- 1. Lack of family tradition
- 2. Lack of resources
- 3. Lack of guidance
- 4. Lack of skill and experience

NUMBER OF TIMES APPLIED FOR JOB:

Distribution of unemployed according to the number of times applied for Job.

Number of times applied for Job	Post Graduate	Graduate	Non – Graduates	Total
0 - 2	-	3	10	13
2-4	1	3	1	5
4 - 6	1	3	5	9
6 – 8	3	2	1	6
8-10	1	5	1	7

Table.9: number of Times applied for Job

10 - 12	1	-	1	2
12 - 14	-	-	-	-
14 – 16	2	1	1	4
16 – 18	-	1	-	1
18 - 20	1	2	-	3
Total	10	20	20	50

Table No. 9. Number of attempts has to be made in job hunting to get hold of a job.

The distribution of the unemployed with various levels of qualification and the number of times applied for jobs by each class is calculated. It is clear that only persons those are under graduates have applied more times then those who are highly educated.

REASONS FOR REMAINING UNEMPLOYED:

The respondents were asked to given the reasons for their unemployed. The reasons given by them are listed below

- 1. Severe competition
- 2. Job not available
- 3. Expecting other decent job
- 4. Temporary nature of the job
- 5. Lack of future prospects
- 6. Inadequate emoluments

COST OF JOB SEARCH:

The important economic aspects of search behavior is the cost of job search. such a cost include expenditure on travel, newspapers, postal cost, To private employment agencies and the non-consumptive portions of expenditure on items like new clothes, boarding and lodging etc..

 Table.10: Expenditure on Travel according to their Qualification

Amount	Post Graduate	Graduate	Technical	SSLC	HSC	Total
0-200	3	5	3	10	4	25
200-400	3	1	-	-	-	4
400 - 600	2	2	3	-	1	8
600 - 800	-	4	3	-	-	7
800 - 1000	2	1	-	-	-	3
1000 - 1200	-	1	-	-	-	1
1200 - 1400	-	-	-	-	-	-
1400 - 1600	-	1	1	-	-	2
Total	10	15	10	10	5	50

The table 10 reveals that the expenditure on travel according to their qualification. The expenditure range with a class interval of rupees 200 per month is made and the number of respondents in each class is found out as the class frequency.

Table.11: Means	of Searching Job
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Qualification	Public Service Commission	Direct Application	Employment Exchange	Other Means
Post Graduates	18	14	8	-
Graduates	10	9	15	-
Technical	8	5	10	-

S.S.L.C	4	_	5	-
H.Sc	10	2	8	-
Total	50	30	46	-

Table 11 reveals that the respondents were asked about the agencies through which they try to get the job 46 of them preferred employment exchange 50 of them preferred through public service commission. 30 of the respondents preferred direct application of the department or institution.

CHOICE OF EMPLOYMENT:

Section of Employment	Qualification								
	P.G	U.G	Technical	H.Sc	S.S.L.C	Total			
Central Government	05	04	0	01	0	10			
State Government	04	05	01	03	02	15			
Local Body	02	02	01	03	02	10			
Private Enterprises	03	01	01	01	02	8			
Foreign Enterprises	01	01	05	0	0	7			
Total	15	13	8	8	6	50			

Table : 12 shown that the respondents have expressed their choice of job of the following agencies in the order of merit. It reveals that 50 of the sample unemployed prefer State Government jobs next comes the jobs in the Central Government and Local body.

All the respondents have expressed their view that increase in the levels of educated unemployed will (i) Cause of job seekers to lower their acceptance level (ii) increase in the number of job seekers (iii) increase the competition for available vacancies (iv) rise in duration of unemployment and (v) decrease the probability of offer at each level of wage.

The respondents do not agree with the view that absence of differential in wage rate will lead to full employment. They have expressed their view that will as the percentage of educated unemployed is increasing year by year. Flexibility in wage rate will partly help to attain full employment.

The respondents were asked to state the difficulties and obstacles in getting a job. The opinions of the respondents are classified in the order as given below.

- 1. Educated persons are increasing year by year.
- 2. Influence of recommendations.
- 3. Caste preference.
- 4. Influence of Politicians.
- 5. Problem for finance.

- 6. Problem for seniority.
- 7. Severe competition for available jobs.
- 8. Bribery.

IV. SUGGESTIONS

The following are the suggestions to solve the problem of educated female unemployment.

Minimum marks to pass in the examinations should be increased. There must be a change in the educational system such that vocational and job oriented education should be given during the period of schooling.

Briery should not be encouraged. Jobs should be given according to ability, skill and qualification and not on the basis of caste, recommendations, influence of politicians etc.

The best solution to solve the problem is to increase self-employment opportunities. Financial and technical assistance should be made available without hand course to encourages self-employment opportunities. In rural areas, co-operative stores, medical stores can be opened where the educated unemployed can be employed.

There is a tremendous employment potential in the librarian profession in India. It is regarded particularly suitable to women. There is a shortage of statistician's actuaries and accountants throughout the world. Women can qualify themselves in these fields and easily find employment chances.

Women are required to change their occupational outlook and avail themselves of the training facilities for the acquisition of technical skills which will pave the way towards achieving equality of opportunity.

Education at all levels has to be streamlined and the main purpose of such streamlining should be avoidance of wastage in all forms, because unemployment amount to wastage of man power which has tremendous possibilities to contribute to nation's progress.

V. CONCLUSION

Employment is a need or way of survival in today's growing world. Educated young men and women on whose shoulder lies with a great responsibility of making India an ideal socialist state. Our young men, on their own part, must make it a principle that they should not run after outwardly shine in urban life, rather they should settle in villages, thereby contributing their quota of services and buildup of our villages.

It women empowered means mother India will be empowered. These are the words said by Pandit Jawaharlal Nehru. His words should come true.

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Oral Health conditions in hemodialysis Patients

Paulo Leonardo Ponte Marques¹, Maria Vieira de Lima Saintrain², Alexandre Braga Libório³, Lucianna Leite Pequeno¹, Anya Pimentel Gomes Fernandes Vieira-Meyer⁴

¹ School of Dentistry, University of Fortaleza (UNIFOR), Ceará, Brazil.

² Public Health Graduate Program, University of Fortaleza (UNIFOR), Ceará, Brazil.

³ School of Medicine University of Fortaleza (UNIFOR), Ceará, Brazil.

⁴Family Health Master's Program, Oswaldo Cruz Foundation (FIOCRUZ), Ceará, Brazil.

*Corresponding Author: Maria Vieira de Lima Saintrain

Abstract— *Objectives: This study aimed to assess oral health status and self-perceived oral health in hemodialysis (HD) patients.*

Materials and Methods: Thedecayed, missing and filled teeth (DMFT) index and the community periodontal (CPI) index were used to assess oral health status and self-perceived oral health in 128 HD patients. Salivary flow (SF) and pH were also measured.

Results: Mean age was 56.2 ± 17.1 years and mean DMFT was 23 ± 9.14 . There were 41 (32%) edentulous participants and 81 (94.3%) non-edentulous participants presented periodontal alterations. SF was normal (≥1.0 ml/min) in five (3.9%) participants before HD and in 17 (13.3%) participants after HD. SF was very low (≤ 0.3 ml/min) in 60 (46.9%) participants before HD and in 26 (20.3%) participants after HD. The difference in SF before (0.39 ± 0.28 ml/min) and after (0.60 ± 0.34 ml/min) HD was significant (p<0.001). There was a negative correlation between salivary flow and age before (r=-0.188, p=0.033) and after (r=-0.261, p=0.003) HD.

Conclusions: Despite the increase in salivary flow after HD sessions, the rates were still below the normal levels, thus indicating the need for special care.

Clinical Relevance: Our findings show that the oral health care professional should provide preventive and restorative treatment to HD patients and should be included in themultiprofessional health team managing the care of HD patients.

Keywords— Salivary Flow. Oral Health. Hemodialysis. Dentistry.

I. INTRODUCTION

Chronic kidney disease (CKD) is a progressive condition characterized by a gradual loss of kidney function over time. Its diagnosis is made on the basis of decreased glomerular filtration rate or markers of kidney damage, or both, of at least 3 months duration [1]. Early recognition and intervention are essential to slowing disease progression, maintaining quality of life, and improving outcomes [2].

According to a survey of chronic kidney disease patients, there were 122,825 dialysis patients in Brazil in 2016, with a dialysis treatment rate of 596 patients per million inhabitants and a mean annual increase in the number of dialysis patients of 6.3% over the last five years.

Additionally, the survey revealed that 57% of the patients were men, 87.5% were aged 65 and older, 41% presented diabetic nephropathy, and 92% were hemodialysis (HD) patients [3]. However, many HD patients and the medical staff responsible for their care are unware of oral health conditions and changes associated withHD [4, 5].

Hemodialysis is the treatment used to replace kidney function. It is a complex process that requires a multidisciplinary approach in order to ensure a more comprehensive patient management [6]. Special attention should be given to the oral health of HD patients, not only because of oral conditions and specific diseases, but also because of various systemic manifestations commonly associated with CKD [7, 8]. Therefore, the control of the oral and systemic manifestations to which these patients are very susceptible should be part of their treatment. Failure to do so can lead to the onset of infectious diseases that interfere with the treatment and/or even delaykidneytransplant [9].

The saliva, which plays a major role in digesting food and in preserving the integrity oforal tissues, can be negatively affected inpatients with kidney failure.However, few studies have evaluated salivarychanges and composition in patients undergoing HD [10, 11].Research has shown that fluid intake restriction, use of different types of drugs, systemic disorders and radiation therapy are specific risk factors for changes insalivary pH and flow [12].

Although HD therapy prevents patients from visiting the dentist, it is estimated that 90% of patients with CKDundergoing HD have some oral health problem [13, 14]. The most common oral health problems in this population are gingival inflammation, increased periodontal probing depth, xerostomia, halitosis and dental caries [5, 15, 16]. Moreover, many patients do not perceive the need for preventive dental care, and systematic oral health education programs targeted at HD patients have not been described in the literature [17, 18].

Thus, considering the hypothesis that HD can modify the oral environmentin the long term andimmediately after the treatment session, understanding the changes in the salivary flow andthe oral health conditions related to HD may improvehealthcare professionals'decision-makingregarding treatment protocols for these patients. Given that, the present study aimed to assess the oral health status, including dental problems, soft tissue and salivary (flow and pH) changes, and the self-perceived oral healthof patients undergoing hemodialysis.

II. MATERIALS AND METHODS

A cross-sectional study was conducted in two hemodialysis clinicslocated ina capital city in Northeastern Brazil. Data were collected in 2013 and these clinics were selected for being reference hemodialysis treatment centers.

The research was approved by the Research Ethics Committee of the University of Fortaleza, Brazil, under Approval No. 150.713. All the participants were aware of the study protocol and gave their written informed consent prior to participation in the research. Eligible patients were randomly assigned for enrollment and clinical decisions were not controlled by the study protocol. Inclusion criteria were: patients undergoing HDin the hemodialysis clinicsselected for the research who could answer the interview questions.Patients under 18 years of age were excluded from the study. Data were collected in three phases by a single researcher (PLPM) who was trained by a co-author (ABL) for phase twoand calibrated against a gold standard examiner (MVLS) for phase three (intra and inter kappa values were>0.8). In the first phase, an interview was conducted to obtain information on patients'self-perceived oral health status. The questionnaire was adapted from a World Health Organization's Oral Health Survey [19]and included questions regarding oral pain, dry mouth, difficulty swallowing, problems with the taste of food, and burning mouth sensation. Additionally, data onparticipants' general health and socioeconomic status were collected from medical records.

The second phasewas designed to assess salivary flow and pH.The participants were aware of the required abstinence from smoking, drinking, eating and tooth brushing at least one hour prior to saliva collection. This phasetook place at two moments: immediately before and immediately after the hemodialysis session.Salivary pH was measured using pH indicator strips (pH 0-14; Merck®, Darmstadt, Germany). The patient was asked to remain with the mouth open and a strip was placed on the tongue for one minute. After removing the strip, the color change was compared with the color chart and recorded in the patient's file [20].

The analysis of salivary flow was performed with saliva collected after stimulation. This procedure is useful forallowingsaliva collection from major and minor salivary glands [21]. Patients were asked to chew a piece of sterile rubber sheet (3 cm x 2 cm), which is used in dental procedures, for one minute. The rubber sheet was tied to dental floss to prevent swallowing. The first sample of saliva collected immediately after stimulation was discarded. After that, the patient was asked to spit into a glass container graduated in milliliters for five minutes and the amount of saliva collected was divided by the time the collection process lasted, thus providing the salivary flow rate in mL/min [22].Stimulated salivary flow rates that ranged 1-3 mL/minute were considered normal for adults. Hyposalivation occurred when he rate was below 1mL/minute [23, 24].Stimulated whole saliva flow rates below 0.7 mL/minute are within the lower range of output and suggest salivary hypofunction [25]. Therefore, the percentage of patients with salivary flow rates below 0.7mL/min was also calculated and studied.

The last phase of data collection consisted of an oral examination before the hemodialysis session using the following sterilized instruments: flat mouth mirror (size No.5) and the WHO-621 periodontal probe, which has a ball end of 0.5mm diameter and a first colored band at 3.5–5.5mm. Assessment of oral health and oral mucosal status was carried out with the patient sitting on a chair under

artificial light. Periodontal status was assessed using the Community Periodontal Index (CPI) and dental caries wasassessed using theDecayed, Missing and Filled Teeth Index(DMFT).Bothindices used parameters and forms adaptedfrom the World Health Organization Oral Health Survey [19]. Oral examination was performed, and the data were recorded in about 15-20 minutes.

The data were analyzed using SPSS for Windows (version 19.0,SPSS Inc., Chicago, IL, USA) with a significance level set at 5% (p<0.05). Pearson's correlation test,Fisher's exacttest and one-way ANOVA wereused to analyze the data and checkfor correlations between the variables. Continuous variables were described as median and mean \pm standard deviation (SD) and categorical variables were described asfrequencies and percentages.

III. RESULTS

There were155 eligible patients in the HD clinics, but16 were excluded after application of the exclusion criteria and 11refused to participate in the research. Thus, the final sample consisted of 128 patients. Of these, 92 (72.7%) were originally from the state's capital and 36 (27.3%) were from smaller cities.

The age of the participants ranged 20 to 91 years, with a mean age of 56.2 ± 17.1 years and a median age of 59 years. Table 1 shows the socioeconomic status of the participants in the two centers. The patients were predominantly men (n=66; 51.6%), married (n=79; 61.7%), retired(n=64; 50%), had primary education(n=51; 39.8%) and received up to one minimum wage(n=88; 68.8%).

The information collected from the patients' medical records revealed that the disease that more often causedCKDwas hypertension (n=96;75.1%), followed by diabetes (n=47; 36.8%). Other diseases directly related to kidney disorders, such as glomerulonephritis and kidney stone, accounted for 26 cases (20.3%).

Table 2 shows patient's self-reported oral discomfort, with dry mouth being the patient's major complaint, although it did not significantly correlate with salivary flow before or after hemodialysis (p=0.342 and p=0.404, respectively).

Table 3 depicts the DMFT and salivary flowand pH results in relation to participants' age.Periodontal status was assessed in 87 patients only because the others were edentulous(n=41; 32%). Of these patients, 82 (94.3%) had some type of health problem. No correlation was found between periodontal problem and the duration of treatment (r=0.042, p=0.702; one-way ANOVA p=0.537). Changes in soft tissue were detected in 21.9%(n=28) of the patients examined.Stomatitis (n=14; 10.9%), ulcers (n=6; 4.8%), cheilitis (n=4; 3.1%) and candidiasis (n=4; 3.1%) were observed. The mean DMFT was 23.0 ± 9.15 , with a mean of 8.98 ± 9.12 decayed, 18.95 ± 11.72 missing, and 1.66 ± 3.44 filled teeth. The need for rehabilitation with dental prosthesis was observed in 75.8% (n=97) of the patients.

Table 4 shows thatsalivary flow rate before the hemodialysis session ranged 0.10 mL/min to 1.80 mL/min and some patients exhibited a salivary flow rate below 0.7 mL/min. After the session, salivary flow rate ranged 0.10 to 2.0 mL/min, with some patients exhibiting a salivary flow rate below 0.7 mL/min. Salivary flow was normal (\geq 1.0ml/min) in five (3.9%) patients before the hemodialysis session.Extremely low salivary flow rates (\leq 0.3ml/min) were found in 60 (46.9%) patients before the HD session.

Salivary flow differed significantly before and after the hemodialysis session and it was measured using continuous and categorical scales. Increased salivary flow was observed in 106 participants (82.8%) and salivary pH was higher before the HD session(pH 7.18 ± 0.87)compared with the pH after the HD session (pH 6.82 ± 0.78), as shown in Table 4.

Table 5presents the significant correlations of changes in salivary flow before and after hemodialysis with age, DMFT and pH. No correlation was observed between duration of hemodialysis treatment and periodontal problems measured by the CPI (r_s =0.039. p=0.720) even when comparing the duration of hemodialysis treatment between different periodontal problems groups (one-way ANOVA, p=0.537).

When the correlation between salivary flow and age was analyzed, a negative relationship was found (age and salivary flow before hemodialysis: r=-0.188, p=0.033; age and salivary flow afterhemodialysis: r=-0.261, p=0.003; age and salivary flow difference: r=-0.208, r=0.019), showing that not only salivary flow is decreased with age, but also that the increase of salivary flow after hemodialysis is decreased with age.

IV. DISCUSSION

Patients undergoing hemodialysis (HD) are vulnerable to infection and the oral cavity is a potential source of infection. Therefore, it is important to monitor HD patients' oral health (including salivary flow and sources of infection, such as dental cavities and periodontal problems) and implement oral health preventive measures.

In the general population, the association between salivary flow and age is unclear. While some clinical studieshave shown a reduction in salivary flow with age [26,27], other studies have not reportedsuch association [28, 29].However, saliva is a robust indicator for monitoring health status and for disease surveillance as it is a noninvasive, cost-effective and highly sensitive diagnostic approachthat correlates with blood samples[11].In our study, the association between salivary flow and age revealed that not only salivary flow is decreased with age, but also the improvement of salivary flow after HDproportionally decreased with age. The saliva plays a major role in oral healthand older adults undergoing HDare at increased risk for oral diseases [22]. Therefore, this population group needs a higher standard of care to prevent systemic complications caused by oral health problems.

It should be noted that HD patients also present with general and oral health problems (e.g., xerostomia, drug idiosyncrasy, drug side effect) that affect their oral health and quality of life [6, 30]. A decrease in salivary flow may result in a significant decline in oral health defense and thus lead to discomfort and clinical problems, such as caries, altered taste, halitosis, and increased susceptibility to infections [22]. Therefore, the dentist should be part of the HD care team so that patients arecarefully managed.However, the dentist musthave awide knowledge of HD treatment to better understand how HD can modify oral health status. Some factors are essential for the dental treatment of hemodialysis patients, particularly the evaluation of medical history, medication profile and radiographic and laboratory data [31]. The restorative dentistry treatment should preferably be performed prior to the first HD session [32]. However, if this is not possible, dental treatment should be avoided on dialysis daysin order to avoid the interference of the use of local anesthesia with adrenaline, which will demand special care from the health care provider [33].

Patients' low socioeconomic status, as observed in the present study, can increase their vulnerability to health complications.Researchersemphasize that oral diseases are still a major public health problem in high-income countries and a growing problemin many low- and middle-income countries.Socioeconomically disadvantaged groups are atincreased risk for these problems and often do notreceive adequate oral health care. In addition, oral disease prevention is usually neglected in public health services, which, once again, puts patients undergoing HD in public servicesat greater risk for oral health problems[34].

Thesialometry showed a significant increase in salivary flow after the HD session (p<0.001).However, such increase was not enough to place the majority of patients undergoing HD in the normal range of salivary flow seen in healthy patients (0.7 to 1.0 mL/min) [35, 36]. Thesefindings are corroborated by studies performed in India and Brazil[10, 37]. Salivary flowcorrelated with the DMFT index, thus indicating thatpatients'reduced salivary flow leads to a greater prevalence of dental caries. Reduced salivary flowcompromises taste and swallowingand increases the risk of fungal and bacterial infections [38].It is important to understand that saliva is a fluid with many functions, such as oral digestion, oral mucosa lubrication, maintenance of the ecological balance in the oral cavity, antimicrobial activity and effective protection of teeth integrity by maintaining pH in the oral cavity [39]. Control of oral infections may be hampered if salivary flow and or its function is altered or reduced, which will decrease its lubricating effect and therefore its capacity to maintain the integrity of oral structures [40].

The association between risk factors shared by various disabling conditions requires interventions by national health programs, which can be effective in improving the oral health status and quality of life of population groups [34]. Oral health issues need to be addressed by the public health system, especially whensocioecnomically disadvantaged population groupsare involved. Given that, it should be noted that the HD patients analyzed in the present study are faced with a double burden - the disease (and all its related problems) and the difficulty to access oral health treatment, which is commonly observed in population groups of low socioeconomic status. A multinational study conducted inFrance, Hungary, Italy, Poland, Portugal, and Spain suggested that the stress deriving from the treatment itself reduces the quality of life and self-care capacity, resulting in worse oral hygiene although the multifactorial nature of oral diseases is also acknowledged [41,42].

In our study, dentalcaries was evaluated by the DMTF index. The findings regardingpresent (decayed teeth) and past (filled and missing teeth) experiences suggest a poor dental status in the study population. This situation may beindirectly influenced by the kidney disease and by socioeconomic and cultural factors, especially with regard to missing teeth, for which the mean was 18.9 ± 11.7 teeth.Similar findingsregardingedentulismhave been reported in another study [43], and the last national oral health survey in Brazil showed adults with a mean of 7.4 missing teeth [44].

Our data support other findings that chronic kidney disease (CKD) may have significant effects on periodontal health. Although there was no correlation between PCI and HD treatment duration as reported in the literature, changes such as increased dental calculus, gingival inflammation, probing depth and attachment loss were also detected[45,46].Given that, treatment and control of periodontal disease should be started in the early stages of CKD due to a bidirectional association of cause and effect, with systemic impact of inflammation/infection and immune response [47, 48].

Although the need for such care is acknowledged, access to dental care in the past year was reported only by 32% of the patients in our study. A similar study of 147 hemodialysis patients in Canada showed that 41% of the participants had undergone dental treatment in the previous year [33]. These findings reinforce the need for greater provision of primary and preventive care by oral health professionals in order to reduce infection and other complications that contribute to increased morbidity and mortality, such as atherosclerotic complications and future transplant rejection [10, 47, 49].

The present study showed oral and salivary changes in patients undergoing HD. Despite the absence of correlation between salivary flow and oral discomfort, salivary flow (before and after HD) was negatively correlated with age and DMFT and positively correlated with salivary pH.Nevertheless, a high percentage of participants reported some type of oral discomfort. Awareness of the oral health of HD patients is an important strategy to alert dentists about preventive measures aiming to minimize problems that might impair general health status.Oral and salivary changes in HD patients suggest a need for special attention tooral health treatment [10].

Despite not being the main objective of our study, our findings demonstrated the need to include the dentist in the multidisciplinary team responsible for patients undergoing HD. The inclusion of the dentist in the multidisciplinary team should be discussed in HD centers around the world, particularly in public facilities and infacilities that serve patients of low socioeconomic status.

The present study has some limitations. The study did notinclude a control group and did not consider that other external factors may influence oral health, salivary flow and pH measures. Although the findings cannot be generalized to all the patients, changes in the oral health status were found in patients undergoing HD. Therefore, further studies should be carried out to strengthen research in this field.

Our findings demonstrated thatHD patients present with dental and periodontal problems. There was a high prevalence of moderate and severe periodontal disease and a high DMFT index, with a predominance of missing teeth. An association between salivary flow and age was observed, showing that not only salivary flow is decreased with age, but alsothat the improvement of salivary flow after HD proportionally decreased with age. Despite an increase in salivary flow after the hemodialysis session,itsvalueswere still below the normal levels. The oral health care professional should provide preventive and restorative treatment to HD patients and should be included in themultiprofessionalhealth team managing the care of HD patients.

V. COMPLIANCE WITH ETHICAL STANDARDS

Conflict of Interest:Paulo Leonardo Ponte Marquesdeclares that he has no conflict of interest. Maria Vieira de Lima Saintraindeclares that she has no conflict of interest. Alexandre Braga Libório declares that he has no conflict of interest. LuciannaLeitePequenodeclares that she has no conflict of interest. Anya Pimentel Gomes Fernandes Vieira-Meyerdeclares that she has no conflict of interest.

Funding: None.

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the Research Ethics Committee of the University of Fortaleza (Approval No. 150.713) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Informed consent was obtained from all individual participants included in the study.

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Variable	Frequency (N=128)	%
Gender		
Women	62	48.4
Men	66	51.6
Marital status		
Single	25	19.5
Married	79	61.7
Divorced	5	3.9
Widowed	19	14.8
Schooling		
Illiterate	19	14.8
Literate	13	10.2
Primaryeducation	51	39.8
Secondaryeducation	32	25.0
Highereducation	13	10.2
Occupation		
Employed	05	3.9
Unemployed	16	12.5
Social Security	43	33.6

Table 1. Socioeconomic characteristics of the study participants.

International Journal of Advanced Engineering Research and Science (IJAERS) <u>https://dx.doi.org/10.22161/ijaers.74.42</u>

[Vol-7, Issue-4, Apr- 2020] ISSN: 2349-6495(P) | 2456-1908(O)

	-	()]
Retired	64	50.0
Income		
No income	16	12.5
1 minimumwage	88	68.8
>1 minimumwage	24	18.8

Table 2. Oral discomfort reported by the participants and its correlation with salivary flow before and after hemodialysis.

Variable	Salivaryflow	before				
	Hemo	odialysis		hemodialysis		
	Low	Normal	pvalue*	Low	Normal	pvalue*
Mouthpain			··· ·	· · · ·		·
Yes	11	0	0.264	10	01	0.070
No	103	14	0.204	77	40	0.079
Toothpain						
Yes	16	04	0.152	12	08	0.200
No	98	10	0.152	75	33	0.280
Drymouth						
Yes	60	06	0.242	46	20	0.404
No	54	08	0.342	41	21	0.404
Difficultytoswallow						
Yes	22	01	0.027	16	07	0.524
No	92	13	0.237	71	34	0.534
Problems with taste of food						
Ves	18	_		13	05	
No	96	1/	0.106	74	36	0.452
Rurningmouthconsotio	90	14		/4	50	
n						
Yes	05	02		04	03	
No	109	12	0.170	83	38	0.399

*Fisher's Exact test.

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https://dx.doi.org/10.22161/ijaers.74.42

[Vol-7, Issue-4, Apr- 2020] ISSN: 2349-6495(P) | 2456-1908(O)

	35-44ye	earsold (n	=31)		45-59 ye	arsold (n=	=34)		60+ yea	arsold (n=	63)		Total (r	n=128)		
	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD
DMFT	0	26	11.26	6.46	10	32	23.47	6.81	7	32	28.52	5.14	0	32	23.00	9.15
Healthyteeth	6	32	20.68	6.43	0	22	8.56	6.81	0	25	3.46	5.13	0	32	8.98	9.12
Decayedteeth	0	24	3.52	4.81	0	16	3.18	4.71	0	11	1.43	2.45	0	24	2.40	3.89
Missingteeth	0	14	4.29	4.16	3	32	18.56	10.01	3	32	26.37	7.49	0	32	18.95	11.72
Filledteeth	0	17	3.45	3.96	0	14	1.74	3.43	0	21	0.75	2.81	0	21	1.66	3.44
pHbefore HD	6	8	7.58	0.56	6	8	7.24	0.78	5	9	6.95	0.97	5	9	7.18	0.87
pHafter HD	6	8	7.06	0.73	6	8	6.82	0.67	4	8	6.70	0.84	4	8	6.82	0.78
pHdifference	-1	2	0.52	0.77	-1	2	0.41	0.99	-1	3	0.25	0.82	-1	3	0.36	0.86
Salivaryflowbefore HD	0.1	1.7	0.51	0.35	0.1	1	0.37	0.25	0.1	1.8	0.35	0.26	0.1	1.8	0.39	0.28
Salivaryflowafter HD	0.3	2	0.77	0.41	0.1	1.3	0.61	0.32	0.1	1.8	0.52	0.29	0.1	2	0.61	0.34
Salivaryflowdifference	-0.2	0.7	0.27	0.21	0	0.5	0.24	0.14	-0.2	0.6	0.17	0.16	-0.2	0.7	0.21	0.17

Table 3: Descriptive DMFT (divided by components) and salivary pHand flowby age group.

Table 4. Analysis of the mean salivary flow and saliva pH before and after the HD session.

Variables	Mean	Standard deviation (SD)	Difference (before and after HD	N (%)BeforeHD	N (%) AfterHD	р
pH beforeHD	7.18	0.87	0.36	-	-	<0.001 ^a
pH afterHD	6.82	0.77		-	-	
Salivary flow before HD (ml/min)	0.39	0.28	0.21	-	-	<0.001 ^a
Salivary flow after HD(ml/min)	0.60	0.34		-	-	
Salivary flow						
≥1ml/min	-	-	-	5(3.9%)	17(13.3%)	<0.001 ^b
0.7-0.9ml/min	-	-	-	10(7.8%)	30(23.4%)	
0.4-0.6ml/min	-	-	-	53(41.4%)	55(43.0%)	
≤0.3ml/min	-	-	-	60(46.9%)	26(20.3%)	

^a Paired t-test^b Chi-Squared test

	Salivaryflow		Salivaryflow	
	beforeHD		afterHD	
Variables	Pearson'scorrelatio n	р	Pearson'scorrelat ion	р
Age	-0.188	0.033	-0.261	0.003
CPI	0.115	0.288	0.043	0.690
DMFT	-0.228	0.010	-0.304	0.001
pH beforeHD	0.182	0.040	0.231	0.009
pH afterHD	0.106	0.234	0.217	0.014
MonthsonHD	0.125	0.159	0.028	0.755

Table 5. Correlation between stimulated salivary flow before and after HD session and the study variables.

Influence of Express® and Vistascan® Image Scanning Systems on the optical density of Endodonic Cements

Gonzalo Martin Souza Rodriguez, Francine Kühl Panzarella, José Luiz Cintra Junqueira, Eduardo Fernandes Marques, Rodrigo Coelho Bezerra de Menezes e Larissa Coelho Bitencourt

Abstract—This study aimed to assess whether there is influence of the Express and VistaScan scanning systems on the optical density of the image of endodontic cements. 36 specimens were used, 6 of each material, and each material was manipulated and inserted into holes in an acrylic plate supported by a glass plate. The radiographic exposure was performed on phosphorus plates together with an aluminum scale of 9 steps with 1 mm each, this being used as the gold standard. After the periapical radiographic acquisitions, the phosphor sensors were scanned by the Express and VistaScan equipment and saved in TIFF. The optical density of each material was measured in shades of gray and in millimeters of aluminum equivalent (mm Al), according to ISO 6876/2001 standards, using the ImageJ software, twice with an interval of 1 week. The optical density of the filling materials was corrected by subtracting the optical density from the glass plate. To compare the average densities according to the different cement brands, the Tukey test was applied for multiple comparisons. All tests were performed at a 5% significance level. There was a strong correlation between optical densities measured at time 1 and time 2, for optical densities measured from the Express scanning system, Pearson's correlation between measurements made at time 1 and 2 was equal to 0.9983 (p < 0.0001) and for measurements made from the VistaScan 0.9998 system (p < 0.0001); in both cases the correlations are very close to 1 indicating an almost perfect correlation. In the Express system there was a variation in optical density between 155 and 185, and in the VistaScan system this density varied between 70 and 160. The VistaScan system showed a higher contrast resolution where, through the Analysis of Variance, a greater difference was observed in the densities of the evaluated cements. It was also evident that the measurement via the Express system was numerically superior to VistaScan. There was interaction between the scanning methods and filling cement, mainly in the measurements in the VistaScan system. It was observed that optical density measured in the i-Express system was numerically always higher than the optical density measured in the VistaScan system, and in the Express system, the AH Plus filling cement was the one that obtained the lowest optical density value and the MTA Fillapex reached density larger optics. In the VistaScan system, Sealer 26 cement had the lowest optical density and AH Plus cement had the highest optical density.

Keywords— endodontic cements; radiopacity; digital images; optical density.

I. INTRODUCTION

The perfect hermetic sealing of the root canal system is the main objective of an endodontic treatment, preventing it from acting as a possible source of infection. To achieve such a seal it is necessary, in addition to excellent techniques, the use of good filling materials that satisfy biological and physicochemical requirements. An ideal filling material should be biocompatible with the pulp and periadjacent tissue; waterproof; bacteriostatic or bactericidal, not dye; insoluble in tissue fluids; adherent to dentin and core materials; soluble in common solvent in order to facilitate its removal and also be radiopaque (Costa et al. 2009).

Radiopacity is an essential physical property that allows visualization of endodontic filling material through radiographic examination, particularly in the detection of obscuration of lateral channels; apical deltas; internal restoration and also to monitor the restoration of cements in cases of apical leakage (Costa et al. 2009). According to Candeiro et al. (2012), the radiopacity of the main and secondary cones and endodontic cement plays an important role in the evaluation of the filling, distinguishing it from the dentin and the alveolar bone, allowing the evaluation of its quality and preservation of the treatment.

Since the use of programs for the analysis of digitized or digital images is able to provide reliable and reproducible results (Tanomaru-Filho et al. 2007; Rasimik et al. 2007), there was a need to compare the optical density different endodontic cements available on the market.

With the emergence of digital image, there was a technological revolution in the acquisition of radiographic images, as well as in the development of computer network systems for image recovery and transmission, eliminating chemical processing, responsible for a large percentage of errors that interfere with image quality, promotes a better visualization of density and contrast depending on the program used and, finally, determines the gray levels from 0 to 255, with intermediate tones where the extremes 0 is black and 255 is white (Attaelmanan, Borg and Grondahl, 2000). In addition, the intraoral sensors used require less radiation than conventional films, reducing the dose absorbed by the patient. One of the disadvantages of digital systems is still the high cost, but the trend over time will be to reduce these costs (White &Pharoah, 2007).

Therefore, it is necessary to know the radiopacity of endodontic cements in digital systems on the market.

II. MATERIALS AND METHODS

2.1 Ethical aspects

This study was submitted and dispensed by the institution's Research Ethics Committee according to the number 2014/0312.

The experimental units were images of 36 specimens made from the insertion of obturator materials in holes 10 mm in diameter and 2 mm deep in an acrylic plate, which were divided into 6 groups according to the brand. shutter material. The measured response variable was the optical density of the filling materials, observed in the images scanned in two indirect digital systems, measured on a gray scale.

As reference values for the optical density of the filling materials, the optical density of the steps of an aluminum scale with 9 steps was obtained, each step being 1 mm thick.

This experimental study followed a completely randomized design, in a 6x2 factorial scheme, and the factors under study were:

• Sealing materials: in 6 experimental levels AH Plus, MTA Fillapex, Endometazone, Sealapex, Pulp Canal Sealer and gutta-percha.

• Image scanning system: Vistascan Mini View and i Express.

Preparation of the Specimens

In the Materials Testing Laboratory, the specimens were made from holes made in an acrylic plate, supported by a 8 mm thick glass plate.

The selected endodontic cements were manipulated following the instructions of each manufacturer for the preparation of the experimental groups and inserted, using the Centrix syringe, in each hole of the acrylic plate under low vibration in order to avoid the formation of bubbles.

A weight of 1 kg was used to overflow and level the surface after handling the cements, removed after setting the materials.

Gutta-percha cones were plasticized with the aid of a lamp at 80°C for 2-3 minutes. These have in their composition: gutta-percha (19% to 20%) in alpha and beta forms; zinc oxide (60% to 75%) provides rigidity and antibacterial activity to the cones; barium sulfate (1.5% to 17%) are radiopacifiers and resins, waxes and dyes (1% to 4%) (Gurgel-Filho et al. 2003).

Subsequently, the specimens were kept in relative humidity at a temperature of 37 $^{\circ}$ C for 48 hours until the final setting of the cements, and kept in the acrylic plate.

Image acquisition and data collection



Fig.1: Image of the specimens on the glass plate and the aluminum scale.

Source: Own authorship.

After the laboratory phase; the specimens were sent to the Radiology Clinic of the same institution and radiographic acquisitions using the Heliodent periapical Xray machine were performed according to the 60 kVp, 10mA and 1.6 seconds regimen.

The specimens supported on the glass plate were radiographed, with the sensors of each system together with the aluminum scale (Figure 1). After the radiographic exposure, the sensors were inserted in the Express and VistaScan Mini View equipment for scanning the images.



Fig.2: Radiographic image of the aluminum scale without the glass plate.

Source: Own authorship.

Using the same radiographic acquisition regime, the aluminum scale was radiographed and scanned using the sensors of both systems (Figure 2).

The images were saved in files in TIFF format in order to maintain their quality and were examined on a 17 "flat-screen LCD monitor, model 5000: 1 (LG, Seoul, Korea), with a resolution of 1280 x 1024 pixels and maximum color quality (12 bits) in a low light environment.

The values of the optical density, in shades of gray, of the endodontic cements, of the gutta-percha and of the aluminum scale using the ImageJ software (National Institutes of Health NIH, Bethesda, USA) (Figures 3 and 4). repeated twice by the researcher himself, the data being recorded in an Excel spreadsheet (Microsoft, USA).



Fig.3: Selection of the region of interest by the ImageJ software.

Source: Own authorship.



Fig.4: Optical density values obtained using the ImageJ software

Source: Own authorship.
Statistical analysis

First, the precision of the measurement process or method was evaluated, comparing the measurements made at time 1 with the measurements made at time 2, using Pearson's correlation. To evaluate whether there is a difference in the average optical density between the different image scanning systems and between the different brands of filling materials, the Analysis of Variance method for repeated measures was applied (since the images obtained by different methods are images of the same specimens). To compare the average densities according to the different filling materials, the Tukey test was applied for multiple comparisons. All tests were performed at a 5% significance level. All analyzes were performed using software R version 3.1.1 (www.rproject.org).

III. RESULTS

The aluminum scale showed different shades of gray for the two digital systems, as shown in table 1. The optical density of the filling materials was corrected by subtracting the optical density observed in an image with only the glass plate of the scanning devices (without the bodies of proof), 27,829 for the Express scanning system, and 17,435 for the VistaScan system.

Table 1 - Reference values of the image of the aluminumscale (in shades of gray) scanned in the Express andVistaScan systems, subtracting the optical density of theglass plate.

AL ScaleDegrees	Express (shadesofgray)	VistaScan (shadesofgray)	
1	6.832	3.517	
2	21.471	13.25	
3	40.426	25.999	
4	56.710	39.559	
5	83.735	50.37	
6	110.937	61.751	
7	140.507	72.439	
8	165.547	83.515	
9	179.327	95.976	

Source: Own authorship.

5.1 Accuracy of measurements

Firstly, the precision of the measurement process or method was evaluated, comparing the measurements made at time 1 with the measurements made at time 2. For the optical densities measured from the Express scanning system, Pearson's correlation between measurements made over time 1 and 2 was 0.9983 (p value <0.0001) and for measurements made from the VistaScan 0.9998 system (pvalue <0.0001); in both cases the correlations are very close to 1 indicating an almost perfect correlation. The absolute difference between the two measurements ranged from 0.020 to 0.817 (mean = 0.334) for the Express system and from 0.001 to 0.799 (mean = 0.353) for the VistaScan system.



Fig.5: Scatter plot for optical density measured at time 1 and time 2, according to the image scanning system. Source: Own authorship.

Figure 5 shows the scatter plots between the optical densities measured at time 1 and time 2 according

to the scanning systems. It is observed in both graphs that the points are arranged practically on the equality line (dashed line) indicating the strong correlation between the two measurements. Additionally, in the graph of the measurements obtained via Express, we have that the optical density varied between 155 and 185. Note the presence of a possible discrepant point, given by an observation with an optical density around 155, while all other measurements were greater than 163 (this is the optical density of a specimen that received Sealer 26, specimen number 2, As for the measurements obtained via the VistaScan system, the optical density varied between 70 and 160, and the presence of three groups of images is observed in the graph: the first with optical density between 70 and 80, the second with optical density between 110 and 120 and the third with optical density between 150 and 160.

As there was a very strong correlation between the measurements made at time 1 and at time 2, for the subsequent analyzes, the mean density between the two measurements was considered as the optical density.

5.2 Comparison of image scanning systems



Filling material

Fig.6: Scatter plot for optical density and filling material.

Source: Own authorship.

Figure 6 shows the graph of dispersion between the measured optical density (and corrected by the optical density of the glass plate) and the filling material used in the specimen. From the graph, the following observations can be made:

The optical density measured via the Express system is, numerically, always higher than the optical density measured via the VistaScan system.

There seems to be an interaction between the scanning system and the filling cement. This is because, the difference in measurements between scanning systems varies with the material used, for example, the difference observed for the images obtained from the specimens that used the AH Plus cement is less than that of the specimens that received the Sealer material 26.

For the Express system there is not much evidence of differences between brands, however there seems to be a difference in optical density between cements for measurements made via VistaScan.

There is a possible discrepant point for the measurements made via VistaScan in the test bodies that received the Sealapex material. The specimen number 3 presented an optical density equal to 74,213, while the other specimens presented an optical density between 109 and 113.

Table 3 shows the mean values and standard deviation for optical density according to the

brand of the filling material and the image scanning system. A high standard deviation is observed in relation to the other groups, for measurements made via VistaScan with the Sealapex brand. This is due, as noted above, by the presence of an image with an optical density much lower than the density of the other images with the same scanning system and the same brand of filling material. When excluded from the analysis of optical density, the respective mean and standard deviation values change to 113.725 and 3.675, and to the difference 60.851 and 3.628.

In addition, it is noted that the average difference between scanning systems varies from 10 to 92, according to the brands of filling material.

Table 3 - Values of mean and standard deviation (sd) for the optical density according to the mark of the filling material andthe scanning system and for the difference.

	Express		VistaSo	can	Diference		
Filling Material	average	dp	average	dp	average	dp	
AH Plus	164,458	0,687	154,062	3,102	10,396	3,363	
Endometazone	179,582	4,656	114,090	3,219	65,493	5,599	
Gutta-percha	169,742	2,596	112,595	2,555	57,147	3,647	
MTA Fillapex	179,744	1,522	108,359	3,328	71,385	4,310	
Sealapex	174,434	1,053	107,140	16,463	67,294	16,113	
Sealer 26	166,676	6,847	74,381	3,036	92,295	6,048	

Source: Own authorship.

To assess whether there is a difference in the average optical density between the different image scanning systems and between the different filling cements, the Analysis of Variance method for repeated measures was applied (since the images obtained by different methods are images of the same bodies evidence). As one of the assumptions of the Analysis of variance is that the variances (or standard deviations) are approximately equal, the image of the specimen that received the Sealapex material was then disregarded from this analysis and obtained via VistaScan, which presented discrepant optical density.

Table 4 shows the result of the Analysis of Variance. There is a statistically significant difference between filling cements and between scanning systems; there is also a statistically significant effect of the interaction between the material's brand and the scanning system.

 Table 4 - Result of the Analysis of Variance for repeated measures to test the effect of the filling material mark and scanning system on the optical density of the images.

variationsource	Degreesoffreedom	F	P value
Brand filling material	5	166	< 0,0001
Scanning system	1	5423	<0,0001
Interaction: brand * system	5	190	<0,0001

Source: Own authorship.

Comparison of filling material brands

The next step is to compare the sealer cements according to the images obtained by each of the two scanning systems separately. For that, two models of analysis of variance of one factor were adjusted, one for each system. The analysis of variance showed, in both cases, a p-value <0.0001, indicating that there is a statistically significant difference in the average optical density of the images obtained from different filling materials.

To compare the average densities according to the different brands of filling material, the Tukey test was applied for multiple comparisons. The results are shown in Tables 5 and 6.

Table 5 shows the comparison between the filling cements for the images obtained via Express. There are, in general, two groups of material brands: 1) AH Plus,

Gutta-percha and Sealer 26; and 2) Endomentazone, MTA Fillapex and Sealapex. The comparison with the LA scale was made as follows, if the value of a respective step on the scale is contained in the 95% confidence interval presented (95% CI) then there is no significant difference, at the 5% level.

			SS		
Filling Material	Average	IC 95	5%	Tukey* Test	Al Scale degrees **
AH Plus	164.458	161.551	167.365	a,b	8
Endometazone	179.582	176.676	182.489	b	9
Gutta-percha	169.742	166.836	172.649	a,c	Between 8 and 9
MTA Fillapex	179.744	176.837	182.651	b	9
Sealapex	174.434	171.528	177.341	b,c	between 8 and 9
Sealer 26	166.676	163.770	169.583	а	between 8 and 9

Table 5 - Results of comparisons of the optical density of images obtained via Express.

Legend: * Different letters indicate a significant difference at the 5% level. ** Comparison of the 95% CI with the respective step values of the Al scale shown in Table 5.

Source: Own authorship.

Table 6 shows the comparison between the filling materials for the images obtained via VistaScan. In general, three groups of material brands are observed: 1) AH Plus; 2) Endomentazone, Gutta-percha, MTA Fillapex and Sealapex; and 3) Sealer 26.

Table 6 - Results of comparisons of the optical density of the images obtained via VistaScan.

	VistaScan						
Filling Material	Average	IC 9	5%	Tukey* Test	Al Scale degrees **		
AH Plus	154.062	151.539	156.585		Higherthan 9		
Endometazone	114.090	111.567	116.613	a	Higherthan 9		
Gutta-percha	112.595	110.072	115.118	a,b	Higherthan9		
MTA Fillapex	108.359	105.836	110.882	b,c	Higherthan9		
Sealapex	113.726	110.962	116.490	a,c	Higherthan 9		
Sealer 26	74.381	71.858	76.904		7		

Legend: * Different letters indicate a significant difference at the 5% level. ** Comparison of the 95% CI with the respective step values of the LA scale presented in Table 5.

Source: Own authorship.

IV. DISCUSSION

New proposed filler cements must have their physico-chemical and biological properties tested. The American National Institute, American Dental Association and the International Organization for Standardization have defined standards and standardized assessment tests, among other parameters, configuration time, flow, film thickness, solubility, radiopacity, dimensional stability and compressive strength of endodontic cements (ANSI / ADA, 2008, ISO 2012). The radiopacity of aluminum is considered a standard reference because its radiopacity has been described as similar to that of dentin, since 1 mm of aluminum is equivalent to 1 mm of dentin (Akcay et al, 2012). The radiopacity of dental materials has been compared to steps on a scale and identified as millimeters

of aluminum equivalent (mm Al).

The results obtained in this research demonstrated that all studied cements had an optical density higher than dentin, which is considered ideal, as recommended by ISSO 6876/2001 and ANSI / ADA, in

agreement with other works found in the literature (Aznar et al., 2010; Carvalho Filho et al., 2008; Bodrumulu et al., 2007).

Several studies, such as Tanomaru-Filho et al. (2007), Resende (2008) Carvalho Júnior et al. (2007) and Viapiana et al., (2014) evaluated the physical-chemical properties of endodontic cements through different digitization systems where AH Plus showed a higher optical density being used as the gold standard for comparisons with other endodontic cements (Garrido et al. 2010).

The optical density values obtained at time 1 and time 2 showed a very strong correlation between the two measurements, as seen in figure 9. This can be attributed to the Image J measurement system, which is simple and reproducible and has been used in numerous studies such as those by Costa et al. (2002) and Aznar et al. (2010). In the measurements obtained via Express, it was observed that the optical density varied between 155 and 185. As for the measurements obtained via the VistaScan system, the optical density varied between 70 and 160, and the presence of three groups of images: the first with optical density between 70 and 80, the second with optical density between 110 and 120 and the third with optical density between 150 and 160.

In the Express system, the AH Plus filling cement had the lowest optical density and the MTA Fillapex reached the highest optical density. In the VistaScan system, Sealer 26 cement had the lowest optical density and AH Plus cement had the highest optical density.

The optical density measured via the Express system was, numerically, always higher than the optical density measured via the VistaScan system. It should be noted that in the present study, the contrast resolution in the Express system was 14 bits while in the VistaScan system it was 16 bits. The spatial resolution in Express was 14.3 Lp / mm whereas in VistaScan it was 24.1 Lp / mm. These data corroborate those obtained by Molander et al. (2004) where they concluded that a greater bit depth improves the image quality.

The difference in contrast resolution in radiographic images, due to the interaction of the characteristics of the linear attenuation coefficient of the tissues being radiographed White &Pharoah (2007) corroborate the results of Duarte et al. 2009; and Brito-Júnior et al. 2012, which consider the differences in radiopacity between the obturators, due to the different atomic composition and interaction with X-rays. An analysis of the formulation of these materials revealed that they have radiopacifying agents.

AH Plus contains zirconium oxide, which contributes to greater radiopacity compared to the other tested fillers (Tanomaru et al. 2004). These studies explain the differences in densities in the evaluated systems where the interaction of radiopacifiers and the different contrast and spatial resolutions justify the differences in the densities of the evaluated cements.For the Express system there was not much evidence of differences between the brands, however there seems to be a difference in the optical density between the cements for the measurements made via VistaScan.

Table 3 shows the mean values and standard deviation for optical density according to the brand of the filling material and the image scanning system. A high standard deviation was observed in relation to the other groups, for measurements made via VistaScan with the Sealapex brand. This is due, as noted above, by the presence of an image with an optical density much lower than the density of the other images with the same scanning system and the same brand of filling material. If we remove this image with discrepant optical density from the analysis, the respective mean and standard deviation values change to 113.725 and 3.675, and to the difference 60.851 and 3.628. In addition, it was noted that the average difference between scanning systems ranged from 10 to 92, according to the brands of filling material.

According to the results of the Analysis of Variance in table 4, there was a statistically significant difference between the sealer cements and between the scanning systems; there was also a statistically significant effect of the interaction between the material's brand and the scanning system. The analysis of variance showed, in both cases, a p-value <0.0001, indicating that there is a statistically significant difference in the average optical density of the images obtained from different filling materials.

Two groups of material brands were observed in Table 5, in the Express system: 1) AH Plus, Gutta-percha and Sealer 26; and 2) Endomentazone, MTA Fillapex and Sealapex. In the Vista Scan system, table 6, three groups of material brands were observed: 1) AH Plus; 2) Endomentazone, Gutta-percha, MTA Fillapex and Sealapex; and 3) Sealer 26.

Endodontic cements are classified according to their composition, zinc oxide eugenol (Endofil), calcium hydroxide (Sealapex), resinous (Sealer 26 and AH Plus) and Silicone (Roeko Seal), as verified in the studies by Tanomaru et al. (2004) and Aznar et al. (2010), where resinous trees presented greater radiopacity, with AH Plus being the only one to present greater radiopacity than gutta percha.

Due to its great radiopacity, easy handling and flow, AH Plus resin cement has been used as the gold standard for comparisons with other endodontic cements (Garrido et al. 2010).

Studies that evaluate the radiopacity of filling cements should be carried out periodically, since manufacturers have been constantly reformulating the composition of their products in order to achieve better properties. In view of the results presented, further research is suggested in relation to the method of evaluating the optical density of obturator materials in endodontics using new technologies for image acquisition as well as a standardization in digital systems in relation to pixel size, contrast resolution and resolution space.

V. CONCLUSION

From the results presented, differences were observed in the optical density of the cements and the influence of scanning systems on the optical density of the studied cements.

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Use of different Grades of Concrete in Shear Wall: A Comprehensive Review

Manoj Patidar¹, Sagar Jamle²

¹ M. Tech. Scholar, Department of Civil Engineering, Oriental University, Indore (M. P.), India ² Assistant Professor, Department of Civil Engineering, Oriental University, Indore (M. P.), India

Abstract— The main focus in present era is to use a dual system in a multistoried structure, since the major focus is to reduce the lateral loads acting on it. The research topic to reduce the lateral load in the current trend has increasing day by day. This trending expansion leads to the result in safe high rise structures. To contribute something in this, the current work shows the survey of the work in shear wall usage in dual structures as per Indian Standards. This study deals with the comparative analysis of the research trend on the current topic and after the survey, comprehensive outcomes are provided in conclusions that forms the objectives of the additional study.

Keywords— Concrete Grade, Dual system, Lateral load capacity, Optimization, Shear Wall.

I. INTRODUCTION

Optimization of the structures has now been the new and latest ways to make the structure efficient. The trend follows all the economic customs to make cost effective structures. Stability of the structures is a tough task and it loose the above economic trend, since it requires heavy sections, it needs some additional stiffness resisting members and also need extra cost to make the same seismic free. Shear wall is the basic need of the modern tall structures. It not only stabilizes the tall structures but also protect the same from seismic disasters; on the other hand, it is a heavy R.C.C. additional component that increases the overall weight of the structure along with its base shear. Overall project cost ultimately increases with the usage of shear wall.

Shear Wall

An additional structural component used to resist lateral force effects on a structure consist of a stiff R. C. C. wall. This R.C.C. vertical wall starts from foundation base to the top of the building. As per Indian Standard, the Shear wall is classified into two types viz. Ordinary RC structural walls and Ductile RC structural walls. The former one doesn't meet the special detailing requirements for ductile behavior as per IS 13920 and the later one meet the special detailing requirements for ductile behavior as per IS 13920.

Types of Shear Wall

There are various types of shear wall each of them has its own importance. The various types of shear wall are as follows:-

- 1. Simple rectangular type shear wall
- 2. Coupled shear wall
- 3. Rigid frame shear wall
- 4. Framed walls with infill frame
- 5. Column supported shear wall
- 6. Core type shear wall



Fig. 1: Structure with Dual Structure Configuration



Fig. 2: Structure with shear Wall at Core



Fig. 3: 3D Sectional View of Structure with Shear Wall at Core

II. REVIEW OF LITERATURE

An Experimental Approach was performed by the researchers by the usage of Polyethylene Glycol in their work as self-curing agent in the concrete that cures itself. Polyethylene Glycol was replaced by cement in 0% to 3.2%. Only 28 days curing have discussed in this approach with total 5 mixes of concrete. M20 and M25 grade concrete have used and mix were abbreviated as Mix-1 to Mix-5. Flexural strength found out best at 2.4% replacement for M25 grade concrete and 1.6% for M20 grade concrete. Similarly, for compressive test results, strength found out best at 2.4% replacement for M25 grade concrete and 1.6% for M20 grade concrete. The main function of Polyethylene Glycol is to increase the selfcuring property, one the other hand,, it will increase the strength too. The recommendations show it can also be replaced within the limit (Prakash Mandiwal et. al.).

The following work suggested the value of silica fume in concrete and has created a great effort in the field of structural engineering. The authors have conducted an experimental approach by replacing the binding particle. The cement itself has the ability to bind the concrete, but the introduction of the silica fume in the replacement of cement has a major part of their study. Cement has replaced by 0% to 25% with silica fume to increase its strength. The experimental tests have performed on 7, 14 and 28 days of each percent replacement by casting a cube. Results shows maximum compressive strength has achieved on 15 percent cement replacement (Prabhulal Chouhan et. al.).

The experimental approach was done on M25 grade concrete with replacing glass powder along with fly ash. These two materials selected such that the same had been a waste material from different manufacturing industries and are free of cost. Cement, on the other hand, a costly binding material used in concrete, A partial replacement have done by using both the glass powder and fly ash. They are abbreviated for glass powder as GP and for fly ash as FA. Compressive and flexural strength have performed on the same with total seven mixes on 7, 14 and 28 days of curing. Results shown that by using 75% cement with 25% Fly ash, both flexural properties and compressive properties of concrete have increased. By replacing glass powder with fine aggregate, there was a decrease in strength. The Mix 2 performs well among all mixes (Sachin Sironiya et. al.).

Following work has accomplished with the use of Self Curing property of Concrete by the usage of PEG-400. This chemical was used in the form of liquid or in powder form. The main approach in their study was, they replaced the cement amount and substitute it with the Poly Ethylene Glycol – 400 chemical. Total 6 batch mix have prepared by them and after than they performed durability test and split tensile test. They recommended that optimum tensile strength was achieved by the use of PEG-400 and was found out for M25 to be 2.4 % for M20 1.6%. From the experimental result analysis, they also found out that without the usage of PEG-400, for M25 grade, about 12.24% loss in compressive strength was observed and for M20 grade, about 11.35% loss in compressive strength was observed. For acid venerability, concrete with PEG chemical was observed more durable (Prakash Mandiwal et. al.).

Again the works on silica fume has done by the authors and have suggested the importance of flexural and split tensile strength of the concrete. The replacement of concrete had done for M25 grade concrete by replacement of cement from 0 %, 5%, 7.5%, 12.5%, 15%, 20% and 25%. The water cement ratio is maintained at 0.42 units. For flexural test, beam of size 10cm x 10cm x 50cm have casted by different percent replaced mix abbreviated as M1 to M7. Results show that 15% replacement will be the optimum ratio for flexural test. Again for split tensile test, cylinders of size 15cm in diameter x 30cm have casted by different percent replaced mix abbreviated as M1 to M7. Result shows that 20% replacement will be the optimum ratio for split tensile test (Prabhulal Chouhan et. al.).

III. CONCLUSIONS AND OUTLINE OF PROPOSED WORK

The conduction of the literature survey has done by reviewing and learning data objectives of various research papers it has now cleared that there should be a proper analysis before going further in any topic to find out the current research done. The current trend has also been obtained in dual configuration structures. Therefore it is necessary to increase the stiffness at particular locations in the building to make an optimized one to resist the same from lateral loading.

The conclusive outcomes drawn from the study are enlisted below:

- 1. Dual structural configurations should be necessary to overcome the lateral effects in the form of displacements.
- 2. Soil type should also be checked as per Indian Standardization IS 1893-2016 (part 1).
- 3. Seismic zonal analysis should be check to analyze the data for different seismic zones.

- 4. The study is conducted for both the directions viz. lateral and longitudinal direction.
- 5. Different parameters of analysis should be checked and validate as per Indian Standards along within the limits.

The main focus is to check the dual system with different grades of concrete that has going to be a major study for upcoming proposed work.

ACKNOWLEDGEMENTS

I, Manoj Patidar, M. Tech. Scholar, would like to thank *Mr. Sagar Jamle*, Assistant Professor, Department of Civil Engineering Oriental University Indore, for his valuable guidance from the commencement of the work up to the completion of the work along with his encouraging thoughts.

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The influence of heat treatments in the shear force during the machining of the SAE 4320 Steel

Brayner Cardoso dos Santos, Thalita Francisco Possão Dantas, Carlos Augusto Cardoso Lima, Gabriella Pinto Valentim, Fernanda Couto Silva

Federal Institute of Goiás, School of Engineering, Goiânia, GO, Brazil

Abstract— The steel have a wide range of applications in the industry, being of extremely importance in any manufacture process. The SAE 4320 steel is used in a lot of ways, some of them are the transmission systems like gears and pinions. The heat treatments are used to improve some properties of the steel like, hardness, ductility and impact resistance. There are many different types of heat treatment. In this article it was made the tempering process in water and oil, and the quenched process was done in the samples. The purpose of this activity is to do the heat treatments, that were mentioned before, in the SAE 4320 steel, and then analyze with tests the mechanical property variation in the shear force during the machining, with the objective of verifying if there is any correlation between these parameters and if the shear force is also influenced by this modification of the microstructure. Some parameters, like the time that the sample was in the austenitization temperature and the machining parameterswere fixed. After the heating treatments some analysis of the microstructures and hardeningwere made.

Keywords— SAE 4320 Steel; Heat Treatment; Hardness; Shear Force.

I. INTRODUCTION

The study of thermal and thermochemical treatments, as well as mechanical analysis after certain treatments are of great relevance to optimize the machinability of a given material. The SAE 4320 steel, which is widely used in the manufacture of pins, gears and elements requiring high surface hardness, is still of few use in the range of products available on the market. This report has the objective to broaden the knowledge already acquired in relation to steel, contributing to its applicability. Using different thermal treatments it was evaluated how these processes influence the machining of a part made of SAE 4320 steel, allowing the choice of the ideal processes according to the application of the material.

The concepts and knowledge developed in the machining of hardened steel are applied to obtain desired surfaces and production in the shortest time possible, eliminating future operations, mainly rectification [1]. The choice of the appropriate tool and application of the cutting parameters can contribute not only to obtaining the specified surfaces but also to the execution of the operations with lower costs [2]. Machining is of

fundamental importance to other manufacturing processes, being the most widely used in the industry, turning into chips about 10% of all metal production, employing tens of millions of people worldwide [3]. It also accounts for more than 15% of the total value of processed products, whether mechanical or not.

By comparing the machining forces (Fu) of thermally treated samples, it is expected to determine which variables should be used in order to optimize the manufacturing process of parts made of 4320 steel. It is also expected that the work will contribute to the determination of the heat treatment variables of the steel under study, in order to offer results that will show which type of treatment is most suitable for obtaining certain mechanical characteristics such as hardness.

Among the main objectives to be taken into account, one highlight is the heat treatment of 4320 steel, as well as the metallographic analysis that evaluates how such treatments can change the machinability of the material. In this way, to see if the results obtained were satisfactory for the applicability of SAE 4320 steel in the variety of materials available in the market of mechanical and structural elements.

Among the range of materials available in the market, the SAE 4320 is still a poorly exploited material for mechanical analysis when compared to other materials such as SAE 1020, 1045 and 4340 steel. Although it is a low carbon steel (0.2 %), the material presents good temperament because it contains molybdenum (Mo) in its composition.

SAE 4320 steel has high surface hardness and is mainly used in parts such as pins, crowns and gears [4].Thus, processes such as thermal and thermochemical treatment are operations that aim to further optimize the properties of this material, being able to contribute with the metalworking industry, in addition to providing amplification in the application of this material. Chandler *et al.* [4] concluded that SAE 4320 steel has high surface hardness and is mainly used in parts such as pins, crowns and gears. Thus, processes such as thermal and thermochemical treatment are operations that aim to further optimize the properties of this material, being able to contribute with the metalworking industry, in addition to providing amplification in the application of this material.

Materials from the same family, such as the SAE 4340 alloy, have a considerably larger range of information, where SAE 4320 is somewhat underresearched. Therefore, the activity developed had as foundation to also contribute to the literature and assist those who seek a material of high hardness, good temperability and low percentage of carbon. Among the mechanical analyzes it is noticed that the machining is very important to generate the final cost of a part. Thus the research contributes to the optimization of this process in the studied material, since the forces involved in the machining of this steel will be analyzed, having or not being submitted to different types of thermal treatments.

II. MATERIALS AND METHODS

This work had as main goal the accomplishment of thermal treatments in the steel SAE 4320 and to verify its changes, and what those changes can interfere in the process of machining and in its shear forces. Samples of the steel under study were submitted to various types of thermal treatments, from which they provided alterations in the microstructures of the pieces, where these were analyzed with the Metallographic Test. In order to verify the influence of the treatments on the machinability of the material, shear tests were performed. Then the collected data were analyzed and treated in order to generate primordial graphs for the discussion of the results.

In each type of treatment, three (3) samples were used, in order to improve the collected data. Prior to the repeatable tests, pre-tests were performed. The pre-tests contributed with the training and experience of the researchers, which reduces possible failures in the studies ahead, besides leaving the machines and tools already prepared and adjusted for the later actions of this research.

2.1 Sample Preparation

To obtain the samples to be worked, it was necessary to segment the pieces. Thus, a steel bar with a diameter of 1 inch (25.4mm) was used, and with the use of the Horizontal Band Saw of the brand "FRANHO" and model "FM-900", the parts were produced with approximately 30mm of length (for the machining force test).

Before the start of the experimental procedures, the characteristics of the parts were determined according to Table 1, where each sample was destined for the machining test. Respecting that, 3 pieces of each sample were used.

Sample 1	Tempering in water
Sample 2	Tempering in oil
Sample 3	Quenched from the tempering in water
Sample 4	Quenched from the tempering in oil
Sample 5	No Treatment

Table 1. Sample Description.

All steps to be described are set forth in Figure 1 which represents the procedures in which the 30 mm long samples were submitted for the determination of the machining force.



Fig. 1. Complete chart with the activities for the machining force analysis.

2.2 HeatingTreatments

2.2.1 Tempering

Chandler *et al.*[4] concluded that the austenitizing temperature of SAE 4320 steel is 850 ° C. Thus, the pieces were taken to the Oven (EDGCOM 3P) until they reached the described temperature at a rate rising level of $15 \degree C$ per minute. Before being withdrawn, the samples were left in the oven at their austenitization temperature (850 ° C) for 30 minutes [4]. Cooling is an essential part of tempering, of which the type and speed plays a key role in its outcome. So for this study, water and oil were used for this stage.

2.2.2 Quenching



Fig. 2. EDGCOM 3P (MC-2) Oven

Quenching is done shortly after tempering, and consists of reheating the part at a temperature below that of the material's austenitizing temperature. Thus, some of the "tempered" specimens 25 were returned to the oven (Figure 2), warming them to the quenching temperature (150°C), and the samples were held at that temperature for 30 minutes before being cooled in Water. [4]

2.3 MetalographicPreparation

To get a properly regular and flat piece prepared for metallographic analysis, sanding is very important. After the use of the saw and successive heat treatments, the samples were taken to the sander (ORATEC APL-4D), and with the use of 80, 180, 240, 320, 600 and 1200 sander with water, the pieces were prepared for polishing. To observe the phases present in steel, the sample is polished until "mirrored", followed by the use of an appropriate chemical reagent. One of the most commonly used chemical reagents for carbon steels is nital, which consists of a mixture of 0.5 to 6% nitric acid in ethyl alcohol. [5]

After the sanding, the specimens were taken to PolitrizMetalgraphic Sander (PL 02 ET), where they were prepared to receive the chemical attack and later analysis under the microscope. The pieces were polished using Alumina 0.5 μ m (aluminum oxide). Before the metallographic test, the chemical attack was carried out, in order to provide the visualization of the grain contour and the phases of the microstructures. The agent used was Nital 4% (solution of nitric acid in ethyl alcohol 96° GE), and the polished pieces looked "opaque" after the attack and were cleaned and taken for analysis of the microstructure. All samples, except for the samples for the traction test, went through the metallographic preparation stage, since their microstructures need to be studied, even the "Sample 5", which are the pieces that did not receive any type of thermal treatment, but are essential to make comparisons and define what each treatment has changed in the steel structure.

2.4 Metallographic Analysis

In order to verify the microstructural changes, the samples, including those not treated thermally, were submitted to metallographic analysis. In this step the Optical Microscope (Olympus BX51M) connected to a computer was used, where the parts were positioned and focused on magnifying glasses for visualization. Samples for the machining strength test, whether or not heat treated, sanded and polished, were subjected to chemical attack with nital.

The softwares"analySIS ®" and "PixelLINK Capture ®" were of main importance. The samples 1, 2, 3, 4 and 5 were analyzed microscopically in three (3) regions with two (2) lenses (500x and 1000x magnification), to obtain more coherent results and better visualization.

2.5 Hardeness Test

After verification of how the heat treatments modified the microstructure of the material, the samples were submitted to the Vickers microhardness test, to also highlight how the same treatments influenced this mechanical property. According to Budynas (2011), [6] the hardness property of a material (in the Vickers microhardness test) is related to the penetration resistance of a sharp tool.

The method used consists of a square base diamond penetrator with an angle of 136° between the opposing faces. Thus, the impression when visualized with an optical microscope is in the form of a rectangular diagonal "L" diamond. The test has relation to the applied area and the area of the faces printed on the material. It is a suitable process for tempering and carburizing. The voltage unit of this test can be used as HV, Kgf / mm² or N / mm² and is calculated according to Equation 1. [7]

$$HV = \frac{1.8544*P}{L^2}$$
[1]

The microdriometer "HM 102" was adjusted to apply a load of 1kgf, using a Pyramid Indentador with diamond tip. Five (5) measurements were made, always from the center to the end of the pieces, so that the first one is in the center (reference point), and the other ones distancing 2, 4, 8 and 10mm respectively, according to the representation of Figure 3.



Fig.3. Measurements points of microhardness Vickers (dimensions in mm)

2.4 Shear force

In order to know the influence that the described heat treatments have under the machining force of the SAE 4320 steel, it is important to do tests that evaluate the shear forces associated to the machining of the samples. Through the top milling, and using the CNC Milling Machine (Petrus 50100R), shown in Figure 4, and an 80 mm milling cutter with seven (7) carbide inserts (490R-140408M-PM 4240), the shear forces of each test were analysed.



Fig.4. CNC Milling PETRUS 50100R – DIPLOMAT.

The samples were fixed in a bench vise attached to the Kistler Dynamometer (model 9265B), which by means of the deformation of their "sensors" quantifies the force exerted by the cutting tool on the "x", "y" and "z" axes. The data then acquired at a speed of 2000 dots per second, and in text file format, were stored and analyzed. Each test was performed separately in each of the samples (and their replicates) with machining parameters (depth, feed and rotation) set according to Table 2, so that the final

results are better compared.

Cuttingdepth[ap]	Rotation[n]	Feed[f]	Cuttingspeed[Vc]	Mill diameter[df]
1(mm)	300 (RPM)	75 (mm/min)	75,4 (m/min)	80 (mm)

Table 2. Parameters used in the machining of the samples during the shear force test.

A low cutting depth and feed were used in order to minimize tool wear, and for greater depths it could not be affirmed that the tool would be in contact with the altered microstructure material (the treatments are more effective on the surface of the piece).

Top milling was done on the samples in a way that they were centered relative to the cutter and positioned

with a wooden block (so that all samples are machined in the same position) according to the illustration in Figure 5. Cutting fluid was not used, and tool wear was not considered to generate the final resultsof machining force calculations.



Fig.5. Representation of the way that the machining of the samples were made during the shear force test.

III. DISCUSSION AND RESULTS

3.1 Hardness Test

In order to obtain a better visualization of the data, Table 3 was created, it shows, in a summarized form, the average of all the samples treated. The average of each position of the samples was calculated, allowing the construction of the graph of Figure 6, which shows how the hardness of the piece at each point varied. The activity in question was made with three (3) samples for each treatment.

Table 3–Average of the values of	of microhardness Vicker.	s (HV) of the replicates in	relation with the	position it was measured.

MEASUREMENTS AVERAGE IN EACH ONE OF THE POSITIONS										
Distance [mm]	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5					
Center	464.3	389.7	400.3	305.7	251					
2	453.7	324.3	424.7	295.3	236					
4	480.0	362.0	436.3	323.7	264					
8	443.0	353.0	445.3	341	225					
10	453.3	315.0	455.0	320.7	243					
Total Average	458.9	348.8	432.3	317.3	253.8					

According to the Table above, it is verified that Sample 1 (tempered and cooled in water) obtained a greater hardness in comparison to the other samples, thus confirming the formation of martensite, adifusional phase of high hardness. In agreement, the Sample 3 that was also cooled in water, but with the process of quenching, was placed second in terms hardness, evidencing that the cooling in water, because it is faster, facilitates the formation of martensite. The quenching process alleviates martensite tensions, which may reduce its hardness a little (due to the precipitation of iron carbides).

On the other hand, samples 2 and 4, due to having undergone oil cooling, obtained lower hardness. Agreeing to what has been said previously, that hardness is related to cooling speed.



Fig. 6. Hardness Average Graph (Total Average and Standart Deviation) between the replicates of each kind of sample.

The graph of Figure 6 indicates that even with the standard deviation made in Table 3, it can be seen that the water-tempered piece (Sample 1) had the highest hardness average, especially in relation to the untreated piece (Sample 5), thus proving the proportional relationship between hardness and tempering/quenching.

3.2 Machining Force

With the dynamometer properly fitted and adjusted to the CNC milling machine, the top milling of SAE 4320 Steel was machined in a single pass (Figure 7), in which each sample was subjected to the same machining parameters (Table 2), in order to obtain greater comparability between them. The dynamometer collected 2000 data per second and these data were computed with the aid of the software "Scilab ®". Therefore, fifteen (15) test bodies were machined, and the graphs referring to the shear forces (of each process) were plotted with the aid of the "Scilab ®" Software.

The Figures 7, 8, 9, 10 and 11 show how the shear force behaved on the three (3) axes during the tests, and the RMS value of the forces is shown in the graphs by the line perpendicular to the vertical axis.



Fig. 7. Graph referring to the machining force tests of Sample 1 and its replicates.



Fig. 8. - Graph referring to the machining force tests of Sample 2 and its replicates.



Fig 9. -Graph referring to the machining force tests of Sample 3 and its replicates.



Fig.10.Graph referring to the machining force tests of Sample 4 and its replicates.



Fig 11.Graph referring to the machining force tests of Sample 5 and its replicates.

Using the software "Excel \circledast ", the force data on the "x", "y" and "z" axes of each test sample were collected, and it was possible to calculate the resulting force "Fu" for each case. It is necessary to emphasize that the machined area did not remain constant during milling, as shown in Figure 5, which explains the behavior of the plotted graphs, where with the tool advance to the center of the part, the shear force increases, and from then on it decreases to the other end of the piece, precisely because of the change in the depth of cut provided by the way that the samples were positioned. Tables 4, 5 and 6 show all values (RMS) obtained in all tests, as well as the average of the replicates, and the machining force.

Shear		Tempe	ered (1)		Quenched (3)			
Force[N]	R1	R2	R3	Average	R1	R2	R3	Average
Fx	239.99	237.78	232.41	236.73	212.41	217.82	175.58	201.94
Fy	223.09	225.68	228.37	225.72	214.01	208.29	186.89	203.06
Fz	237.77	229.42	233.95	233.05	224.77	213.45	196.42	211.55
Fu	403.68	400.14	401.12	401.65	376.08	369.31	323.01	356.13

Table 4- RMS Values obtained in the machining force test and its replicates, samples treated with water.

Tabl	le 5 - RMS V	alues c	btained	in the	machining	force	test ar	ıd its	replicates,	san	nples treated with o	il.
		-							0		1 (1)	

Shear		Tempe	ered (2)		Quenched (4)			
Force[N]	R1	R2	R3	Average	R1	R2	R3	Average
Fx	167.15	144.64	140.79	150.86	141.76	114.75	148.66	135.06
Fy	198.65	189.09	173.56	187.10	186.75	155.42	177.45	173.21

Fz	157.16	146.95	138.83	147.65	141.22	115.11	141.94	132.76
Fu	303.48	279.77	263.09	282.12	273.71	224.89	271.54	256.71

Table 6 - RMS Values obtained in the machining force test and its replicates, samples without treatement.

Shear Force [N]	WithoutTreatament (5)					
	R1	R2	R3	Average		
Fx	94.61	91.98	92.51	93.03		
Fy	167.22	159.88	169.24	165.45		
Fz	89.66	86.58	99.73	91.99		
Fu	212.02	203.76	217.13	210.97		

It should be noted that the force for the removal of material was higher in the pieces that were treated in water (Samples 1 and 3), thus also confirming that the increase in hardness influences the shear force. According to that, the sample that did not undergo any heat treatment, which presented less hardness due to the absence of the martensite structure, was the one that the milling occurred with greater ease. Then, it is seen that the "Fu" of the tempered samples increases noticeably, with Sample 1 having the highest of all the pieces, with a 90% increase when comparing with Sample 5. Sample 4, that had a lower "Fu" (between heat treated samples), an increase of 21.7% was obtained when compared with a sample without treatment. Analyzing Tables 4, 5 and 6 with table 3 it is verified that the results are coherent, since the machining force increased as the hardness increased between the samples.

For a more satisfactory and simple analysis, a graph was created from the tables presented, which shows the average of the machining force of the samples according to Figure 12, which also provides a direct comparison between the values obtained in each of the tests.



Fig.12. Average graph of the machining forces of each sample.

IV. CONCLUSION

With the results obtained, a great correspondence of the data was verified. At first, processes such as heat treatment and hardness testing proved the existence of martensite and thus the increase in hardness of the samples, whose best case (Sample 1) obtained a 109% increase in relation to the untreated piece (Sample 5).

Subsequently, the machining (milling) delimited that with the increase of the hardness harder is the removal of material, in which Sample 1 had an increase in machining force of 90% and the Sample 4 (lower hardness) an increase of 21, 7%.

Therefore, it should be noted that the activity in question contributed in some way to the metal/mechanical industry, where the range of SAE 4320 steel information is still scarce. Thus, temperability is a variable which can further improve the properties of a material, especially the alloy in question, specifically contributing to parts requiring high surface hardness, such as gear, crowns and pins.

ACKNOWLEDGEMENTS

I would like to thank stomy parents and my friends by financial support to this project.

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Feasibility of Coagulation-Flocculation Followed by Mango Seed Filtration for Treatment of Swine Industry Effluent

Elias Gabriel Fernandes de Rezende¹, Matheus Neves de Araújo², Gleydson Wellington de Sousa Monção³, Lázaro Sebastião Roberto⁴, Geoffroy Roger Pointer Malpass⁵, Mônica Hitomi Okura⁵

¹Graduation in Chemical Engineering, Universidade Federal do Triângulo Mineiro, Av. Dr. Randolfo Borges Júnior, 1200, 38064-200 Uberaba.

²Graduation in Environmental Engineering, Universidade Federal do Triângulo Mineiro, Av. Dr. Randolfo Borges Júnior, 1200, 38064-200 Uberaba.

³Environmental Engineer. Empresa Fertagro Fertilizantes

⁴Bioidéias's Businessman

⁵Programa de Mestrado Profissional em Inovação Tecnológica da Universidade Federal do Triângulo Mineiro, Av. Dr. Randolfo Borges Júnior, 1200, 38064-200 Uberaba.

Abstract— The effluent generated by pig farming has a high potential to cause pollution. However, correct disposal of pig farming effluent is not normal, due to the high cost of implementation and maintenance of conventional treatment systems. In this context, the present work sought to conduct a study of the feasibility of a two-step treatment: coagulation/flocculation system with subsequent filtration. In the coagulation/flocculation process, a polymer was used as a coagulant and the filtration process was carried out comparing two filters, one containing conventional sand and activated carbon and the other containing sand and activated carbon produced from mango seed. To analyse the viability of the treatment, pH, acidity, turbidity, total organic carbon, standard plate pathogen count and thermotolerant coliforms analyses were performed. The process proved to be efficient in removing the analysed parameters with emphasis on the removal of approximately 100% of the microbial load. An analysis of variance to compare the performance of activated carbon produced with conventional showed that the filters showed significant differences in all tests and, in most of the analyses performed, the activated carbon filter produced from mango seed presented a better performance. than conventional activated carbon.

Keywords— *coagulation-floculation; biopolymeraze; swine effluent.*

I. INTRODUCTION

According to the Brazilian Association of Pig Breeders (Associação Brasileira de Criadores Suínos), in 2015, Brazil had 1,720,255 heads, having produced 39,263,964 pigs for slaughter in 2015 (ASSOCIAÇÃO BRASILEIRA DE CRIADORES SUÍNOS, 2015). In 2018, Brazilian pig farming faced challenges related to the increase in grain prices combined with instability in exports and high production maintenance costs, which has led producers to work in an unfavourable financial situation (ASSOCIAÇÃO BRASILEIRA DE CRIADORES SUÍNOS, 2018).

Pig farming is considered a major cause of environmental pollution. Swine manure is made up of faeces, urine and

water from the sanitation of the stalls, in addition to dust, hair, among other materials (KONZEN et al., 1997). In Brazil, the collection and treatment of sewage does not cover the rural area, leaving the producer responsible for the correct disposal of wastewater and solid waste from production management. However, due to the high investment costs required for the installation of treatment plants and the need for maintenance of treatment systems, the correct disposal (without proper treatment) causes soil contamination and increases the levels of metals such as sodium, zinc and copper, as well as high levels of pathogens and nitrate that can cause groundwater pollution and consequently cause reach the general population (MS, 2004).

Given the impacts caused by this activity and also the need to seek new sources of income for producers, the treatment and reuse of wastewater from the pig farming chain becomes a desirable option. Currently the techniques commonly used for the treatment of swine manure consist of physical, chemical and biological processes. New techniques to reduce the amount of waste generated and increase treatment efficiency are being studied and are in the research and development phase, such as the use of microalgae that increase the efficiency of biogas generation (Dias et al., 2016).

Coagulation is a process used in water and wastewater treatment that consists in destabilizing colloidal and suspended particles by the addition of a coagulant and has as characteristic the short time required for its realization (LIBANIO, 2010). In this process it is expected to remove suspended and dissolved organic matter, turbidity, toxic substances of organic and inorganic origin, substances that confer odour and microorganisms in general. It occurs in the quick mix unit and is of utmost importance to the performance of the rest of the treatment process. In the case of low coagulation efficiency, particles that are not removed will not be retained in the granular media of subsequent processes, e.g. direct filtration (BERNARDO; DANTAS, 2005). Thus, the choice of coagulant becomes an important factor and should be made in view of the type of effluent to be treated, the technology of treatment and the cost involved in purchasing the coagulant (BERNARDO et al., 2002). Currently, the coagulants most employed in treatment units are: aluminium sulphate, ferric chloride and ferric sulphate (KAWAMURA, 2000)

Aluminium sulphate is the most widely used coagulant in Brazil due to its low cost, high efficiency and the fact that it is produced in all regions of the country. However, the use of this coagulant generates two relevant problems regarding the maintenance of human health and the environment: (1) neurological diseases caused in humans associated with the presence of aluminium in the water and (2) the sludge generated by the treatment becomes impracticable for reuse (CARVALHO, 2008). Thus, natural coagulants present themselves as an alternative as, in addition to not containing potentially toxic substances, the generated sludge is biodegradable and/or can be reused.

Since the late 1950s in the USA, with the aim of reducing the use of chemical coagulants and optimizing the coagulation process, natural or synthetic polymers have been employed as coagulation aids in water treatment processes (LIBANIO, 2010). The use of natural or synthetic polymers has been efficient in wastewater treatment, for example in the treatment of tannery effluent (Gomes et al., 2016). Natural and synthetic polymers can be classified as anionic (negatively ionized sites), cationic (positively ionized sites), or ampholytic (with negatively and positively ionized sites) (BERNARDO; DANTAS, 2005). However, studies investigating the use of polymers in the treatment of swine effluents are scarce (STEINMETZ et al. 2009), which justifies an investigation in this context, as it may represent an environmentally friendly, simple to use and low-cost alternative.

II. MATERIAL AND METHODS

2.1. ACTIVATED CARBON PRODUCTION

Mango seeds from the species Palmer, were purchased in the city of Uberaba – MG. The activated carbon production was performed employing the following steps (TELES; FURTADO, 2016): (1) washing and removal of pulp from the seed, (2) drying in the sun for 6 h, (3) drying in oven at 50°C for 6 h, (4) chemical activation with 10 g / L NaOH for 24 h, (5) oven drying at 50°C for 6 h, (6) carbonization in a mufla oven at 400°C for 1 h. After cooling the carbon was washed several times in running water to remove excess activating agent and dried for 6 h at 50°C.

2.2. FILTER CONSTRUCTION

For the construction of the filter, 500 ml PET bottles of water were collected. As the filter material, 200g of sand was mixed with 40g of activated carbon (standard or from mango seeds). The amount of sand was kept constant for standardization of the tests. For the complete construction of the filter, a small amount of cotton was placed at the exit point, so that no particle drag occurred. To support this configuration, a screen made of cloth with openings large enough so that it did not interfere with filtration was tied to its output point. The filters using standard carbon or from mango seeds were constructed in triplicate.

2.3. EFFLUENT SAMPLING

The effluent was supplied by the companys Fertagro and Bioideias, from a swine farm localized in the City of Uberaba, Minas Gerais State, Brazil. The effluent received only one pre-treatment before being collected - with grating to remove coarse solids. A sample of the effluent is illustrated by Figure 1. In all, 6 L of raw effluent were used.



Fig.1: Visual characteristic of the swine effluent sample used in the experiments.

2.4. BENCH TEST

The polymer used is known as Biopolimeraze (The new product developed by the company) and was supplied by the company Fertagro and diluted with water at a ratio of 1:10. In order to investigate which polymer concentration would be used in the coagulation step, initial bench tests were performed using 20 mL of raw effluent. Manufacturer data recommends a concentration of 20 mL / L of polymer for domestic sewage treatment. As the domestic effluent presents lower organic matter, turbidity and microbiological loads than the pig effluent, the concentrations chosen for the bench tests were higher than recommended (ARAÚJO et al., 2012; AISSE et al., 2000). After the polymer was added to the raw effluent, the mixture was stirred for 10 s and then decanted for 30 min. Ratios (mL of polymer to raw effluent) of 30, 40, 50, 60, 70, 100, 125, 150 mL were tested.

2.5. JAR-TEST

For the jar-test assays (Milan, JT303M - 3 jars), 2 L of raw effluent were added to each jar and placed under agitation (100 rpm) for homogenization of the mixture. Subsequently, the fast mix was simulated by simultaneous addition of the coagulant to the 3 jars, mixing for 10 s and then resting for 30 min so that all the solid was decanted in the jar. The supernatant material was subsequently removed.

2.6. FILTRATION

The supernatant from the coagulation was divided into two 500 ml conical flasks for each jar and then filtered under gravity through the previously constructed filters.

2.7. PHYSICOCHEMICAL ANALYSIS

In order to investigate the behaviour and the removal

efficiency of the treatment, physical and chemical analyses of the effluent and filtrates were performed. The following analyses were performed in triplicate:

- Total Organic Carbon (TOC), Inorganic Carbon (IC) and Total Carbon (TC) analyses were using a total organic carbon analyser (SHIMADZU). These parameters refer to dissolved fractions of carbonic species smaller than 0.45 µm.
- pH measurement was performed using a digital pHmeter (LAB 1000 model mPA210).
- Turbidity Turbidity was measured using turbidimeter (LAB 1000) calibrated with standard solutions.
- Acidity by titration was performed with 0.01 N NaOH and 1% phenolphthalein as indicator. The degree of acidity was obtained as mg CaCO3 / L.

2.8. PHYSICOCHEMICAL ANALYSIS OF THE SLUDGE

The sludge generated in the treatment was dried in an oven and in order to investigate its potential use as an organomineral fertilizer. Total nitrogen, phosphorus, potassium and total organic carbon analyses were performed. The analyses were performed by the laboratory LABFERT, located in the city of Uberaba - MG.

2.9. MICROBIOLOGICAL ANALYSIS

Microbial analysis was performed in order to investigate the initial microbiological charge and subsequent removal of the from the raw and filtrate effluent.

2.10. EXPERIMENTAL DESIGN

The data obtained in the physicochemical analyses of the raw and filtered effluent passed the normality tests, as verified by the Kolgorov-Smirnov test with Lilliefors correction. The ANOVA should be performed to verify and compare the performance of the activated carbon filter produced from the mango kernel with the conventional activated carbon filter. For the null hypothesis rejected, the data passed the Tukey test to verify the significance of the factors.

All tests were performed with a 95% confidence level with the aid of Excel[®]. To prevent undesirable and unknown factors from interfering with the response of the studied effects, the analyses were performed in triplicate.

III. RESULTS AND DISCUSSION

For the production of activated carbon, preliminary tests were carried out in order to investigate the behaviour of the material when using a Mufla furnace. The mango seeds were heated at 400°C for 3 h, as performed by Teles and Furtado (2016). After 3 h the material was removed, and it was found that it had been completely converted into ashes. This result was not expected. Both Teles and Furtado (2016) and Kwaghger and Adejoh (2012) suggest that an adjustment in the amount of material used and a shorter time in the carbonization stage would be more favourable for activated carbon production. Thus, for the subsequent tests, ~120 g (six to eight seeds) of material were used, divided into two crucibles for a carbonization time of 1 h. The result of the production of activated carbon from the mango seed is shown in Figure 2. In total, approximately 150 g of activated carbon were produced. Figure 3 represents an enlarged image of the activated carbon produced and it is possible to observe that the result was satisfactory as the material is visually porous.



Fig.2: Image of activated carbon from mango seed.



Fig.3: Enlarged images of activated carbon produced from (a) mango seed and (b) conventional activated carbon. Magnification: 40 x.

The results of the bench tests are illustrated in Figure 4. It can be seen that in the higher concentrations of the polymer the supernatant became visibly clearer. As a result, the concentrations chosen in the subsequent tests were 100, 125 and 150 mL / L, which represent respectively, 10, 12.5 and 15 g of the polymer.

Subsequently, coagulation tests were performed under agitation of 100 rpm for 10 s for (rapid mixing step) and a decantation time of 30 min, as performed in the bench tests. It was possible to observe a clear difference, compared to small-scale tests, which is possibly due to errors at the time of polymer dosage. In the preliminary investigation, only 20 mL of effluent was used, so the amount of polymer added was small and the dosage was performed by means of automatic micropipettes. For the jar test 2 L were used. Thus, a large amount of polymer was used, and its dosage was performed using 500 mL beakers. When added to the jars, it was observed that a small amount of material adhered to the beaker surface, causing losses and decreasing the added concentration. Another factor that may have influenced the efficiency of the test is the speed of rotation of the rapid mixing step. After consulting the polymer manufacturer, it was found that the speed of rotation is an important factor for the efficiency of the process. In this sense, a deeper investigation regarding the rotation speed for jar tests is necessary.



Fig.4: Bench tests of polymer with ratios (mL of polymer to raw effluent) of: a) 30 mL/L; *c)* 50 mL/L; *e)* 70 mL/L; *g)* 125 mL/L; *b)* 40 mL/L; *d)* 60 mL/L; *f)* 100 mL/L; *h)* 150 mL/L.

Following the jar-test, the supernatant liquids were collected and transferred to flasks and subjected to filtration. The decanted solid was collected and dried in an oven. Once dry, the solid is an odourless, fine powder that can be studied for application as a fertilizer. The results of the physicalchemical and microbiological analyses of the raw effluent (RE) and the filtrates, identified as M for the activated carbon filter of the mango seed and C for the conventional activated carbon filter are given in Table 1. Test 1 represents the concentration of 100 mL/L, Test 2, 125 mL/L and Test 3, 150 mL/L.

 Table 1: Results of physico-chemical and microbiological analyzes of the effluent and filtrates with mango seed active carbon and traditional active carbon.

	Filter	рН	Turbidity [NTU]	Acidity [mg CaCO ₃ /L]	CE [mS/cm]	CI [mg/L]	TOC [mg/L]	CT [mg/L]	MPC	Termotolerant coliform (NMP)
RW	-	8,19 ± 0,04	1128 ± 29,71	441,66 ± 2,35	$8{,}28\pm0{,}05$	$633,85 \pm 3,85$	$204,85 \pm 6,95$	$838,70 \pm 10,80$	1.040.000	>23
Tost 1	1 M	$12,23 \pm 0,03$	$8,06\pm0,19$	-	$3{,}94\pm0{,}14$	127,10 ± 0,40	102,20 ± 2,60	229,30 ± 3,00	160	<1,1
Test I	1 C	12,23 ± 0,01	$13,63 \pm 3,16$	-	$4,\!14\pm0,\!11$	129,65 ± 2,52	148,60 ± 35,90	278,25 ± 35,15	900	<1,1
Test 2	2 M	$12,29 \pm 0,03$	$3{,}00\pm0{,}38$	-	$6{,}24\pm0{,}03$	96,93 ± 1,13	97,66 ± 3,43	$194,60 \pm 2,30$	150	<1,1
Test 2	2 C	$12,32 \pm 0,01$	$2,\!80\pm0,\!30$	-	$6{,}13\pm0{,}18$	$93,7\pm0,8$	$108,88 \pm 1,22$	$202,60 \pm 0,42$	160	<1,1
Test 3	3 M	$12,30 \pm 0,01$	$3{,}63\pm0{,}37$	-	$6{,}21\pm0{,}30$	$116,85 \pm 1,05$	$100,95 \pm 3,65$	217,80 ± 2,60	140	<1,1
	3 C	$12,31 \pm 0,02$	$5{,}50\pm0{,}43$	-	$5{,}13\pm0{,}24$	$147,85 \pm 0,55$	114,15 ± 2,15	$262,00 \pm 1,60$	90	<1,1

From the data it can be seen that the raw effluent (RW) presents high levels of turbidity, acidity, pathogens and thermotolerant coliforms. The carbon load represents the dissolved fractions of <0.45 μ m and it is observed that the predominant carbon species are inorganic (IC), and the Total Organic Carbon (TOC), represents 24.42% of the total carbon (TC).

According to Bernardo and Dantas (2005), acidity can be understood as the capacity for base neutralization. According to Libânio (2010), for pH values between 4.5 and 8.2 the acidity in solutions comes from carbon dioxide. In Table 1, the raw effluent (RW) has an average acidity of 441.6 mg / L of CaCO₃. However, for the filtrates, at the time the indicator was added, the solution turned pink instantly with zero acidity. Figure 5 shows the efficiency in removal of inorganic carbon (IC). According to Pavanelli (2001), inorganic carbonic species from carbon dioxide in solution are based on the carbonic acid balance system as a function of pH. The total removal of acidity is related to the

high removal of inorganic carbon in the treatment. Test 2 with filter C, obtained greater efficiency reaching 85.22% of removal, however in Test 3, filter M (put the value) obtained a better performance compared to filter C.



Fig.5: Result of the efficiency of removal of inorganic carbon in the three tests (%) performed: Test 1 (100 mL/L of polymer); Test 2 (125 mL/L of polymer) and Test 3 (150 mL/L of polymer).

Figure 6 shows the results of total organic carbon (TOC) removal. It is possible to observe that in Test 1 the mango seed filter (M) presented the best performance (50.1 %) whilst the filter with commercial activated carbon (C) achieved 27.31%. In the other tests the M filter maintained the best performance, however in Tests 2 and 3 the filter C obtained a higher efficiency than in Test 1. When comparing the efficiency of IC removal with TOC, it is possible to observe a better performance in IC removal. According to Matilainen, Vieno and Tuhkanen (2006), who studied the performance of activated carbon filters in the removal of organic matter, filters of this nature generally perform better in the removal of small and low molecular weight organic molecules. One of the factors that can influence greater efficiency in TOC removal would be the spraying of activated carbon, which would increase the surface of contact with the fluid, which may influence the physical and chemical interactions of the filtration process.



Fig.6: Result of the efficiency of TOC removal in the three tests (%) performed: Test 1 (100 mL/L of polymer); Test 2 (125 mL/L of polymer) and Test 3 (150 mL/L of polymer)

Figure 7 presents the total carbon (TC) removal efficiency. In general, carbon removal was greater for filter M than filter C, with Test 2 in filter M having the highest performance, reaching 76.8% removal and in Test 1, filter C had the worst performance (66.82%).



Fig.7: Result of total carbon removal efficiency in the three tests (%) performed: Test 1 100 mL/L, Test 2 125 mL/L and Test 3 150 mL/L of polymer.

Figure 8 shows the turbidity removal efficiency for the tests. The treatment proved to be very efficient in removing turbidity. In just two treatment stages, removal levels above 99% were achieved. Test 2 and proved to be the most efficient in removing turbidity, reaching 99.75% and 99.73%. for filter C and filter M, respectively. In Test 1, filter C presented the lowest performance at 98.79%. According to Libânio (2010), turbidity consists predominantly of suspended and colloidal particles, and corresponds to particulate organic and inorganic matter, microorganisms, clay fragments, etc. Thus, it can be said that the treatment performed proved to be efficient both in the removal of dissolved inorganic and particulate matter.



Fig.8: Result of total turbidity removal efficiency in the three tests (%) performed: test 1 100 mL/L, test 2 125 mL /L and test 3 150 mL/L of polymer.

Table 1 presents the results of the microbiological analyzes of the raw effluent and the filtrates. After the analysis of the raw effluent, as expected, a standard microorganism plate count (MPC) value of 106 microorganisms was found. A thermotolerant coliform count, which corresponds to the most probable number (MPN), of 23 was observed. In analysis of the filtrates, it was found that the treatment proved to be efficient in disinfecting the effluent, and Test 3 with filter C had the better performance in removing MPC, 99.99%, showing an efficiency of eliminating approximately 100% of the microbial load. When analyzing the results of the filters, we can see that in all tests the results were close to 100% efficiency. In all tests, the removal of thermotolerant coliforms was 100%, thus raising the hypothesis that the polymer used in the coagulation / flocculation step had removed the microbiological load from the effluent. Therefore, a new test, as for the bench tests, was carried out in order to investigate the action of the polymer and it was found that, in fact, it was responsible for the microbiological removal.

From Table 1, it can be seen that the pH values of the filtrates were between 12.23 and 12,32 (basic). A basic pH can influence the inactivation of microorganisms during treatment (FRANCO; LANDGRAF, 2008). The solid material formed by the decantation of the flakes, was taken to the oven for drying, and the result was a fine, odorless powder that is easy to dry and handle, different to sludge generated by conventional wastewater treatment. Table 2 shows the results of the physio-chemical analyzes performed on the generated solid material. It can be observed that the material has an index of 3% of TOC, which is expected due to the nature of the effluent and the coagulant used, for nitrogen, phosphorus and potassium, the indexes found were 1%, 0.8% and 0.12%, respectively,

which reforces the potential for use as an organomineral fertilizer, probably combined with another fertilizer.

Table 2 – Result of the physico-chemical analysis of the
sludge produced.

Parameter	Result (g / 100g)
Total Nitrogen	1.0
Total Phosphourous	0.8
Potassium	0.12
Total Organic Carbon	3.0

In order to analyze whether there are differences in the performance of the M and C filters, double-factor ANOVA with repetition was performed, with $\alpha = 0.05$. For data validation, a normality test was performed, in which all the collected data fell within normality, with a 95% significance level. The ANOVA results are presented in Table 3, and the statistical tests were performed for the turbidity data, TC, IC and TOC. Analyzing the p value for the samples, that is, comparing the filters C and M, and for the columns, comparing Tests 1, 2 and 3 it can be said that there are significant differences in the mean of the values, since the p value is less than α for the data. Thus, the Tukey test was performed (Table 4) to verify at which levels there was a significant difference. For the turbidity and TOC analysis, only Test 1 showed a significant difference between the filters, since the mean difference module is greater than the calculated minimum significant difference (MSD). Analyzing the results for TC it can observed that in Tests 1 and 3 the filters displayed significant differences for the values found. For IC, only test 3 showed a significant difference between the filters.

Table 3 – p-values for ANOVA using a double repeat factor.

Análise	Fonte de variação	Valor - p
Turbidity	Sample	1,12x10 ⁻²
Turbianty	Columns	8,81x10 ⁻⁶
CT	Sample	3,06x10 ⁻⁵
CI	Columns	1,43x10 ⁻⁵
CI	Sample	8,48x10- ⁵
CI	Columns	2,51x10 ⁻⁷
СОТ	Sample	3,5x10 ⁻³
COI	Columns	8,35x10 ⁻³

Table 4 – Tukey test values

Analysis	SMD	Test	Average difference (modulus)
		1	0.497
Turbidity	0.263	2	0.017
		3	0.166
		1	5.843
TC	1.370	2	0.955
		3	5.269
		1	0.399
IC	0.648	2	0.512
		3	4.891
		1	22.789
TOC	8.400	2	1.546
		3	6.426

Observing the physical-chemical and microbiological results of the treatment process applied, it can be said that it presents itself as viable for the treatment of swine effluents. This is true being that a treatment system has several stages, requiring periodic maintenance and high costs (ARAÚJO et al., 2012). On the contrary, the treatment performed consisted of two simple and low-cost steps, achieving satisfactory results for different factors. During the experiments it was possible to observe that the coagulationflocculation stage had a greater influence on treatment. It is believed that this is due to two factors: 1) because the polymer used has positive and negative ionizable sites, the neutralization of colloidal, suspended and dissolved particles present in the effluent is favored; 2) due to the fact that according to Bernardo and Dantas (2005), descending filters with fast action have depth action, where the particles are retained along the filter medium, thus a higher filter could indicate a greater efficiency in the treatment. In this sense, the polymer presents itself as a potential primary coagulant for the treatment of different effluents, since polymers are usually used and studied as auxiliaries in the coagulation process (RODRIGUES FILHO et al., 2013; LIMA, 2007).

As observed by Teles and Furtado (2016), the activated charcoal produced from the mango seed can be used in water treatment. However, for the treatment of swine effluent, it did not obtain satisfactory results. In view of this, a broader investigation regarding the type of filter and filter medium to be used in this treatment is necessary.

IV. CONCLUSION

The present work aimed to evaluate the viability of a swine effluent treatment system, which consisted of coagulation with the use of a polymer as a coagulant, followed by filtration in two filters, in order to compare the performance of activated carbon produced from mango seed with conventional activated carbon, found on the market. The M filter had better performance than the C filter, except in two tests, in that sense the activated carbon from the mango seed proved to be more efficient than the conventional activated carbon.

The treatment process in general proved to be viable, however the performance of the coagulation step was below expectations when compared to the results of the bench tests, although the polymer was shown as an alternative to the use of chemical coagulants, once that in just one step, is able to remove odor, particulate and dissolved material, inactivate microorganisms, in addition to producing a byproduct that can be reused. Thus, an investigation into the effect of the rotation speed and concentration of the polymer used is necessary.

ACKNOWLEDGMENTS

The authors thank FAPEMIG, CNPQ and CAPES.

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Evaluation of a Non-intrusive packet delivery monitoring service on Networks-on-Chip

Gabriel Ganzer¹, Marcelo Daniel Berejuck²

¹Computer Engineering Department, Politecnico di Torino, Piedmont, Italy ²Computer Engineering Department, Federal University of Santa Catarina, Ararangua, Brazil

Abstract— We present the design and evaluation of a non-intrusive packet delivery monitoring service on a Network-on-Chip (NoC) that focus real-time systems. Recent works show that using adaptive routing or optimization techniques are solutions to improve its latency. These strategies usually need to know the traffic behavior previously to make changes. A monitoring service is indicated as a solution to this issue, but since silicon consumption is a restriction in these projects, most of them use routers or other NoC's resources to performer such task. Our design is based on a strategy that does not interfere with the NoC operation to collect and to evaluate traffic information.

Keywords—System-on-chip, Network-on-Chip, Computational Observability.

I. INTRODUCTION

The Embedded Systems field has used Systems-on-Chip (SoC) with multiple heterogeneous processing units also named cores as means to ensure performance and temporal guarantees to real-time systems. It has become consolidated that a Network-on-Chip (NoC) [1] should perform the communication between those processing units. Generally, those systems are designed to handle flows from different types of tasks at the same time, not only the ones of realtime origin, and a NoC must allow guarantees on bandwidth and latency for each flow.

An approach to achieve Quality-of-Service (QoS) is the use of circuit switching, whose resources are not shared until the end of packet transmission; thereby, real-time guarantees are easily achieved. HERMES [2], QnoC [3], SoCBUS [4][5], SoCIN [6][7], and Xpipes [8][9] are examples of NoCs based on that technique. Time Division Multiplexing (TDM) is another method of circuit switching employed at Æhereal [10][11]. In this technique, the time domain is divided into several recurrent time slots of fixed length, one for each channel. TDM implements virtual circuit switching, which may imply better resource utilization. A third technique is to estimate the network traffic and scale the project by its greater restriction. That is the case of RTSNoC, this paper object of study, a network that aims real-time systems and provides a predictable worst-case latency (WCL) at design time, in which there is no resources reservation.

Critical constraints occur sporadically in SoC communication, which consequently could result in resource depletion in NoCs that use the worst-case latency prediction technique. Thus, non-critical flows also called best-effort (BE) have no QoS guarantees, which results in an average improvement of their latency. Some recent works have proposed the use of adaptive techniques in NoCs as an alternative to providing such level of performance for both real-time and best-effort flows. Such techniques rely on a database that contains information about the current network traffic state provided by a monitoring mechanism.

We noticed that NoCs' researches that explore some monitoring system adopt, most of the times, intrusive approaches or router's resources that result in a performance decrease or a non-relevant improvement. This approach can be seen in [12], an online monitoring and adaptive routing for aging mitigation in NoCs that uses its routers for data evaluation, which proved to be an issue in their service that could be improved. In [13] is presented a NoC that implements a pseudo adaptive XY routing. Their service uses routers for both traffic data collection and evaluation, which by their conclusion increased the latency at some points since routers were busy with those tasks instead of performing the routing ones indeed.

In this context, this paper introduces a non-intrusive packet delivery monitoring service for real-time NoCs. The proposed service would be located in a separate layer, above routing. In contrast with those works presented before, this approach does not use NoC's resources or routers for such task, and it has its specialized components for traffic data collection and evaluation. Silicon consumption may be the reason for previous papers do not explore this kind of approach, since most NoCs have routers able to do a maximum of five interconnections, which is not the RTSNoC's case whose one single router can deal with five up to eight interconnections resulting in a low silicon consumption rate. Thus, a monitoring service could provide information for an adaptive routing or any other optimization technique.

The remainder of this paper has the following organization: in Section II introduces the network concept describing the internal structure of the communications channels and router architecture proposed to build the NoC. Section III introduces the non-intrusive monitoring service

itself discussing its architecture and internal components. Section IV presents the experimental results obtained by simulating communication patterns of standard interconnection networks in an RTSNoC combined with the monitoring service environment, and Section V finalizes the paper with our conclusion.

II. RTSNoC ARCHITECTURE

The RTSNoC network is a latency predictive network for use in real-time systems [1]. Its focus is embedded systems in which there are more real-time applications than best-effort. This NoC is based on the flit-interleaving technique to guarantee throughput and quality-of-service, where every competing flow has their packets interleaved flit-by-flit.



Fig.1: RTSNoC topology: (a) router with eight ports; and (b) example of a network with four routers and twenty-four processing cores.

Routers in the RTSNoC are conceived to be connected in a 2-D orthogonal topology. Each router can be configured at design-time to have different communication channels quantities, from five up to eight as shown in Fig. 1-a. The communication channels are named with cardinal points and can be connected either to one core or to another router. Fig. 2-b depicts a network with four routers and twenty-four processing elements connected in it. Each router interconnection point provides two unidirectional channels, one for input and one for output. Both channels transport packets and synchronization signals.



Fig.2: RTSNoC's packet format. The size of X/Y fields depends on the network size.

From the point of view of its routers, the network's packet is an arbitrary-length sequence of payload flits preceded by a header flit and followed by a tail flit. To perform the interleaving technique, RTSNoC demands extra bits on its flits, as depicted in Fig. 2. When flows compete to be routed, an internal arbiter gives priority to flits coming from farther routers. Buffers are located only at the output interface, an approach that aims to minimize the router's silicon consumption due to interleaving technique. RTSNoC ensures all flits that compose a package are delivered in the same order that they are injected into the network.

During initialization, every channel receives a different level of priority. The highest priorities are assigned to NN, SS, EE, and WW channels since they could be used in routers interconnection. In addition, these channels may send more than one flit to each grant signal. The number of flits that a channel can send to each grant depends on the number of requests occurred at the same time on previous routers in that path. Any flit has its routing request answered if it has the highest priority or if there are no other requests to the arbiter. When the request is answered, the channel receives a lower priority level and can only send other flits if there is no other one waiting to be routed.



Fig.3: RTSNoC's network interface internal structure.

RTSNoC has its own Network Interface (NI) to be used between a core and router when those operate in different clock domains, as shown in Fig. 3. The NI is composed of four main components: an input FIFO, an output FIFO, a core adapter, and a router adapter. The designer at designtime establishes the size of the queues performed by FIFOs, and the network throughput is a direct function of this parameter.

The RTSNoC's project was firstly conceived only in VHDL. In order to facilitate the exploration of the project by decreasing the compilation time but still maintaining the cycle-level accuracy as well as to ensure the possibility of synthesis already provided by VHDL the RTSNoC's router and NI were modeled in SystemC, a standard language for performance evaluation that is able to provide those characteristics to the project .

III. NON-INTRUSIVE MONITORING SYSTEM

The main purpose of this work was to introduce into the RTSNoC's project a system able to observe the network traffic behavior and verify the packet delivery at run-time, without reducing the performance. This following section would discuss the design of two components used in a non-intrusive monitoring system: sniffer (S) and network manager (NM).

III.1 Sniffer

The SoC's core can be classified into three categories: emitters, receptors, and hybrids, i.e., can both send and receive data. When dealing with a service that will monitor the packet delivery in a NoC is intuitive to say that its target will be a receptor or hybrid core. The placement of a Sniffer into the RTSNoC is explicit in Fig. 4. This device captures the signals of the input channel of the core and output of the
NI, an approach that aims to guarantee accuracy in the measurement of parameters.



Fig.4: Placement of a sniffer in a standard NoC.

A sniffer consists of five components: extractor, demultiplexer, flit-counters, timers, registers, and a multiplexer, shown in Fig. 5. When the core sends a new request to the NI, the extractor also receives this signal and starts to "listen" the data channel and reads from flits passing by it their origin address and also their control bit. If it recognizes as a control flit, the extractor will also check whether this is a header or tail flit on the data field. Else, S will skip this check. Internally, the origin address becomes the selection signal of a demultiplexer and one of the register inputs. Each flow needs to be handled separately, i.e.; the sniffer must take into account that flits with different origin addresses can be interleaved even if the core has not received its tail. Therefore, the total outputs of the demultiplexer and consequently inputs into the multiplexer, as well as the number of required timers and registers are directly proportional to the total of valid origin addresses. The upper bound of valid addresses is given by the size in bits of its field shown as n in Fig. 2. Cores that are exclusively emitters are considered not valid addresses.



Fig.5: Internal components of a sniffer.

The values read in the request signal, in the flit control bit, and in the byte stuffing field combined forms the extractor basis to infer what signal would be assigned to the demultiplexer inputs. This signal characterizes the operation to be performed by the flit-counter, timer, and register that belongs to a particular flow. Table 1 lists the states of each of these components by the input op: **0b00** is assigned when the request signal is deactivated, regardless of what is read from the data field; **0b01** is assigned when the request signal is active and the control bit is off; **0b10** is assigned when the request signal is active, the control bit is on and the byte stuffing filed characterizes a header; finally, **0b11** is the value assigned to op when the request signal is active, the control bit is on and the byte stuffing filed characterizes a tail.

Table	1:	Sniffer's	internal	comp	onents	states.
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Ор	Flit-counter	Timer	Register
0b00	Idle	Increment	Idle
0b01	Increment	Increment	Idle
0b10	Reset	Reset	Idle
0b11	Register	Register	Save

III.2 Network Manager

The current monitoring systems use the NoC's resources to transport and evaluate the information obtained. This paper aims a solution that would exempt this task from routers by inserting those components responsible for the monitoring service in a layer above routing. The Sniffer, presented in the previous subsection, is responsible for observing the NoC's traffic behavior and by feeding a second component called Network Manager, with that collected information.

An NM communicates with sniffers via dedicated buses with an on-demand protocol. This approach is intended to exclude from routers' communication channels the task of transporting this information, which may infer on routing behavior. The communication topology between sniffer and manager can be either centralized when all sniffers communicate with a single NM or decentralized, where every router have their own manager. Fig. 6 illustrates a version of RTSNoC that implements a centralize topology.

It is important to highlight that in the particular case of the centralized topology that uses a single communication bus, the system complexity increases proportionally to the network's size, i.e., this topology is indicated only for small networks with few cores. In the decentralized topology, each manager is responsible for the sniffers of a single router. Both topologies can also be combined according to the application's needs and form several other topologies that will not be discussed in this paper.



Fig.6: Internal components of a network manager.

The internal components of an NM are depicted in Fig. 7 composed basically of four different structures: comparators, demultiplexers, a log generator and a multiplexer. In that figure, the main demultiplexer is connected directly to the NM's communication bus acting as a switch to separate the data coming from each sniffer. This demultiplexer is only necessary when the communication topology is not decentralized. The second level of demultiplexers causes the sniffer data to be switched

according to their source address. Again, the insertion or not of these demultiplexers, as well as the quantity of outputs is parameterizable according to the application needs. The data passes through a comparator before being forwarded to the log generator, to avoid repeating information in homogeneous flows. Finally, the log generator is responsible for receiving the data and storing it. This latter component can be either on-chip or off-chip.



Fig.7: Centralized topology.

IV. EXPERIMENTAL RESULTS

This section describes the monitoring service evaluation under traffic patterns established by [15]. The RTSNoC version used in these experiments is the same as demonstrated in Fig. 6. That version is composed of four routers connected in orthogonal mesh able to perform up to eight interconnections with centralized monitoring topology and all twenty-four hybrid cores, i.e., they can send and to receive data. Other parameters were specified in Tab. 2.

Parameter	Specification
Clock frequency	1 GHz
Network size	2x2
Core numbers	24
Payload size	32 bits
Routing algorithm	Static XY
Arbitration	Flit-interleaving
FIFO's depth	32 positions
Counters resolution	11 bits
Timers resolution	17 bits

The following subsections describe general aspects about the traffic generators used to simulate real-time applications, and the experiments themselves, performed in two phases: the first one with a constant injection rate model and the second one with variable injection rate.

IV.1 Traffic generation

The experiments were performed with the aid of a traffic generator. This component can send packets with fixed or variable size and with an interval between packets also fixed or variable. The generation rate can be constant or ruled by probability functions such as Normal, Exponential or Pareto on/off. The communication pattern can also be characterized by specifying the spatial distribution of traffic generators into those with a single destination node and those with multiple destinations throughout the simulation.

Communication patterns with a single destination are based in parallel numerical algorithms such as bit reversal,

perfect shuffle, butterfly, matrix transpose, and complement. In these patterns, the destination node for the messages generated by a given node is always the same. However, only at the complement pattern, every node would have a destination that is not itself, thereby, since the experiments aim to evaluate a packet-delivery monitoring service the other patterns are not considered.

There are three spatial patterns with multiple destinations: uniform, non-uniform, and local. In the uniform pattern, all nodes have the same probability of being a destination, and the number of packets sent is the same to everyone. In the non-uniform pattern, the probability of a node sending packets to another node decreases with the distance between them and neighboring nodes exchange one maximum number of packets. Finally, in the local pattern, all nearby nodes are equally likely to be a destination, and they send the same number of packets. However, non-adjacent ones have zero probability. All of these patterns are used in the experiments.

In NoCs the parameter that defines a packet length is the number of flits that form these packages. In [3] the QNoC traffic is classified into four groups based on the average number of flits of the packets, as shown in Tab. 3. Thus, the same classification was implemented on the RTSNoC's traffic generators.

Flow	Average packet length [flits]
Signaling	2
Real-Time	20
RD/WR	4
Block transfer	2000

Table 3: QNOC flow's classification.

IV.2 Constant model

The first evaluation scenario aims to identify the RTSNoC's behavior under those spatial distributions. The log file generated by the NM is depicted in Fig. 8 and follows the CSV pattern to facilitate data handling. The first column of that file refers to the packet identifier, followed by its flow origin and destination addresses. The third column refers to the number of payloads flits in that packet, followed by the delivery-time in nanoseconds, its type, and its arrival-time also in nanoseconds.

1st Envi	ronment:	Compl	ement				
packet,	ori_addr	-> ds	st_addr ,	n_flit ,	<pre>delivery_time ,</pre>	type,	arrival_time
0,	9	->	21,	2,	84 ns,	signaling,	163 ns
0,	5	->	26,	2,	84 ns,	signaling,	167 ns
0.	21	->	9,	2,	84 ns,	signaling,	178 ns
0,	20	->	11,	2,	84 ns,	signaling,	179 ns
0.	24	->	7.	4,	168 ns,	rd-wr,	224 ns
0,	8	->	23,	4,	168 ns,	rd-wr,	236 ns
0.	4	->	27,	4,	168 ns,	rd-wr.	240 ns
0.	31	->	1.	4,	168 ns,	rd-wr,	267 ns
0.	29	->	3,	4,	168 ns,	rd-wr,	268 ns
0.	23	->	8.	4.	168 ns.	rd-wr.	273 ns
0.	25	->	6,	40.	1064 ns,	real-time,	1135 ns
0.	з	->	29,	40.	1246 ns,	real-time,	1321 ns
ø,	15	->	17,	40,	1232 ns,	real-time,	1335 ns
0.	14	->	18,	40.	1232 ns,	real-time,	1336 ns
0.	7	->	24,	40.	1232 ns,	real-time,	1341 ns
0.	27	->	4,	2000,	28798 ns,	block-transfer,	28877 ns
0.	26	->	5.	2000.	28798 ns.	block-transfer,	28878 ns
0.	11	->	20.	2000.	29274 ns.	block-transfer,	29346 ns
ø.	6	->	25.	2000.	29267 ns.	block-transfer,	29350 ns
0.	1	->	31.	2000.	29288 ns.	block-transfer.	29354 ns
0.	13	->	19.	2000.	29274 ns.	block-transfer.	29369 ns
0.	17	->	15.	2000.	42175 ns.	block-transfer.	42230 ns
0.	19	>	13.	2000.	42175 ns.	block-transfer.	42252 ns
ø,	18	->	14,	2000,	42175 ns,	block-transfer,	42253 ns
Simulati	on time:	42253	l ns				

Fig.8: Log file generated by NM.

In Fig. 9-a is shown how many cycles are used by RTSNoC to switch a single flit from one router channel to another before embedding the monitoring service. In contrast, Fig. 9-b presents the waves observed after that

service being included. The router used the same amount of cycles to do the same operation mentioned before, which proves that our service does not increase the NoC latency whatsoever.



Fig.9: Waves observed on a single router before and after embedding the monitoring service.

It should be noted that the NM records the information in the log file in arrival order. As expected, due to the flits interleaving technique, smaller packets coming from critical flows were delivered earlier and in a shorter time than the other ones. In addition to the information generated by sniffers, the distribution pattern evaluated and the total simulation-time are printed in this file.

The RTSNoC has latency predictability, which is calculated by its WCL equation. Therefore, before the tests, the theoretical values were obtained for each one of the flow types. A packet can go through up to three routers, i.e., three hops. Equation (1) describes the amount of cycles a header flit needs to traverse, for example, routers $0 \rightarrow 1 \rightarrow 3$. In this equation, N represents the number of streams competing for the same resources, equal to eight in a worst-case scenario.

$$L_{header}(i) = \sum_{j=1}^{h} 2N_j = (2x8) + (2x8) + (2x8) = 48$$
(1)

Equation (2) describes the number of cycles that payload flits of a block-transfer packet need to cross the same path

in a worst-case scenario. The number of packets competing for the same router resources is given by k in that equation.

$$L_{payload}(i) = 2k(f-1) = 2x8(2002-1) = 32016$$
 (2)

In ideal conditions where destination cores read those flits waiting at the NI immediately after their arrival being signalized without overfilling memory buffers, B in (3) is null. Otherwise, it has been found during experiments that B depends on the number of flits f, the FIFO's depth p and K, which refers to the clock cycles required for writing into the interface and for a core to read the next flit.

$$B = 2k(f - p) = 2x8x(2000 - 32) = 31488$$
 (3)

Finally, (4) describes the total WCL for a block-transfer flow. The same thought was used to calculate the theoretical value of other flows. These values refer only to the NoC used in this experiment and might vary according to the topology used, traffic generators and different configurations. The theoretical value for the Best-Case Latency (BCL) is obtained when two farther cores communicate without having any competition.

$$WCL_{packet}(i) = \sum_{j=1}^{h} 2N_j + 2k(f-1) + 2B$$
 (4)

The Injection Rate (IR) used in the experiments is shown in (5). This rate relates the number of flits injected by the traffic generators according to their type, i.e., a rate equal to 100% means that all twenty-four cores are block-transfer generators, the flow that demands the most NoC resources.

 $IR = [(2000x_1 + 40x_2 + 4x_3 + 2x_4)/(24x2000)]x100$ (5)

The average delivery-time obtained with the experiments is illustrated in Fig. 10. The first thing to be observed in this graph is its linearity, an expected behavior of a NoC that uses the flits interleaving technique, unlike others that tend to present exponential curves when injection rate is higher than 80%.



Fig. 10: Delivery-time obtained for each spatial distribution.

These results could be compared with Fig. 11 presented by [7], which relates the average latency obtained with SoCIN [6] using the same patterns. This graph shows its curves starting to be exponential at even lower rates. However, the traffic meters used on SoCIN were not embedded in its network design and their architecture was not specified. Other related work discussed in Section I did not detail their project specifications, such as clock frequency, interfacing, or evaluated their NoCs under the same traffic patterns which makes it difficult to compare their results with those obtained by our monitoring service.



Fig.11: Average latency registered on SoCIN [7].

The spatial distribution that presented the best results was Local since in this pattern there is no communication between adjacent routers. The Complement distribution presented performance close to the WCL theoretical curve. It is important to notice that the Non-Uniform distribution has greater locality than Uniform, i.e., cores make more exchanges with its neighbors than with those cores connected into farther routers. It explains why the pattern of Non-Uniform distribution had better results than the uniform. The linear programming branch focus on solving either maximizing or minimizing problems restrained by an objective function that satisfies a certain number of constraints. Graphically, the region delimited by WCL and BCL thresholds is called feasible and due to its linearity optimization methods could be applied to the results to approximate them into an optimum value. Re-configurable computing could also be used in conjunction with linear programming to operate the cores redistribution.



Fig.12: Simulation-time obtained for each spatial distribution.

The constant model of traffic generation allows the total simulation-time measurement, as shown in Fig. 12. Note that curves of all patterns converge to a constant value from a given injection rate. Unlike Best-Effort NoCs where results are exponential with increasing injection rate, it is expected that a NoC with flits interleaving attempts to soften the latency and converge the results into a constant value, as proven by the simulation-time graph. Also as expected, the Local distribution demanded shorter simulation-time and converged at lower rates than the others.

IV.3 ON-OFF model

The second evaluation scenario aims to evaluate if the same properties verified in the constant model of traffic generation are observable in more dynamic environments. The ON-OFF Model was chosen as a representation of real multimedia systems by varying packets' length throughout the simulation. Packets were randomly generated as shown in Fig. 13, by varying t_{packet} and t_{slack} which respectively refer to its length and to the interval between two packets.



Fig.13: Random packet generation.

The graph illustrated in Fig. 14 relates the packets' length generated and the average delivery-time obtained with the Complement distribution. Its results show that in fact, the RTSNoC latency is linear and proportional to the packet length since the average delivery-time curve of those packets reaches peaks similar to the histogram of their length.



Fig.14: Results obtained with variable packets in the Complement spatial distribution.

Results obtained with the Local distribution are related in Fig. 15 in the same way as the distribution presented before.

As expected, this pattern had a shorter average delivery-time than the Complement distribution.



Fig.15: Results obtained with variable packets in the Local spatial distribution.

Respectively, Fig. 16 and Fig. 17 depict the results obtained with the Uniform and Non-Uniform distributions that presented an average performance on constant traffic experiments. The average delivery-time curve had not had the same peaks as the packet length histogram at certain times in the Non-Uniform distribution. This result demonstrates effectively its behavior, in which the probability of a core being destination varies during execution with times when the locality is stronger, which may cause the delivery-time drop.



Fig.16: Results obtained with variable packets in the Uniform spatial distribution.

Randomly generate packets means that there is no correlation between subsequent samples. One way to

determine whether the samples from a data-set are correlated is by their correlation coefficient analysis [16]. It

measures the intensity of the relationship between the samples of a data-set and may vary between -1 and +1. When zero or near zero the samples have no relation, which means that a coefficient near one or minus one would

characterize perfectly correlated samples. Tab. 4 shows the coefficient obtained for each distribution compared to a sinusoidal signal that has a high correlation. It can be said that the four data-sets have no relation, i.e., they are random.



Fig. 17: Results obtained with variable packets in the Non-Uniform spatial distribution.

A stochastic process is a sequence of random variables indexed by some element T, i.e., it is nothing more than a collection of random variables describing the behavior of some process over time [16]. In a random traffic scenario, the adaptability could be done statistically, through the stochastic processes control.

Signal	Coefficient	Correlation
$f(x) = \cos(x)$	0.995	High
Fig. 14	-0.042	Low
Fig. 15	0.081	Low
Fig. 16	-0.164	Low
Fig. 17	0.025	Low

Table 4: Correlation Coefficient.

Two characteristics would allow an algorithm to control a stochastic process: its periodicity in both regular and discrete time; the fact that it evolves from one state to another depending only on its last state, which might cause that after a long execution period the results of a particular state do not change. Therefore, the monitoring service presented in this paper could be used as a means to verify this last property in random traffic for an adaptive technique.

V. CONCLUSION

This paper presented a completely non-intrusive packet delivery monitoring service that uses its resources to transport, store and evaluate the traffic information obtained without interfering on routers operation. This service was embedded into the RTSNoC's project, a network-on-chip with WCL predictability that aims realtime systems which proved to guarantee a low delivery time for flows composed by small packets.

Experiments based on traffic generation models not only validated the proposed approach for monitoring a NoC traffic but also showed that in fact the cores spatial distribution and their packet length are metrics of more significant influence on RTSNoC latency increasing. In addition, the log generated by the Network Manager also demonstrated that the flits interleaving algorithm adopted in arbitration guarantees QoS.

RTSNoC is an efficient alternative of interconnection between processing elements in applications that present a large number of small packet flows. However, systems whose adopt this NoC architecture but have their flows mostly characterized as best-effort, e.g., multimedia applications, will have an average latency for all of them. The monitoring service presented in this paper could be used as a way to provide the necessary information needed by optimization methods, re-configurable computing techniques, load redistribution algorithms, and stochastic process control, all of which aim to improve the average latency of best-effort flows.

Lastly, it is important to highlight that by virtue of our main goal all components used in our experiments and the RTSNoC itself were implemented in SystemC due to its enforcement on performance exploration. Measurement of silicon area consumption with this particular hardware description language it is not only fairly laborious but it is also not efficient. Thus, possibilities of future work for our paper include the project conversion into another language, such as VHDL, which easily allows quantifying the overhead imposed by our monitoring service in terms of extra area needed. Furthermore, the mitigation in practical settings and application of those improvement techniques described before are also prospects of future work.

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Artificial Intelligence as the Brain of Industry 4.0

Rodrigo Lopes Macedo¹, Mauro César Aparício de Souza², Marden Eufrasio dos Santos³, David Barbosa de Alencar⁴

1,2,3 Academic department, University Center FAMETRO, Manaus-AM, Brazil

⁴ Research department, Institute of Technology and Education Galileo of Amazon – ITEGAM, Manaus-AM, Brazil

Abstract— The purpose of this article is to demonstrate the importance of applying artificial intelligence in enterprises that seek to reach the paradigms that form Industry 4.0, thus unifying the interactivity between systems, machines and assets to result in a more harmonious production environment and efficient. Nowadays, many companies have realized the benefits and started investing millions in the technology applications that make up Industry 4.0. And with that it is possible to store the relevant data, so they can be analyzed and managed. It also allows objects, such as machinery, to be controlled over long distances, remotely, without the need for a face-to-face asset to manage. In addition, there is the technology that can be considered the brain of the fourth industrial revolution (or Industry 4.0) which is Artificial Intelligence , because from it is possible that certain decisions, which previously were only possible to be resolved with a human being , are resolved by Artificial Intelligence itself, without any interference from an asset (human being).

Keywords—Artificial Intelligence; Industry 4.0; Revolution Industrial.

I. INTRODUCTION

Industry 4.0 has communication between man and machine, or better saying Artificial Intelligence, as one of its fundamental characteristics. As a result, the interaction between technological equipment and employees makes processes more harmonious, instead of signifying the decrease in workers.

The resolution of deeper occurrences is essential for the identification of any errors that may occur in the production network and, consequently, resulting in a faster and more effective solution. The control of production paradigms together with the means of inspections, helps the factories to be safer environments for workers. In addition, equipment that has a certain degree of artificial intelligence can protect workers from services that can be harmful. It can be said that this is one of the pillars that form Industry 4.0, because automation and productivity is something that favors the factories.

It is correct to say that industries can take advantage of 3 major aids that Artificial Intelligence provides. Firstly, it is the reduction of failures, since soon after being instructed, the algorithms generated by Artificial Intelligence already obtain qualifications to perform services liable to human failures. Unlike humans, algorithms do not suffer for external reasons, so it is unlikely that anything of this kind will occur.

Another advantage or better saying the second advantage is the decrease in expenses, according to experts. Numerous banks or businesses that focus on electronics used smart devices so that the customer can be served, since human interference is only necessary to solve more relevant problems. In this way, it allows employees to be allocated to more tactical services, which help increase profits, but there is also the possibility that companies will reduce employee costs.

The third advantage that artificial intelligence provides is profit growth. With the reduction of failures and professionals allocated to services of greater relevance, while it may leave the routine tasks to Artificial Intelligence, with this the company will have more time to analyze its own business.

II. LITERATURE REVIEW

2.1 Industrial Revolution

Historians consider the Industrial Revolution to be a time of great contribution, with regard to technology and this event, which took place in the second half of the 18th century, enabled modern industry to emerge. As a result, there were countless changes, but in particular the work relations and the exchange of manufacturing for machining, that is, the production process.

The First Stage of the Industrial Revolution

Occurred between 1760 and 1860, the first stage of the Industrial Revolution was restricted, preliminarily, in England. The cotton fabric industries, with the help of machine loom machines, began to emerge. And the improvement of steam engines had a significant relevance for the advancement of the Industrial Revolution.

The Second Stage of the Industrial Revolution

Between 1860 and 1900 other countries (Germany, France, Italy and Russia) also started to join industrialization. Some of the main innovations that occurred at this stage were:

The use of fuel derived from oil; The use of electricity; The advance in chemical products; The creation of the steam locomotive; The creation of the explosion engine; Steel factories.

The Third Stage of the Industrial Revolution

The third stage of the Industrial Revolution can be dated to the 20th and 21st centuries, according to historians, and some of its innovations are:

Electronic computer; Portable cell phone; Genetic engineering; Use of alternative energy sources.

2.2 What is industry 4.0?

It can be said that Industry 4.0 is a segment of the advancement of machines, a constant process that has perpetuated since the first Industrial Revolution. Industry 4.0 also aims to connect (via smart networks) workers, systems and machines. This creates autonomy throughout the production network.

2.3 Artificial intelligence

Artificial intelligence (AI) is an aspect of research and study in the areas of computing (computer science, computer engineering, etc...) which aims to develop procedures that replicate thinking (or intelligence) of the human being to solve problems, using computational symbols to generate the reasoning. In the twentieth century, between the years that initiated the Second World War, it is that it has records of research related to the development of something that simulates the intelligence of the human being, that is, artificial intelligence, with the central creators of the research scientists : Allen Newell, Hebert Simon, John McCarthy, among others. But the thought of building beings to act and think like human beings existed decades before, as can be seen in the fiction book by writer Mary Shelley: Frankenstein, from 1823.

III. MATERIALS AND METHODS

The functions that artificial intelligence offers in the industry are quite varied, allowing the possibilities to be practically unlimited. Based on technical knowledge in the area and bibliographic studies, it is possible to show the most frequent applications. As much as it seems something recent, artificial intelligence only started to stand out with the adoption of Industry 4.0 paradigms, because countless companies, from different sectors, used this technology to improve processes and automate services. Artificial intelligence is not limited only to companies or factories, for production automation, it is also used in machine learning, robotics, preventive analysis, augmented reality, among others.

3.1 Some uses of Artificial Intelligence

Creation of products and services, since artificial intelligence will be able to monitor and analyze the suggested designs, thereby being able to identify the negative aspects of the product or service.

Change in the way of working and professional obligations, focusing on the qualifications of the functions of: Programming, designer and manager.

Improvement of products and services, as artificial intelligence is able to identify and correct execution errors.

Increase in the identification of demands and responses, imposed by the market. Taking into account the consumer's desires and needs..

IV. RESULTS AND DISCUSSION

Nowadays companies have more and more access to information on a constant basis. This information varies from the consumer to the suppliers, but there are still companies that do not know the importance of condensing the most important information. Because of this, tools that use artificial intelligence are used to compile the most crucial information, thereby granting information that brings a differential to the company.

We note that companies that use artificial intelligence to the customer service department (chatbots) claim that there was an improvement in the service to the customer. The chatbots are intelligent programs, pre-programmed, that try to simulate a chat with users of so natural. They take information faster and more accurately, thereby improving the user experience. Do you think that artificial intelligence benefits the company?



Fig.1: Do you think that artificial intelligence benefits the company?

Source: The Authors, 2020.

We observed that 75% of companies understand that AI (artificial intelligence) can bring benefits that enhance results.

Do you believe that artificial intelligence applied to the digital service has improved the customer experience?



Fig. 2: Do you believe that artificial intelligence applied to the digital service has improved the customer experience?

Source: The Authors, 2020.

Is artificial intelligence already used in your work?





Source: The Authors, 2020.

We see that 36,4 % of the users who carried out this research affirm that artificial intelligence is already used in their work environments, however 18,2 % do not know if they use any tool that contains artificial intelligence in their work, and 45,5 % say they don't use it. This shows that the number of assets that work together with artificial intelligence is still a minority.

Do you believe that artificial intelligence has increased your productivity?



Fig. 4: Do you believe that artificial intelligence has increased your productivity?

Source: The Authors, 2020.

We see that 90,9% of the assets that work together with artificial intelligence claim that there has been an increase in productivity.

Do you believe that artificial intelligence can replace your work?



Fig. 5: Do you believe that artificial intelligence can replace your work?

Source: The Authors, 2020.

We can see that 44% of the assets are uncertain about the permanence of their position, after the application of artificial intelligence. Even though 30% say they have no worries about the remaining work, it is still perceptible that a significant portion of workers are afraid of being replaced by smart tools.

V. CONCLUSION

The conclusion from this article that more and more companies have been adhering to the use of Artificial Intelligence in some of their sectors, such as for managing information until serving customers. This provides that the assets that were responsible for these services can be allocated to other areas, which causes some employees to fear being replaced instead of being allocated to other sectors. However, Artificial Intelligence provides numerous advantages that are fundamental to the company's growth, which makes it inevitably a choice to be adhered to.

ACKNOWLEDGEMENTS

I thank God first for keeping me on the right track during this research project with health and strength to reach the end. We are grateful to our family for the support they have always given us throughout our lives. We would like to thank our advisor for the encouragement and dedication of his limited time to my research project. We also thank the University Center FAMETRO and all the teachers of the course for the high quality of the education offered.

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Affective-Emotional Aspects and Its Impacts on Learning: A Case Report in BrasilianPsychology Clinic

Fatima Maia Queiroga¹, Leonardo Severo da Luz Neto², Luiz Carlos Cavalcanti de Albuquerque³, Helio Franklin Rodrigues de Almeida⁴, Nayara Emanuel da Silva Freitas^{5a}, Hugo Domingos Gomes^{5b}

¹PhD in Psychology from the University of Havana (2002) revalidated the Federal University of Pará degree in Psychology from the Educational Foundation of Bauru, SP (1981).; Member of the research group Subjectivity Study and Research Center in the Amazon (CEPSAM) - CNPq (http://dgp.cnpq.br/dgp/espelhogrupo/0792728471040656) - certified by the institution. Lecturer crowded in the Department of Psychology at the Federal University of Rondônia. Name in citations: Fatima Queiroga

²Master in Education - Autonomous University of Barcelona, Spain. Master in Psychology - University of São Paulo. Master in Religious Studies - Faculty of Theological Education Logos of São Paulo. Bachelor of Nusring. Professional Physical Education. Bachelor in Theology. Professor at the Federal University of Rondonia, Brazil - Department of Collective Health, Researcher at the GEITEC and GEISC of the Federal University of Rondonia, Brazil.

³PhD in Psychology from the University of Coruna/Spain Postgraduate in Higher Education Methodology, the Federal University of Minas Gerais, Psychologist graduated in Faculty of Humanities of Pernambuco, teaching packed in the Department of Psychology at the Federal University Rondonia, subject teacher vocational and professional guidance, Vice-leader of the research group, health observatory and attention to work (OBSAT) and research group member in interdisciplinary studies in public health (GEISC) of the Federal University of Rondônia.

⁴PhD in Physiology from the University of ACoruña, Spain Revalidation University of Brasília, Brazil, Master of Exercise Physiology -Federal University of Santa Maria, Brazil, Graduated in Physical Education – State University of Pará, Brazil. Professor of the Department of Collective Health, Researcher at the OBSAT and Researcher of GEISC of the Federal University of Rondonia, Brazil. ^{5a,5b}Degree in psychology and Auxiliary researchers at GEISC of the Federal University of Rondônia, Brazil.

Abstract— This article is the result of a call in supervised training in Educational Psychology Clinic in Applied Psychology SPA-service, the Federal University of Rondônia. It aims to describe a case attended during practice, highlighting the impact of affective and emotional aspects of learning. Some considerations about the learning of singularities of learning of each and its relations with the emotional field. In the case report, intended to give a sample of the knowledge of the way that the evaluation of the patient was performed, from diagnosis to intervention. It concludes that affection and emotional should be better worked out, not only in the case met but in the educational process as a whole. And that affection establishes a relationship field that allows you to create an environment and take advantage of this.

Keywords— Psychology. Learning. Affective and emotional factors.

I. INTRODUCTION

When it comes to learning, we tend to associate it exclusively to school. Other times, the individual who does not learn or have difficulties to learn, is treated as solely responsible for its performance, and learning complaints are contained therein. We should consider the course of its history, the changes in the body, partly due to the maturation and other biological processes, but also largely due to the relationship with the environment. The fabric of these relationships in the past history of an individual, combined with its genetic endowment and other organic factors, determines their present behavior. The behavior is therefore multidetermined and second Skinner (1967) each conduit is influenced by the interaction between many organic and environmental determinants.

One can, for example, charge a content child not yet assimilated by it, classifying it as incapable or as "backward" if you can not perform a task that others her age can have. We believe that even with such commitments, development is possible and that clinical diagnosis should serve to assist in the development of the student, and not to stigmatization or to justify their non-learning.

Thus, the Psychology Clinic, as a field of knowledge and action seeks encompass different aspects of the subject's life, so understand how it is their way of learning, the establishment of its difficulty and how development happens. According to Weiss (2007), we explore affectiveemotional, socio-economic and cultural aspects, as well as school and organic, aiming to meet the subject in full, and not fragmented, out of his reality.

This article aims to analyze the emotional aspects are important for effective learning. Are presented, at first, some considerations about learning, and then the report of a case treated at the Clinical Psychology Applied Psychology SPA-service, the Federal University of Rondonia. Diagnosis and intervention is highlighted how the educational psychologist's actions can contribute to the understanding of the subject and the operation of their learning. It is intended, therefore, to take a sample of the knowledge produced and the application of resources that occurs in Psychology highlighting its importance for learning difficulties are overcome in the educational process.

II. CONSIDERATIONS ON LEARNING

Understand what learning is crucial to understanding how it happens and its importance for human development. In the case of Psychology, we will just deal with mishaps in this development, looking at what moment this stagnated learning (stagnated in fact) and that would have caused this. Pereira (2010, p. 112-128) that emphasizes this effect, learning or learning can not be both internal and external factors, closely linked, which are complementary.

We must take into consideration that, in principle, any individual is able to learn, even those with limitations or disabilities. No diagnosis or label appropriately describes the capabilities or difficulties of a person. The intelligence individuals considered normal, and even considered geniuses, can have serious deficiencies in specific areas. The teacher, based on analysis of the repertoires to be taught to identify the skills of the students and also the behaviors that they do not dominate, and teach these behaviors, constantly evaluating the results of their teaching procedures.

Many of the learning disability presented by the students can be attributed to the inadequacy of the procedures and not the intrinsic characteristics of the student or through which it comes. It is possible that the difficulties presented by a particular student are, in fact, due to the lack of important prerequisites. In this case, instead of waiting for the mature student, or it reaches the appropriate stage of cognitive development, it is important to identify the prerequisites and teach them directly. The "maturity" involves the acquisition of precursors behaviors of learning a new repertoire.

As Tabile and Jacometo (2017, p. 79), learning "[...] it happens from the acquisition of knowledge, skills, values and attitudes through study, education or experience". Thus, we understand that learning does not take place only within the school, and should also be developed in extramural context. Family, social life, cultural life, values, economics, affection and disaffection, it influences the way we see the world, and therefore the way we learn. Like this,

The learning and development take place in the social plan for the individual. In this process, the most experienced subject of a culture help the less experienced, making it possible for them to take ownership of cultural meanings. Thus, it is understood that the construction of knowledge is a shared activity, which has important implications for education. (TABILE; JACOMETO, 2017, p. 79).

We can say that the way everyone learns is singular. This means that we all have the capacity to learn, however, how it happens and at what time depends from person to person. By being inserted in different contexts, we are beings who learn according to the present reality, which will be reflected in the classroom. Internal aspects can play an important role, but teaching procedures can play a key role and influence of the environment.

Second Natel, Tarcia and Sigulem (2012), the traditional school has historically standardization and harmonization of techniques that aims to teach many different things in a unique way. The authors warn: do not just give information and hope that everyone learns the same way. The learning style and individual cognitive style need to be taken into account when it comes to the educational process.

Another point to be emphasized, and has major factor in the development of this work, it is the affective-emotional aspect and its impact on learning. According to Fonseca (2016), "The emotion drive leads and guides behaviors can not be understood without recognizing learning her role as important in human adaptive function. [...] ". In this way, we can understand that behavior and emotions are intrinsic concepts. The emotional factor is essential for learning because it is contained which essentially directs our attention and concentration necessary for us to be willing to learn. If a child has no positive affect the content, by classmates, or even a problem with emotional content happens in your family are examples of cases that must be taken into account, both the psychopedagogists as the faculty. According Banaco (1999), studying the emotions, suggests that, depending on the life history of each, the same stimulation could cause so much anger as sadness and different reports.

2.1 Case report

During the supervised internship in Educational Psychology Clinical Psychology Service in Applied-SPA at the Federal University of Rondonia, in 2018 it was granted the case of a patient of 11 years old, who attended the 5th grade of elementary school. The reported case preserves the identity of all those involved in the process, and obtained written consent of the responsible for the child answered, that will have the real name of Jonas when we refer to the patient.

During the visits, diagnostic sessions were held and intervention, aimed at understanding the complaint of difficulty of learning and knowledge of the patient. In this way, the sessions were held twice a week in Psychology specific room in Applied Psychology SPA-service of the Federal University of Rondonia.

2.2 About diagnosis and intervention

Sampaio (2014) states that the purpose of clinical psycho diagnosis is to identify what causes blockages present in person experiencing learning difficulties.

For Batista Gonçalves and Andrade (2015, p. 327) through the diagnosis is possible "[...] identify the mode of learning, the level of writing and the cognitive level." We believe that as a jigsaw puzzle, diagnosis begins even obscurely, with spare parts, which are slowly falling into place, allowing us to us to see what the patient wants to show us (even with all the difficulties and resistances).

To the extent that performs the diagnosis, also prevents their patients suffering from other personal difficulties arising from such difficulties in learning.

The diagnosis also helps us to outline the intervention. It is through the results obtained during the diagnostic sessions that can discern the most significant difficulties and work them in specific interventional sessions from case to case.

As Pain (2008), the intervention aimed at building conditions so that the subject can extricate itself from pathological behaviors, ie the symptoms presented as learning difficulties, aggressiveness, among others.

Through the patient's diagnosis, we identified its main difficulties and their main positive points that will be discussed later. After the end of diagnostic sessions, started the intervention process. Without losing the aim of view, the complaint of learning difficulty, in addition to assessing these difficulties, also sought to develop their skills in relation to affective/emotional and socio-cultural patient, always seeking their integral development.

The process of diagnosis of a learning problem is not simple. José & Coelho (Apud SAMPAIO, 2011, p 28) statethat:

(...) symptoms and child behavior are presented with such intensity, that it is difficult for a teacher to distinguish learning problems disorders. It is a complicated task to differentiate the boundaries that separate them from each other, whereas the teacher only detect the difficulties that arise in the classroom and investigating the causes of broadly to include organic aspects, neurological, psychological and possible problems arising from the environment in that lives. By doing so, the educator would be facilitating the referral to the appropriate specialist, who will help the child, treating their problems.

2.3 Instruments - diagnosis

The diagnosis was performed with the grandmother with the patient the **initial interview**. We aimed to know the family better understand the complaint during the screening, check how the family itself, represented today by her grandmother, dealt with the difficulty of the patient. Took advantage also in this session to make the framework leaving agreed day of care (always on alternate days), the schedule of calls (always the same), the frequency of 2 times a week and we would have to diagnose about 8 to 10 sessions. It has also been said about the possible faults, secrecy and that at the end of the sessions of the diagnosis show the result by returning.

In the initial interview took up the opportunity to establish *rapport*, understand the first impression, observe and consider what verbalize (what, when and at what pace) (anxieties and blockages) and non - verbal language.

Another instrument used was the interview **anamnesis** held with his father only. In order to have a more complete view of the patient 's life and the family, providing opportunities to know the history of early learning (non - school, informal) of the patient, their general development (development, control, acquisition of speech ...) clinical history (diseases, hospitalization, treatment, consequences ...), nuclear family history in a socioeconomic and cultural perspective, enlarged family history (maternal and paternal family) and their school history. In **ICOL** (Interview Centered Operative in Learning) instrument proposed by Jorge Visca, (1987, p. 72) aimed to allow understand how to have the bonds that the patient has with learning and school materials, as well as demonstrating what he knows and has learned to do on the school.

They were also held in diagnostic sessions **testings and General checks**, so designated by Sampaio (2014, p.37), which were found from the motor coordination and visualmotor skills by reading, reading comprehension, writing and calculation poll.

The **TDE** (School Performance Test), which is a psychometric test, sought to offer an objective an assessment of basic skills for school performance, specifically reading, writing and arithmetic. In this test, it was indicated in a comprehensive manner, which areas of school learning that were preserved or impaired the patient.

Application of **Projective Techniques** aimed to investigate the network that links the Jonas patient set, taking leading role in affective-emotional expression, which is instructed to draw on three specific areas: school, family and herself. All the tests and the interpretation of each projective technique was carried out according to their particular data were applied.

Evidence of the operative diagnosis were used to determine the level of thinking of our patient, where a quantitative analysis to know the operation and development of their logic functions, cognitive level it was in and if there was lag in relation to their chronological age was conducted .

The playful sessionswere performed with games and activities aimed at establishing an effective relationship with the patient as well as for general learning checks. These sessions help to recover the lost pleasure of learning and the autonomy of the intelligence exercise.

During the sessions of the diagnosis she was also told the patient to bring your school supplies to be carried out the analysis of school supplies. Thus enabled the understanding of its link to learning by organizing the verification of the material, hygiene, spelling, the letter, the activities of the notebook, the corrections ... school supplies Jonas patient in order was requested to observe the learning situation in a context outside the point of care.

They were also carried out visits to the school and the classroom, which provided an opportunity to observe their school routine, your interaction with colleagues, with teachers and their relational databases and posture in a different location of the service area. There were also interviews with teachers and school coordinator, aiming their perception of the patient assisted in Applied Psychology Service of the Federal University of Rondonia as a student. Questions were raised as was the student in the classroom, describe some characteristics of your student as he behaved towards school activities if doing activities at home and how it identified the difficulty of learning of his pupil.

To end the diagnostic sessions was held devolution session and referrals, which was of significant importance to close the diagnostic cycle. What is meant by Return, according to Weiss (2007) is a verbal communication made to the end of all the evaluation, in which it is reported to parents and the patient the results obtained during the diagnosis. It's a problematic analysis, followed by integrative summaries, which should be repeated whenever new information is added, and somehow rearranging the situation towards the reduction of resistance.

The patient return was summarized and without compromising patient confidentiality, results and performance. It was performed with the father and the patient together, and separately, with differentiated structure, for the school staff at school.

2.4 interventional procedure

In the intervention sessions were planned according to the patient's needs and difficulties encountered in diagnostic sessions.

They used various tools and games which were worked learning difficulties, as well as mobile applications to work with the sound of letters, syllables and words.

Regarding the playful use, both in diagnosis and intervention,

Alves, L. and Bianchini, MA (2010, p.286) point out that:

[...] it is of fundamental importance for the physical and mental development of children, assisting in building their knowledge and their socialization, involving cognitive and affective aspects. The playful is also an important educational tool that has the power to improve self-esteem and increase the knowledge of the child, when used with defined objectives.

In addition, the authors claim that the playful makes the learning environment more attractive, satisfying and stimulating. Their use, both in the classroom and in the psycho-pedagogical supervision, are essential to the educational process is seen as interesting and fun by the subject.

III. RESULTS

For the presentation of the results of the instruments used, the interviews and observations, we believe it best didactically divide the results by area:

3.1 Cognitive Aspects

In the analysis of this aspect, the patient shows good results, demonstrating good sense of logical sequence, time orientation, reading comprehension and listening skills. In all operative Diagnostic tests had consistent performance with their chronological age.

Also it showed very participatory, focused and attentive during all sessions of both diagnosis and intervention, with good intellectual and cultural level, referring to comic book characters, movies and stories of which he liked and that was part of their daily lives. He presented enough creativity and improvisational ability, inventing elaborate stories using puppets, dolls and other toys educational psychology room.

3.2 Pedagogical aspects

Regarding the educational aspects, the Jonas patient showed good development and understanding in the survey of mathematical calculations and results consistent with their age at the TDE calculations. However, presented difficulties in testings of phonological awareness, phonemic manipulation, reading and writing skills survey.

During play sessions of the particular alphabet and numbers presented domain knowledge and the numbers but had difficulties in putting alphabet order and recognizing certain letters (B, D, K, M, N, P, Q, W, Y). His reading was syllabic, and to join the syllables and form words sometimes did not give meaning to what I read, did not recognize the word that he had just read.

In Projective Techniques, by portraying a person teaching another, he drew a blackboard with scribbles in place of letters, which can be interpreted as a lack of understanding of writing. Also did not achieve sufficient results during application of tests for reading and writing the TDE.

When the analysis of school material is carried out, it was found that some house chores were not done, others were incomplete. The room tasks, mostly were made.

In the interview with the teacher, it reported that because the patient could not read, the tests were performed with him orally. When it was necessary to write something, she read the question, he answered verbally, and then she copied your answer on paper the part, so that the patient copied in the race. In the classroom, the teacher adopted the strategy that a colleague to help him in the task, sitting beside her. Another point to note is that the patient often had the best room notes. For example, in a simulated 20 issues hit 18. However, the teacher recommended his father to stay Jonas held the 5th year, even if he had enough passing grade, for not knowing how to read, since next year would face difficulties larger.

As well as the patient's difficulties were reading and writing, our main focus were the alphabet and the pronunciation of letters, syllables and words. Through the mobile application usage and other recreational sessions intervention was possible to work such aspects as well as the autonomy and self-confidence of the patient.

3.3 Organic aspects

The patient presented with apparent normality of organic aspects having good fine motor coordination, eye-hand as well as good notions lateral and body structure. She had difficulty speaking, exchanging certain letters for others, such as "R" for "L", "G" for "V", among others, which sometimes made it difficult to understand what verbalized. We can not say, however, that his difficulty speaking is the result of organic impairment, needing thus professional specific evaluation of speech therapy.

I used drugs for memory and understanding that have been prescribed by the neurologist.

3.4 Affective and Social Aspects

On the emotional-social, it was perceived good interaction of the patient with his father and grandmother. But note was little social ties outside the family, with few friends over to cousins and other relatives. Within the classroom, she had no friends. The patient claimed that his colleagues treated him differently and not approached because of his speech labored, featuring thus a form of *bullying*.

In Projective Techniques, represented his day to day monotonous and lonely way, summing up their day to go to school, come home, watch TV, use the phone and play *video games*. In the classroom and in the school room, stood up alone or isolated from the others, with activities focused only himself.

Another important point concerns the fact that the patient had lost his mother recently in a serious accident, and soon after the fact began the service sessions. It was considered that this fact had great impact on their emotional life, and that a fight not experienced could compromise their learning in this period of development.

IV. DISCUSSION OF RESULTS AS AFFECTION "KEY POINT"

When patients come to the SPA-Applied Psychology Service, go through a screening process, which is made an initial interview and sends the case to the appropriate staging area the needs of each. In the case of Jonah, complaints and contained in their screening form were difficult to remember what learning, reading and writing difficulties and speech difficulties. The grandmother and the father requested assistance of psychology under the guidance of neurologist. The neurological report the patient had as a result "Brain slowness" (term used in the report), being sent by the doctor to different professionals, including the educational psychology.

It is reported also that Jonah had experienced a recent loss: his mother had died in a serious accident. The patient lived with his father and paternal grandmother, since she was a baby, and never had close contact with the mother.

The first contacts have shown that it was a very communicative, intelligent child with great ease. However, his communication was troublesome because of a speech impediment. Having all this information in hand, the intervention with the patient turned primarily to their affective-emotional life. During the early realization of games and educational games, the times that used letters or words, the patient was lifted up, shouted, practiced verbal self-harm and the physically unable to perform certain tasks. At all times in which this occurred, activities were discontinued and was given the time needed for him to stay calm. Dealing with frustrations seemed very difficult for him, that he would rather give up or say that not knowing is considered "dumb".

Another point to note is that the diagnostic sessions the patient did not talk about his mother, only her grandmother and father commented about what happened. No one had explained and clarified to the patient in detail the fact that the mother's death. The grandmother said in the interview that told him only that his mother had passed away. Moreover, because there crying, not to talk about it and do not ask, everyone said Jonas felt nothing with her mother's death. His lack of reaction led them to believe that all was well as to fight and that this did not interfere in their learning.

Devolution in the family and the patient, he tried to, as discussed by Weiss (2007), not only to present conclusions about the case, but listen to what those involved in the process had to say, his views formed during diagnosis. the appropriate referrals were given showing the need for psychotherapy sessions, for exploration of issues raised and observed in educational psychology sessions. Clarifying the Psychology of the object of study is learning and so there was the need to meet other professionals. In addition to psychotherapy, it was also recommended sessions with speech therapy and remedial classes. In the case of psychotherapy and speech therapy, they were given free care sites or accessible to the public,

In the intervention process, almost at the end of sessions, Jonas managed to talk about the mother. On its own initiative, during one of the games, she said she had promised to take him to Disney, but did not have time. At this point, it was sad and emotional. He asked for toys and was silent the rest of time left in the session. In the next session, Jonas said he wanted to learn to read and write, and their posture has changed considerably: choose games with letters and words (formerly avoided) and brought a book home to read that we try together.

In the following sessions, his performance made significant advances. When using a mobile application that emitted the sounds of letters and syllables, he could correct their own speech. He trained alone at home and practiced reading. Although still exchange letters, Jonas was calmer, almost reading the entire alphabet and understanding what it meant each letter read. His reading was still syllabic, but frustrations were being overcome, and he persisted longer in the reading without quitting the increase in difficulty.

It is considered that by associating insufficient literacy a speech labored, the patient ended up writing the way he spoke. That is, to pronounce certain words, syllables and words wrongly, and without being properly corrected, he ended up writing this way. In the same vein, the patient could not read words and sentences great because they do not recognize the same, which in his mind had different sounds. This signals the urgency and necessity of psychotherapy, in his speech to be crafted with specific professional and at the same time undergo a process of restructuring their learning.

V. FINAL CONSIDERATIONS

As explained during the work, we realized how much the topic of learning disabilities is wide and as Psychopedagogy is required within this debate. Indeed, a multi and interdisciplinary approach is the ideal, and we believe that every child, teenager, adult or elderly who want to learn and present learning difficulties should have your professional different scope to assist.

During our proposed work, we present a case that exemplifies how affective and emotional factors can impact the learning. Thus, we recommend that professional psychology should be involved in this, as in our case, a bereavement not fully experienced and anguish expressed nonverbally were manifesting in their quality of learning.

Using different tools and methods, always the major one being attentive and empathetic listening, it was possible to understand how the child learned attended and what was preventing the execution of their formal school learning, specifically in the field of literacy.

Sometimes the report or diagnosis may be stigmatizing, jutting out who is that patient. It is important to us to see beyond the report, seeing possibilities and using the information contained in it as allies, not as paralyzing the psycho-pedagogical process. Thus, we understand that sometimes we forget that we are dealing with unique human beings with varying factors, feelings and experiences. We received in our offices not only patients, but life stories that must be told, understood, respected and assimilated. Of no use in a manual follow to the letter without being present, not body only, with every human being who seeks our help.

We believe that the practice within the school clinic provides a huge and significant growth. Direct contact with real people led to the understanding of what actually makes the educational psychologist in clinic. Despite all the difficulties, and often results in intervention are not as large as it would, because of the long established stage, we observed the potential of the patient as well as his desire to learn and continue to develop ever as a student and human.

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Enhancing the quality of naturally oxidized tea with ascorbic acid

Palanivel Murugesan*, Gopal Venkateswaran, Gopalan Sathish, Veilumuthu Shanmugaselvan

UPASI-Tea Research Foundation, Regional Centre, Coonoor – 643 101, The Nilgiris, Tamil Nadu, India *Author for correspondence

Abstract— Tea globally the most popular refreshing beverage, processed from the leaves of Camellia sinensis is evaluated organoleptically. While the biochemical potentials are fixed in the leaves, it is made palatable through processing. But for the rich polyphenols and caffeine in tea, it would not have been a beverage. Catechins are about two thirds of polyphenols undergo oxidation in the presence of the polyphenol oxidase to produce polyphenolic pigments namely theaflavins (TF), thearubigins (TR) and other polymerization compounds. The level of these compounds and their balance in the tea liquor determine the quality of black tea. Among these theaflavin plays a pivotal role and is directly proportional to the quality of liquor. Hence, an attempt has been made to increase the theaflavin levels and other quality attributes of the liquor through addition of ascorbic acid. Native level of ascorbic acid is very less in tea leaves and negligible in processed tea. Ascorbic acid when added during oxidation process reacts with catechins to produce stable secondary polyphenols. Ascorbic acid addition increases the formation of theaflavins from 1.23 to 1.77%. Moreover further polymerization of polyphenols to other undesirable complexes is arrested due to reduced oxygen uptake. Ascorbic acid addition at optimum level does not change the inherent quality and related attributes of the tea liquor. The stability and total liquor colour of the liquor is increased from 3.82 to 4.72%. As increasing the native level of ascorbic acid is difficult, external addition of ascorbic acid in processing is to be explored. The pH and EC value does not change up to addition of 2500 ppm concentration of ascorbic acid. Addition of ascorbic acid is enhancing the overall quality of black tea at concentration of 2500 ppm. Ascorbic acid is also being a tool in biosynthesis of several secondary polyphenols such as theaflavins thearubigin.

Keywords—Black tea, polyphenols, catechins, oxidation, theaflavins, ascorbic acid.

I. INTRODUCTION

Tea (*Camellia sinensis*) is the most popular drink in the world next to water. The major types of tea are green and black tea and other than this there are some specialty teas like white tea, yellow tea, etc. Polyphenol content in black tea is liquor colour and brightness could be considered as reliable quality parameters (Arachchi *et al* 2011) . Tea leaves contains polyphenols around 30% on dry weight and polyphenols have catechins as their major constituent. Oxidation of catechins is a very important process during black tea production (Matsuo *et al.*, 2008). These catechins are converted to theaflavin, thearubigin and high polymerized substances during oxidation with the help of the polyphenol oxidase. Here the catechins are oxidized and the tea is called black tea (fully oxidized tea) (Hilal and Engelhardt., 2007; Ravichandran and Parthiban 1998). The polyphenol oxidase in the leaf is deactivated, there is no oxidation of catechins during the process and the tea is called Green tea (unoxidised tea) (Hilal and Engelhardt 2007). Green tea process consists of mainly three steps steaming/panning, maceration of leaf and drying. The plucked leaves are immediately steamed or panned for deactivating the enzyme polyphenol oxidase (PPO) and then the leaves are rolled (maceration) and dried to moisture content below 3%. In this process the polyphenols and catechins are retained. Black tea process is mainly a four step process involving withering, maceration, oxidation and drying. The plucked shoots are allowed to wither for a duration varying from 12 to

20 hrs in order to remove around 5 to 20% moisture and concentrate the cell sap there by enabling it to be macerated without any loss of juices. During withering flavour compounds are developed due to chemical changes. After withering leaves are ruptured and macerated. After maceration the cut dhool is oxidized, which is indicated by the colour

change from green to coppery brown. Finally the oxidized tea is dried to arrest the oxidation process and reduce the moisture below 3%. Based on the method of manufacture, generally there are two types of black tea processing namely Orthodox process (traditional method) for more flavour and CTC process (crush, tear, curl) for more colour and strength in the liquor. Tea is evaluated organoleptically. This is correlated with bio chemical constituents present in tea. Green tea is rich in polyphenols since they are not oxidised during the process and catechins comprise two thirds of polyphenols. These unoxidised catechins are the quality indicators of green tea. In black teas during oxidation catechins are converted to theaflavins, thearubigins and high polymerized substance due to the activity of enzymes (Kim. et al., 2001; Ansari et al., 2011). Theaflavin and Thearubigins are the quality indicators for black tea as these two compounds are responsible for the taste, colour, briskness brightness and strength of the black tea (Owuor and Obanda., 1998). Given below are major catechins present in tea and their conversion (Ngure et al., 2009).

These catechins are oxidized in the presence of enzymes to form the pigments theaflavin and thearubigin. This oxidation reaction is a continuous process. Initially catechins are dimerized to form theaflavin and further oxidized to trimer form of thearubigin and polymerized to form high polymerized substances (Roberts 1941). Theaflavin plays a major role in fixing the quality of tea. Generally tea retaining higher amount of theaflavins are considered as better quality tea. A lot of research has been conducted for retaining or increasing the theaflavin levels in tea. Here edible acids (specifically ascorbic acid) are used to obtain higher level of theaflavin. The native level of ascorbic acid in tea leaves is around 0.2% and act as an enzyme. After processing black tea is contains negligible amount of ascorbic acid (Hussian *et al* 2006; Senthilkumar and Ramesh Kumar 2004).

The effects of studies on influence of ascorbic acid on the oxidation of tea are being continued (Deijs 1940). Ascorbic acid is useful for producing higher amount of theaflavin, increasing thearubigin and decreasing the polymerization. The

amount of theaflavin and thearubigins are directly related to quality of tea where as higher amount of polymerized substances have an adverse impact on the quality of tea. The experiment is about external addition of ascorbic acid during processing and its impact on quality of tea. Tea was analysed for theaflavins, thearubigins, high polymerised substances, total liquor colour, total polyphenols, total catechins, pH, electrical conductivity and FSSR parameters before and after the external addition of ascorbic acid.

II. MATERIALS AND METHODS

A. Materials

IBMK (iso butyl methyl ketone), n-butanol, disodium hydrogen phosphate, sodium carbonate, folin & Ciocalteu`s Phenol reagent, Sulfuric acid, hydrochloric acid, sodium hydroxide, alcohol, acetone, catechin, gallic acid, caffeine and ascorbic acid.

B. Tea process

Leaf of UPASI – 9 tea clone were plucked and allowed to wither for 16 hours. The withered leaf was macerated with CTC roller and allowed to oxidize for 90 min. After maceration, the tea leaf was divided to eight parts. One part was allowed to oxidize normally and the other seven parts was sprayed with ascorbic acid at 500, 1000, 1500, 2000, 2500, 5000 and 10000 ppm levels. The dhool (macerated tea leaf) after oxidation was dried for removal of moisture and deactivation of enzymes. The tea was processed at UPASI

mini factory, Glysdale farm, Coonoor, The Nilgiris, Tamilnadu, India. The processed made tea was graded and BOP (Broken Orange Pekoe) grade was selected for laboratory analysis.

C. Analysis

Analysis was carried in UPASI Tea Research Foundation, Regional centre, Coonoor, The Nilgiris, Tamil Nadu, India, a NABL (National Accreditation Board for Testing and Calibration Laboratories) accredited laboratory for chemical testing as per ISO/IEC 17025:2005. All analytical results were calculated on dry matter basis (DMC).

D. Quality Parameter Analysis

Liquor

2 g of BOP grade tea was added to 100 ml freshly boiling water and steeped in boiling water bath for 10 min at above 85°C. Brewed tea was filtered through cotton and liquor taken for analysis. 25 ml of tea brew was shaken with 25 ml of IBMK in separating funnel and allowed to separate, to organic (A) and aqueous layer. 10 ml of aqueous layer was shaken with 10 ml of Butanol and allowed to form organic (B) and aqueous (D) layer. 10 ml of organic layer (A) solution was shaken with 10 ml of 2.5% disodium hydrogen phosphate solution and allowed to separate to organic (C) and aqueous layer. 1 ml of each A, B, C, and D layer was pipetted out to 9 ml 45% ethanol in boiling tube. 1 ml of tea brew was pipetted out to 9 ml of distilled water containing boiling tube (E). The optical density (OD) of all the solutions was determined in UV spectrophotometer (GBC 918. Australia). The OD of solution E found at 460 nm represents total liquor colour of tea (TLC). OD at 380 nm of A, B, C, D solutions were determined. Here A, B and C represent Thearubigins (TR), C represents Theaflavins (TF) and D represents High Polymerised Substance (HPS). Concentration of TF, TR, HPS and TLC was calculated from the absorbance values as given below. The calculation factors include molar extension coefficient and dilution (Roberts and Smith., 1963; Tea board., 1995). The results are represented on dry basis.

TF% = C*4.313*100	TR% = (A+B) - C * 13.643*10
DMC	DMC
HPS% =	
D*13.643*100	TLC = E*10*100
DMC	DMC

Dry matter content (DMC)

The procedure for determining dry matter content is given below. Weight the empty bottle (A) g, Bottle with 5 g tea sample (B) g and Bottle with 5 g tea sample after 16 hours drying (C) g.

DMC% =
$$(C-A) *100$$

(B-A)

Total Catechins

0.2 g ground tea sample was extracted with 5 ml of 70% hot ethanol in water bath at 70° C for 10 min, then centrifuged at 3500 rpm for 10 min and filtrate decanted in 10 ml. This process was repeated twice and made up to mark. 2 ml of filtrate was pipette out into 100 ml. SMF and made up to mark. 2 ml of aliquot was pipette out in a boiling test tube and 6.5 ml of 1% vanaline solution (70% Sulphuric acid) was added. 1.5 ml of water to this solution and 30 min were

allowed for development of colour. After colour developments optical density was found at 500 nm in spectrophotometer (GBC 918, Australia). The same process was done for standard catechins 10, 20, 30, 40, 50 ppm standard solutions.

Total Catechins $\% = \underline{\text{Graph reading}*12.5}$

Weight* DMC

Total Polyphenols

0.2 g of ground tea sample was extracted with 10 ml of 70% hot methanol in water bath at 70°C for 10 min, and then centrifuged at 3500 rpm for 10 min and the filtrate decanted to 10 ml SMF. This process was repeated twice and made up to mark. 1 ml of filtrate diluted to 100 ml in SMF. 1 ml of this solution was pipette out to boiling tube, 5 ml of Folin-Ciocalteu: water reagent (1:10) added, after 5 min. 4 ml of 7.5% sodium carbonate solution was added and allowed to remain for 1h for colour development. OD was found at 765 nm in spectrophotometer (GBC 918, Australia). The same process was done for standard Gallic acid 10, 20, 30, 40 and 50 ppm solutions.

Total polyphenols $\% = \underline{\text{Graph reading}^{*10}}$ Weight* DMC

Caffeine

1 g ground tea sample was soaked in 5 ml liquor ammonia in a separating funnel for 5 min. 25 ml of chloroform was added to separating funnel, shaken well and allowed to settle for 30 min. After settling chloroform solution was transferred to 1% potassium hydroxide in separating funnel, extracted and allowed to separation for 30 min. The extracted caffeine in chloroform solution was filtered through anhydrous sodium sulphate to 100 ml. This process was repeated thrice to made mark; 2.5 ml of chloroform solution was diluted to 50 ml. The standard caffeine at 1, 2, 4, 6, 8, 10, 20 ppm was prepared in chloroform. OD was found at 274 nm in spectrophotometer (GBC 918, Australia).

Total Lipids

1 g ground tea sample was soaked in 1% NaCl solution in a separating funnel and extracted with chloroform

and allowed to separate for 30 min. The chloroform solution was filtered through anhydrous sodium sulphate to pre weighed china dish (L_1). This process was repeated thrice. The china dish containing chloroform was evaporated in water bath and dried in hot air oven for 30 min, cooled and weighed (L_2).

Total Lipids % = $(\underline{L_2}-\underline{L_1})*100*100$ Weight*DMC

Taste

The 2% BOP grade tea brew was prepared with five minutes steeping time. The brewing tea details was hide and evaluated by a professional taste expert from taster's office, Coonoor, The Nilgiris, Tamil Nadu, India. The score was given out of ten.

III. RESULTS AND DISCUSSION

A. Theaflavins

The role of theaflavins in improving quality lies in their effect on the brightness and briskness of tea brews, as well as the coppery colour of the infused tea (Ramaswamy 1986; Peterson et al 2005). All these characteristics increase the value of tea. Theaflavin content contributed positively toward valuations for tea quality (Taylor and Francis 1995; Ansari et al 2011; Liang and Yu 2001). The experimentshows a clear picture on the importance of ascorbic acid in increasing the level of theaflavin in tea. The results were indicating that tea leaf containing high amount of ascorbic acid had better quality. Increasing the ascorbic acid level externally will have a positive impact on tea quality (Table1). The ascorbic acid added during oxidation act as an enzyme dehydroascorbidase (Tanaka et al 2010). Ascorbic acid slows down the formation of thearubigins and high polymerized substances and delays further oxidation of theaflavins. Ascorbic acid reacts with epigallo catechin gallate to form ascorbyl epigallo catechin gallate, which accelerates the theaflavins (monomer) formation and slows down further oxidation. Gradually increasing the ascorbic acid concentration up to 10000 ppm increased the theaflavin levels without any adverse effect in the tea.

B. Thearubigins

The formation of thearubigin is linked to quality characteristics of black tea (Obanda *et al.*, 2004). Color and strength are related to thearubigin content, one of the

components of thearubigins is theaflavins and it is known that during oxidation the theaflavins reach a peak after which they are believed to undergo further oxidation to produce thearubigins (Taylor & Francis., 1995; Ansari et al., 2011). The analytical result shows that thearubigins level increase with increase in concentration of ascorbic acid upto 2500 ppm. Higher concentrations gradually decrease thearubigins (Trimer). Initially the thearubigins levels are increased due to the slowing down of the reactions when ascorbic acid is added. When the addition of ascorbic acid exceeds 2500 ppm, ascorbic acid reacts directly with catechins to produce more theaflavins and hence thearubigins is reduced (Table1). Increase of thearubigins is also impact tea quality positively. The results of the laboratory analysis indicate that the thearubigins levels increase with addition of ascorbic acid, implying a positive influence in quality of tea liquor.

C. High Polymerized Substance

High polymerised substances (HPS) are the products formed due to polymerization during the oxidation process. Increased HPS formation during oxidation had a similarity to the pattern of the colour production (Hafezi et al 2006). Generally high polymerized substances have a negative influence on tea quality. Hence higher levels of polymerized substance make the liquor cloudy. Higher amount of HPS indicates that the oxidation process is not proper. The results of the study indicate decrease in the HPS level with increasing ascorbic acid concentration (Table1). Ascorbic acid addition reduces the formation of HPS by slowing down the oxidation process. Addition of low concentration of ascorbic acid reduces polymerisation. Addition of concentrations above 2500 ppm ascorbic acid marginally reduces HPS due to direct reaction of ascorbic acid with catechins. The results indicate a decrease in HPS due to addition of ascorbic acid which is good for the quality of tea.

D. Total Liquor Colour

Colour is an important quality attribute (Obanda *et al* 2004; Bokuchava *et al* 1980). There is an increasing demand for natural food colour all over the world. Tea is a source of natural colour (Baruah *et al.*, 2012). The characteristic colour of black tea is formed during its oxidation process. During this process, the colourless catechins which are abundant in fresh leaves are oxidized both enzymatically and chemically to give two major groups of pigments, theaflavins and thearubigins.The colour of liquor increases with the addition of ascorbic acid upto a concentration of 2500 ppm as concentrations up to this level increases theaflavins and thearubigins (Table1).

E. pH and EC

Lower pH in tea is associated with an apparent increase in theaflavins (Subramanian et al 1999 & Vuong. et al 2013). The presence of ascorbic acid may partially prevent the degradation or epimerization (Chen et al 1998). The ascorbic acid inhibit oxidation reaction (Zimmermann & Gleichenhagen 2011).The experiment shows low concentration of ascorbic acid did not have any change in pH & EC. At higher concentration exceeding 2500 ppm, pH was reduced by 0.19 units at 5000 ppm and by 0.39 units at 10000 ppm (Table1). Higher concentration of ascorbic acid increased the electrical conductivity. Theaflavin is more stable in medium than alkaline range of pH (Su 2011).

TABLES

Table 1. Liquor Parameters (Brew)

Con. Ascorbic acid (ppm)	Theafl avin (TF) %	Thearu bigin (TR) %	High polymeriz ed substance (HPS) %	Total liquor colour	рН	EC (ds/m)
Control (0)	1.23	10.30	9.71	3.85	4.88	0.95
500	1.28	11.23	8.84	4.83	4.88	0.95
1000	1.33	11.42	8.75	4.33	4.91	0.93
1500	1.42	11.68	9.67	4.53	4.89	0.94
2000	1.48	11.89	9.54	4.42	4.91	0.95
2500	1.52	12.03	9.41	4.72	4.89	0.95
5000	1.58	11.47	8.11	4.44	4.69	1.22
10000	1.74	10.54	7.08	4.44	4.28	1.40
$\begin{array}{c} CD \ at \\ P = \ 0.05 \end{array}$	0.02	0.05	0.06	0.03	0.01	0.02
CD at P = 0.01	0.03	0.06	0.09	0.04	0.01	0.03

Table 2. Biochemical parameters (Processed tea)

Con. Ascorbic acid (ppm)	Total Polyphenols%	Total Catechins %	Total Lipids %	Caffeine %
Control	16.77	6.52	8.01	2.42
500	16.70	6.41	7.85	2.43
1000	16.50	6.39	7.76	2.42
1500	16.38	6.35	7.27	2.44
2000	16.23	6.29	7.18	2.45
2500	16.05	6.07	6.21	2.44
5000	14.52	4.62	6.28	2.43
10000	13.38	3.55	5.94	2.42
$\begin{array}{c} CD \ at \ P = \\ 0.05 \end{array}$	0.07	0.05	0.07	0.09
CD at P= 0.01	0.09	0.07	0.09	0.13

F. Total polyphenols and Catechins

During the course of oxidation, the polyphenols are rapidly converted to pigments (Harbowy and Balentiene., 1997; Sang et al., 2011). The lower the pH and temperature the more stable the tea catechins are during processing and storage. Tea catechins are stable in acidic system (Ananingsih et al., 2013). During fresh tea leaves are crushed at the initial stage, the four major catechins are enzymatically oxidized and the resulting quinones undergo complex chemical changes. The composition of the oxidation products of tea catechins is extremely complex (Tanaka and kouno 2003). There is a slight decrease in polyphenols and catechins with addition of low concentration of ascorbic acid (upto 2500 ppm). At addition of higher concentration ascorbic acid (5000 and 1000 ppm) catechins react with ascorbic acid to form theaflavins (monomer), reduce formation of thearubigins (dimer) and hence there is a notable decrease in the level of polyphenols and catechins (Table 2).

G. Lipid and Caffeine

Generally a lipid is negatively correlated to tea quality (Ganesan and Ramasamy., 1996). In this study addition of ascorbic acid decreased the lipid levels. High lipid leads to Pacha taint in tea (Ganesan and Ramasamy., 1996). Ascorbic acid gradually decreased the lipids level and caffeine is responsible for the briskness (Borse and Rao 2012). Caffeine is an alkaloid group compound which is naturally present in tea leaves. It does not involve in the oxidation process (Kim *et al.*, 2001). No change in caffeine level was observed during this study. Caffeine content was almost the same with or without addition of ascorbic acid (Table1).

Table 3. Taster Evaluation

Con. Ascorbic acid (ppm)	Infusion	Ċolour	Strength	Briskness	Other comments
500	7	5	7	5	-
1000	7	6	7	6	Good infusion
1500	7.5	6	7	6	Good liquor
2000	8	7	8	7	Good liquor
2500	8	7	8	8	Good liquor
5000	9	5	6	5	Slight sour
10000	9	5	5	5	sour

H. Taste

Tea contains a number of biochemical components, some are responsible for colour, and some are responsible for taste of the liquor (Baruah *et al.*, 2012; Liang *et al.*, 2003). These biochemical parameters directly correlated to taste of the tea (Ngure *et al.*, 2009). Higher amount of polymerized substance present in tea give undesirable taste. Hence during oxidation process polymerization should be as minimum as possible. Theaflavins are responsible for astringency and briskness. Thearubigins gives strength and good mouth feel. Addition of ascorbic acid gradually increased the taste related compounds (Table3).

IV. CONCLUSION

This study clearly shows that addition of ascorbic acid during oxidation process increases the overall quality parameters in tea. Tea is stable in acidic conditions and addition of ascorbic acid reduces catechins degradation in brew and processed tea. This study indicates the role of ascorbic acid in increasing the quality of tea. Hence, increasing the native level of ascorbic acid in tea leaf will help to increase the tea quality parameters naturally. Addition of ascorbic acid is enhancing the overall quality of black tea at concentration of 2500 ppm. This study gives gate way for further research on extraction of theaflavin, isolation of flavour compounds and increasing shelf life of tea brew.

ACKNOWLEDGEMENTS

The authors are thankful Mr. K. G. Udayabhanu, Deputy Director, UPASI Tea Research Foundation, Regional centre, Coonoor, The Nilgiris, Tamil Nadu, India for constant guidance, moral support and encouragement.

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