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ENTREPRENEURSHIP AND PLANNING: CONCEPTS AND PERSPECTIVES

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PRESENTATION

Welcome to Educational Development: Theories and Application, an essential work for all those involved in the field of education. This book offers a comprehensive and accessible exploration of the theories and practices that shape educational development.

Intended for teachers, students, professionals in the field, and anyone interested in the subject, this book provides insight into the fundamental concepts that underpin modern educational practice. Throughout the text, you will find an analysis of contemporary educational theories and their practical applications, offering valuable tools for improving pedagogical practice and theoretical understanding.

Whether you are an educator seeking new strategies, a student in training, or a professional committed to deepening your knowledge, this book will serve as a guide to understanding and implementing best practices in educational development. By exploring the themes presented, you will be better prepared to meet the challenges and seize the opportunities in the field of education.

Get ready for an enriching journey that will not only broaden your view of educational development, but also provide actionable insights for transforming theory into effective practice.

SUMMARY

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CHAPTER 1

THEORETICAL FOUNDATIONS OF INTEREST RATES AND YIELD CURVES: CONCEPTS AND ECONOMIC IMPLICATIONS

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ABSTRACT: Interest rates play a fundamental role in the economy, influencing consumption, investment decisions, and monetary policies. This chapter provides a detailed overview of interest rates and yield curves, addressing their fundamental concepts and economic impacts. It begins by exploring the theoretical origins of interest rates, discussing different economic perspectives such as classical, Keynesian, and neoclassical schools, and how each interprets the role of rates in the economy. The effects of interest rates on consumption, investments, inflation, and exchange rates are analyzed, along with their role in fiscal policy and responses to economic shocks. Next, the importance of yield curves is discussed, explaining their definition and differentiating between normal and inverted curves while examining how these curves reflect market expectations about the economic future. The chapter also revisits the main theories explaining yield curve variations and their role in economic forecasting.

KEYWORDS: interest rates, yield curves, economy.

RESUMO: As taxas de juros desempenham um papel fundamental na economia, influenciando decisões de consumo, investimentos e políticas monetárias. Este capítulo oferece uma visão detalhada sobre as taxas de juros e curvas de juros, abordando seus conceitos fundamentais e impactos na economia. Inicialmente, explora as origens teóricas das taxas de juros, discutindo diferentes perspectivas econômicas, como as escolas clássica, keynesiana e neoclássica, e como cada uma interpreta o papel das taxas juros na economia. São analisados os efeitos das taxas de juros sobre consumo, investimentos, inflação e taxas de câmbio, além de seu papel na política fiscal e resposta a choques econômicos. Em seguida, discutiremos a importância das curvas de juros, explicando sua definição e diferenciando entre curvas normais e invertidas, além de examinar como essas curvas refletem as expectativas de mercado sobre o futuro econômico. O capítulo também revisita as principais teorias que explicam as variações nas curvas de juros e seu papel na previsão econômica.

PALAVRAS-CHAVE: taxas de juros, curvas de juros, economia.

1. INTRODUCTION

Interest plays a significant role in our daily lives, directly affecting individual financial decisions and the functioning of the economy as a whole. It is crucial that society understands the importance of interest rates to make informed decisions about loans, investments, and financial planning. Understanding interest rates allows people to assess the real cost of borrowing, influencing choices ranging from home finance to credit cards. A well-informed society about the nuances of interest rates is better able to cope with financial complexities. Thus, a deeper understanding of the true origin of interest and its various theories over time becomes essential.

This chapter aims to clarify the theoretical basis of interest rates, exploring from the contributions of the main economic schools to the mechanisms by which interest influences the economy on a macro and microeconomic scale. The theoretical analysis complements a discussion on the practical application of these rates, focusing on how rate variations affect the real economy, from consumption to investments to the impact on monetary and fiscal policies.

In addition to interest rates, the interest curve is also a central element in economic analysis. It represents the relationship between interest rates on debt securities with different maturities, reflecting market expectations about the future of the economy. The shape of the interest curve, whether upward sloping, flat or inverted, reveals important information about market expectations for economic growth and inflation. An upward curve typically reflects optimism about future economic growth, suggesting that investors believe in an expanding economy. Conversely, an inverted curve is often a warning sign, indicating that investors are anticipating an economic downturn or even an imminent recession.

This chapter will deepen the study of interest curves, detailing their variations and the theories that explain their different forms, such as Theory of Expectations, Preference for Liquidity and Market Segmentation. The goal is to provide a consolidated understanding of interest rates and interest curves and their relevance to economic analysis and decision making.

2. ORIGIN OF INTEREST

The history of interest rate-related economic theories is broad, encompassing several currents of thought and historical periods, including classical theory, Keynesian theory, and neoclassical theory. In this segment, an overview of the main theories and their development over time will be presented, as well as historical moments in which interest rates played a crucial role in global economies. One notable example was the Great Depression of 1929, during which a stock market collapse occurred, with interest rates being a significant factor in aggravating the situation. As explained by Ebeling (2011), in 1928, in the face of monetary expansion, the increase in prices of the American economy became evident. The Federal Reserve, fearing absolute lack of control in prices, adopted measures to significantly reduce the growth of the money supply. With the end of the expansion, interest rates began to rise towards their market equilibrium levels. Long-term investments, both completed and in progress, proved unprofitable in the face of new and higher interest rates. The investment boom period ended, and the collapse was signaled by the stock market crash in October 1929.

The classical theory stated that the interest rate was determined by the relationship between saving and investment. According to Lopes and Rossetti (2002), in the context of the classical model, a rise in the interest rate acts as a stimulus to saving, but of discouraging entrepreneurial initiatives of new investments. In essence, classical theory recognizes that the interest rate can have contradictory effects on the decision to save and invest in the economy, revealing complex impacts of economic decisions. Once again Lopes and Rossetti (2002) argue that interest is a concrete reality. Savings, as an unused income, are directed, through the interest rate, to investors who are willing to remunerate for the resources allocated to production. Moderation and marginal productivity of capital are the elements that ultimately determine the interest rate, accepted as a phenomenon associated with the real sector of the economy. Temporarily, money may have an influence on the interest rate.

Unlike the classical model in which the interest rate is determined by the interaction between saving and investment, the Keynesian model will emphasize that it is the currency that determines the interest rate. On the determination of the interest rate on the Keynesian prism, Sartorio, Colombo and Favorato (2021), they point out that the interest rate in Keynes is influenced by the demand for currency, which, in turn,

is conditioned by the Preference for Liquidity, which is ultimately shaped by the perception of economic agents about the future, characterized by uncertainty. Therefore, the Keynesian conception suggests that the determination of the interest rate occurs by means of a monetary approach.

According to the theory with neoclassical theory the interest rate is nothing more than the relationship between saving which is the supply of borrowing funds and investment being the demand of these funds. The neoclassical theory of loan funds, as explained by Costa (2020), suggests that interest plays the role of a compensation for "waiting", indicating the decision to postpone present consumption (saving) in favor of better conditions for future consumption (investment). The interest rate is thus established by the interaction between the supply of funds (saving) and the demand for funds (investing).

In addition, neoclassical investment theory suggests that the real interest rate is one of the relevant variables in investment decisions, as it not only represents the cost of capital utilization, but also provides a measure of the opportunity cost associated with making productive investments.

2.1 INTEREST ROLE IN THE ECONOMY

Interest rates play a crucial role in the functioning of any economy, exerting a comprehensive influence on all sectors. Its importance significantly impacts both individual decisions and government policies, going beyond being merely a component of monetary policy, but a key piece shaping the economic landscape.

According to Omar (2008), the interest rate plays a central role in economic decision-making by influencing prices and costs in all sectors of the economy. It highlights the existence of close connections between the interest rate and crucial economic variables such as inflation, unemployment, exchange rate, capital flows, balance of payments structure, and external and domestic debt levels. Raising the interest rate will have a negative impact on investment and consumption and therefore have effects on economic growth.

In essence, interest rates represent the value of money over time and play a crucial role in economic dynamics. Its relevance is evident in maintaining equilibrium in various aspects of the economy, from containing inflation to managing

unemployment and influencing the exchange rate. They are therefore key pieces in the formulation of economic policies, such as monetary, fiscal and exchange rate policies.

These policies, in turn, have the power to shape the course of the economy, seeking both retraction and expansion, depending on the circumstances. Adjusting interest rates is a strategic tool in these policies, and can discourage or incentivise consumption and investment, as well as impact government spending decisions. Ultimately, a deep understanding of the function of interest rates is vital to effectively guide a nation's economic development.

2.2 INTEREST RATE AND ITS IMPACT ON THE ECONOMY

In the economic context, interest rates play a key role in monetary policy and in the regulation of economic activity. The interest rate is the percentage amount that is charged or paid for the use of money over a given period. Such fees exert a considerable influence on the choices made by the various participants in the economy, including consumers, businesses and government entities. In a stable economic environment, interest rates tend to decrease, making new investments more attractive. This increases the stimulus to consumption, savings and financing, because it reduces the cost of credit. For the government, interest rates play key roles in both fiscal and monetary policy. The government and the Central Bank use various instruments to regulate interest rates and influence economic activity, such as increasing or reducing the basic interest rate, carrying out open market operations, which consists of buying and selling government securities in the market, promoting an expansionary or contractionary monetary policy. According to Assaf Neto (2021), changes in interest rates can trigger a number of interconnected events in the economy. For example, lowering rates can stimulate economic growth, while an increase in rates to contain inflation can discourage investment and lead to an economic downturn. These aspects are fundamental in the formation of interest rates in the economy.

In Brazil the basic interest rate of the economy is the Selic, which is defined by the Monetary Policy Committee (COPOM) of the Central Bank of Brazil (Bacen), being a reference for the other interest rates of the country. An overview of the basic concepts relating to interest rates will be provided below. Understanding these concepts is

essential to analyze the effects of interest rates on the economy, investments and loans. By considering the basic Selic interest rate, defined by the Copom, and the other short and long term rates, it is possible to understand how these indicators are influenced by monetary policy. In addition, the differentiation between nominal and real interest offers a more accurate view of returns and financial costs. Understanding the role of interest rates in the economy is essential for decision-making and understanding the country's economic dynamics.

Nominal interest is interest rates expressed in monetary terms, without taking inflation into account. Blanchard (2011) clarifies that interest rates that are expressed in dollars or, more broadly, in terms of the national currency unit are designated as nominal interest rates. In contrast to nominal interest, so-called real interest rates exclude inflation and are defined as nominal interest discounted from inflation. Actual interest represents the investor's actual gain after considering the loss of purchasing power due to inflation. Blanchard (2011) further notes that the real interest rates are attributed to the interest rates expressed in terms of a basket of goods.

In the market, there are both short and long – term interest rates, both determined by different factors. Short-term rates are influenced by supply and demand for short-term resources, market liquidity and expectations regarding monetary policy, in turn, long-term rates are affected by factors such as the expectation of future inflation, economic growth and country risk, which reflects the perception of consumers and investors about a country's economic and political stability.

2.2.1 Basic interest rate

In the United States, the reference interest rate is determined by the Federal Reserve, which is the central bank of the United States. The Federal Reserve (commonly referred to as the Fed) is responsible for the conduct of monetary policy in the United States. In the United Kingdom, the reference interest rate is the Bank Rate, determined by the Bank of England. In Brazil, the basic interest rate is known as the Selic Rate, it is determined by the Copom, which is responsible for setting the goal of the Selic rate at each meeting. These benchmark interest rates aim to influence monetary policy and control inflation in each particular economy. They serve as a guide to other interest rates practiced in the financial markets of these countries.

The interest rate plays a key role in the global economy, affecting various aspects such as investments, savings, consumption, inflation and financial stability. The way interest rates are set and managed by central banks can have a significant impact on a country's economic and financial results. Therefore, monitoring and understanding the evolution of interest rates is essential for informed decision-making and analysis of global economic developments. The Selic is the basic interest rate of the Brazilian economy, used by the Bacen as a monetary policy device and main instrument for controlling inflation, playing a fundamental role in the formation of the interest curve, being defined by the Copom that establishes the target for the Selic Rate at each meeting every 45 days. From the perspective of Assaf Neto (2021), the Selic Rate is defined as the average interest rate resulting from daily funding backed by federal government bonds, realized within the Special Settlement and Custody System.

The Copom was established in 1996 as a body of the Bacen with the aim of establishing the Selic rate target and shaping the country's monetary policy. It is composed of directors of the Central Bank of Brazil and other representatives of departments of the economy, and is responsible for meeting every 45 days to analyze inflation, the economic situation of the country and determine the Selic rate. In this way, it plays a fundamental role in regulating interest rates in the money market, seeking to conduct them in the best possible way.

Several factors should be assessed to define changes in interest rates, according to Assaf Neto (2021), the Copom analyzes information from three distinct categories: the environment, which involves studies on economic activity, public finances, general price indices and other relevant indicators. In the context of the foreign exchange market, the assessment of the external economic environment, exchange market behavior and the management of international monetary reserves, among other aspects, takes place. The financial market incorporates the analysis of the banking system's liquidity, the behavior of open market operations, and other relevant elements.

As stated on the Bacen website, the Copom is the collegiate body, formed by its President and directors, and has as one of its fundamental tasks the definition of the basic interest rate of the economy, Selic. Meetings culminating in the setting of such a rate occur every forty-five days, usually take place on two consecutive days, and the calendar of meetings for a given year is disclosed by the month of June of the previous year.

The Assembly of the Copom is following a process which seeks to base its resolution in the best possible way. The members of the Copom attend technical presentations of the functional body of the Bacen, which address the evolution and perspectives of the Brazilian and world economies, the liquidity conditions and the behavior of the markets. In this way, the Committee uses a wide range of information to support its resolution. Subsequently, the meeting is reserved for discussion of the decision among the members. The resolution shall be based on an assessment of the macroeconomic scenario and the main risks associated with it. All members of the Copom present in the assembly vote and their votes are cast. The resolutions of the Copom are aimed at ensuring that inflation measured by the Broad National Consumer Price Index (HICP) is in line with the target set by the National Monetary Council (NMC). After the meeting, the Copom's determination is made public on the same day as the resolution by means of internet communication. The minutes of the Copom meeting shall be published within four working days of the date of the meetings. Once the Selic rate is set, the Bank acts daily through open market operations – buying and selling federal government securities – to keep the interest rate close to the value set at the meeting[1].

2.3 INTEREST AND ITS IMPACT ON THE BRAZILIAN ECONOMY

The interest rate is known to have a significant impact on all areas of the Brazilian economy, influencing consumption, investments, inflation and foreign exchange. This has consequences in the short and long term, affecting the decisions of economic agents in relation to saving and investment, and these factors are decisive for the formation of interest rates in the economy. Therefore, it is by means of the Selic rate that the other interest rates are defined. In the vision of Lisbon *et al*. (2006), the interest rate is linked to the interaction between supply and demand of currency. When there is an abundance of money available on the market, the interest rate tends to decrease, signaling a greater propensity of people to save at the expense of consumption. This excess of money reduces the need to look for loans. By contrast, if money supply decreases and people need loans to complete their expenses, the

[1] Available at: https://www.bcb.gov.br/controleinflacao/copom. Accessed: February 06, 2024.

interest rate tends to increase. This implies that prices of goods and services may remain stable for a time until the market finds alternatives to adjust the current situation

2.3.1 Effect of interest rates on different economic sectors

The interest rate is a central component in economic dynamics, having a direct impact on consumer, corporate and investor decisions. Its fluctuations, determined by a complex interaction of factors, shape the economic scenario. In addition to the stage of the business cycle, fiscal policies, working conditions and external shocks, future expectations, the level of indebtedness, monetary policy and globalization also play crucial roles. This complex interconnection between interest rates and economic factors creates a dynamic environment, where decisions in one sector reverberate throughout the economy.

When interest rates are low, credit and consumption are stimulated, on the other hand, when interest rates are high, credit is tightened, affecting the propensity to consume. According to Bodie, Kane and Marcus's analysis (2010), tax policy is identified as a more direct method to accelerate or slow the economy, with the reduction of public spending directly impacting demand for goods and services, while the increase in income tax rate results in an immediate reduction in consumer income, leading to a rapid drop in consumption. While fiscal policy acts directly to boost or slow down the economy, monetary policy exerts its influence primarily through the impact on the interest rate. The expansion in the supply of money, for example, results in a reduction in the interest rate, encouraging the demand for investments. As the amount of money in the economy increases, investors perceive excess liquidity in their securities portfolios, leading to a rebalancing through the purchase of securities, such as debt securities, which in turn raises the prices of those papers and lowers interest rates. Over a longer period of time, investors can expand their stock positions and acquire real assets, providing a direct stimulus to consumer demand.

Selic, as a reference for the other interest rates in the Brazilian economy, plays a crucial role in the effects on the exchange rate and inflation. When the interest rate is reduced, the opposite behavior is observed in both the exchange rate and inflation, thus influencing the economic landscape comprehensively.

In the exchange rate context, the decrease in interest rates tends to make Brazilian assets less attractive to foreign investors. This results in a reduction of foreign currency inflows into the country, putting pressure on the local currency devaluation. In contrast, when interest rates are higher in Brazil, Brazilian assets become attractive to foreign investors in search of higher returns, which stimulates a greater circulation of foreign currency. Thus, when the interest rate rises, the real tends to value in relation to the dollar, reducing the cost of imports. However, the currency appreciated may make Brazilian exports more expensive to other countries, negatively impacting the exporting sector.

In the context of inflation, the rise in interest rates tends to slow it down. When Bacen seeks to reduce inflation, it increases the Selic rate, making loans, financing and consumption more expensive. The reduction in consumption, in turn, puts pressure on a rise in prices, contributing to the economic downturn. On the other hand, the lowering of the basic interest rate stimulates consumption and investments, boosting economic activity.

Since 1999, Brazil has adopted the inflation target regime as a strategy to keep inflation under control, with the economy's basic interest rate being the main instrument used to achieve these goals. The regime's choice of inflation targets reflects the quest for a delicate balance between controlling inflation and sustainable economic growth.

2.4 ECONOMIC CYCLES AND THEIR RELATIONSHIP WITH INTEREST RATES

Economic cycles are characterized by fluctuations in economic activities over time and one of the factors influencing economic cycles is changes in interest rates, playing a crucial role in financial decisions in a number of sectors, from monetary policy to individual investment choices. In addition, government policies, such as fiscal and regulatory measures, can play a significant role in managing economic cycles to stabilize and promote sustainable growth. According to Roque (2009), the origin of interest can be associated with the temporal preference of individuals, indicating the amount of savings available for investment in a free market. This relationship between interest and savings is fundamental even in a monetary economy, where savings continue to be a reflection of the abundance of goods. However, when an institution such as a central bank intervenes, interest is manipulated, triggering recurring business cycles.

Economies that conduct an in-depth study of interest rates and interest curves not only enrich economic theory, but also empower economic agents to make strategic decisions. Understanding these concepts is a powerful tool for dealing with economic and financial challenges, allowing for more efficient management of financial resources in different contexts. Moreover, globalization and interconnections between economies also play a crucial role, as events in one part of the world can have significant impacts on other regions, influencing economic cycles.

2.5 INTEREST CURVES

The interest curve that is also known as the *yield curve*, forward curve and forward structure of interest rates (ETTJ) is a visual representation that illustrates the dynamics between interest rates or yields with respect to the maturities of securities and financial instruments. This representation provides information on how interest rates evolve over time, playing a crucial role in the financial market.

Since the discovery of the structural relationships between interest rates and the time horizon, several researchers have dedicated themselves to exploring this theme, analyzing the connections between long term and short term interest rates. These analyzes range from scenarios in emerging economies to in – depth analyzes in first – world countries, providing a comprehensive picture of interest rate behavior in various contexts.

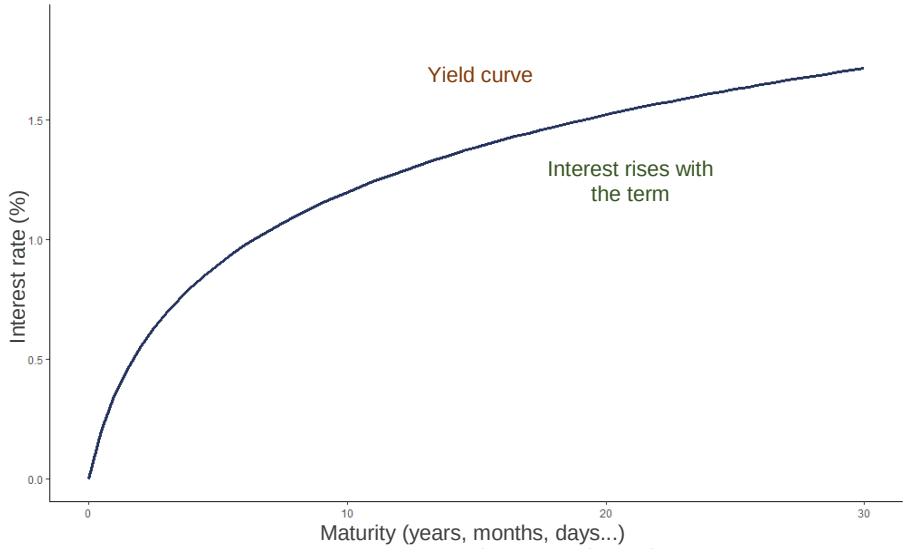
2.5.1 Conceptualization and construction of interest curves

It is crucial to stress that the interest curve plays a crucial role for investors, fund managers, financial institutions and monetary authorities. This is a graphical representation that illustrates the relationship between interest rates and maturity of fixed-income securities. This representation not only reflects current market conditions, but also incorporates participants" expectations for future interest rates. In addition, the interest curve has a significant influence on investment decisions and monetary policy strategies. As outlined by Assaf Neto (2021), the ETTJ is characterized by the relationship between interest rates and maturities. Different maturities of securities show different interest rates, denominated as income at maturity. The observation of

yields on securities with several maturities at a specific date makes it possible to graphically represent this relationship by means of the yield curve.

The specific shape of the interest curve may vary depending on economic conditions and market expectations. The curve can be ascending, descending, or flat. An upward interest curve (Figure 1) indicates that long-term interest rates are significantly higher than short-term ones, which generally suggests expectations of economic growth. A downward interest curve (Figure 2), on the other hand, may indicate expectations of economic downturn.

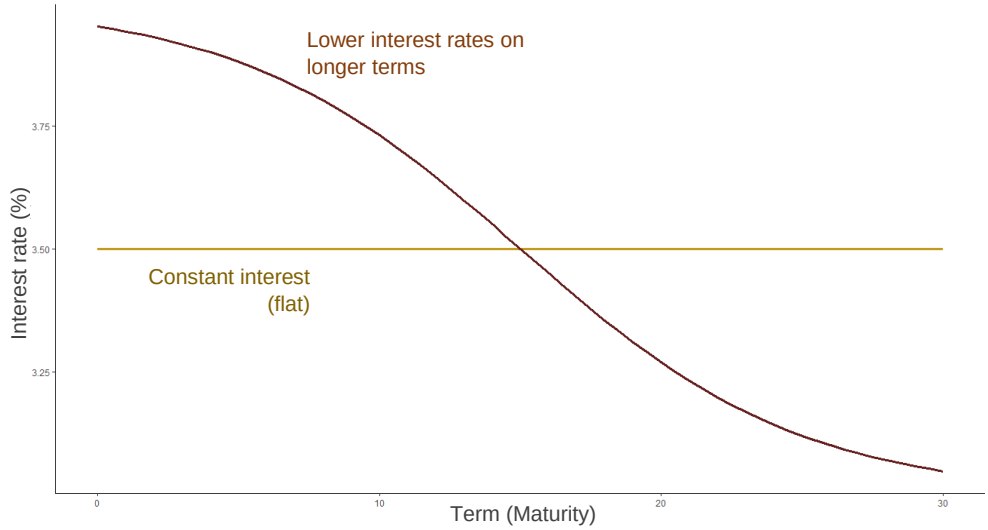
Figure 1 – Upward Yield Curve



Source: Own Development (2024)

Figure 1 illustrates an upward interest curve in which interest rates rise as maturity increases. This reflects the expectation of imminent economic growth. An upward interest curve indicates an optimistic outlook for the economy, with more favorable growth expectations and investment opportunities on the horizon. Investors see this as a sign of rising inflation and better investment opportunities. This increase in long-term interest rates may also indicate that investors are willing to take more risks, betting on continued economic growth.

Figure 2 – Downward and Constant Yield Curve



Source: Own Development (2024)

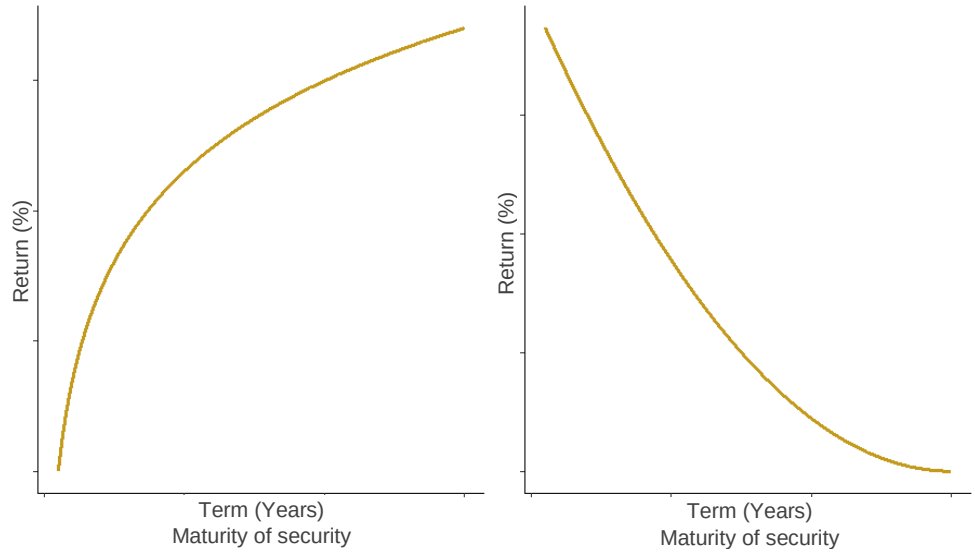
From the analysis of Figure 2, it is possible to identify the curve that indicates lower interest rates at longer maturities, characterized by a downward or inverted structure, in which short term interest rates surpass long term ones. This momentum raises concerns among investors, indicating the possibility of a reduction in interest rates in the future. The reversal of the interest curve is often interpreted as an early indicator of an impending economic downturn. On the other hand, the *flat* curve exhibits constant behavior, evidenced by the uniformity of interest rates at various maturities.

2.5.2 Difference between normal and inverted interest curves

In the complex universe of the financial market, interest rates play a crucial role in determining the time value of money. These rates, when organized according to their maturities, provide the basis for the formation of the so-called "interest curve" that reflects the relationships between interest rates and maturities, revealing essential nuances for the understanding of economic conditions, the most observed are a crucial tool for investors, policymakers and economic analysts, are the normal curves and an inverted curve that makes possible the anticipation of changes in economic conditions and enables market agents to take decisions. Below is the clarifying analysis by Assaf Neto (2014) on the normal and inverted interest curves, as well as their applications in the context of the financial market:

> A fairly common way of expressing interest behavior in the market is through the temporal structure of interest rates, which relates the income (interest) on securities and the time to maturity of the securities. This time structure should be established for asset classes with similar risks. The rate – maturity relationship is established graphically by the yield curve. (*Yield Curve*) This curve, which reflects the yield of the bond with the time remaining until its maturity, is changing as the behavior of the market changes. The relationship between the maturity of a transaction and the interest rate is called the forward structure of interest rates (Assaf Neto, 2014, p. 93).

Figure 3 – Yield Curve



Source: Own Development (2024)

The curves shown in Figure 3 portray distinct dynamics in interest according to the maturity of the securities. While the first yield curve shows an upward slope, indicating an increase in interest rates for longer maturities due to the higher associated risk, where investors demand higher returns due to the longer maturity and increased investment risks, the second curve illustrated shows an inverted curve, suggesting short – term interest rates higher than long – term ones. An inverted interest curve may indicate expectations of an economic downturn, causing short-term investments to pay a higher return than long-term securities, worrying investors, since long-term securities present greater risks and consequently higher returns. In this way, an inverted interest curve can set off a warning in the economy.

2.5.3 Key theories explaining changes in interest curves

In the financial market context, the determination of interest rates is a crucial aspect that impacts investment decisions, the cost of capital and thus the functioning

of the economy as a whole. Several theories have been proposed over time to explain this complex phenomenon, among them the Unbiased Expectations Theories, Liquidity Preference and Market Segmentation. Each of these approaches offers a unique perspective on the mechanisms that shape interest curves, providing a more comprehensive understanding of the financial environment.

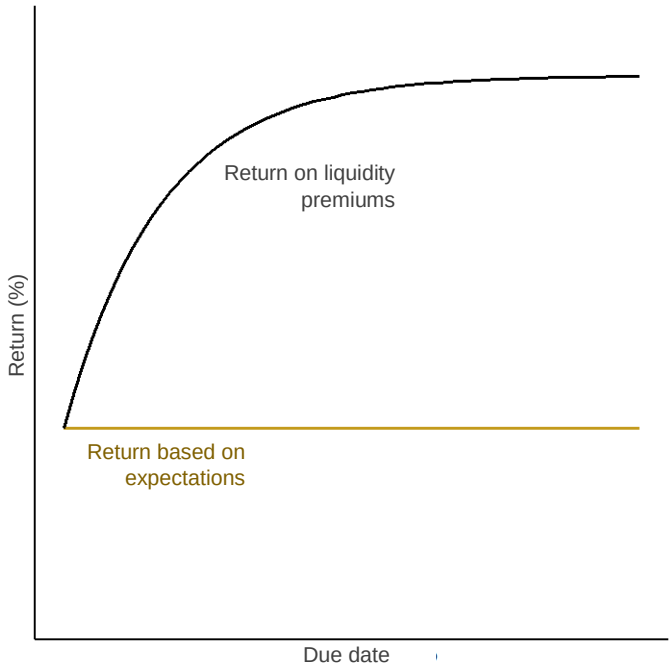
The Theory of Expectations plays a key role in economics and finance, especially when considering interest rates. Economic agents form their expectations based on available information, analyzes of past data and future projections. The expectation of future interest rates is crucial in determining present interest rates. If market participants believe that interest rates will rise in the future, long-term interest rates may rise, even if short-term rates remain unchanged. This relationship between expectations and interest rates highlights the dynamic influence that future projections exert on the financial environment. Assaf Neto (2014) considers that according to the proposed theory, the long-term interest rate is formulated as a geometric average of short-term interest rates, considering both current rates and projections for the whole maturity horizon. In summary, the theory argues that the expected interest rate for the same period does not vary independently of the maturity of the assets. In that context, the interest rates to maturity of the security are then established on the basis of short – term interest rate expectations. That wording presupposes neutrality of investors in relation to risk.

According to the theory of liquidity preference proposed by Keynes (1996), it highlights the importance of liquidity, i.e. the availability of cash and assets easily convertible into cash, in the choices of economic agents. The preference for liquidity is delineated for transactional, precautionary and speculative reasons, directly influencing demand for money and levels of economic activity. According to Lopes and Rossetti's analysis (2002), Keynes's conceptions of motive-speculation are easy to understand, but for their formalization it is necessary to resort to expressions of financial mathematics. The fundamental basis of the Keynesian approach is the idea that it is not irrational for economic agents to keep monetary assets inactive pending changes in the prices of securities or, equivalently, in interest rates. The expectation of a decline in the prices of securities and the subsequent increase in interest rates make possible speculative gains that, although risky, may contribute in a positive

manner to the expansion of the wealth of the economic agents that acquire securities during the phases of the fall in their prices and sell them afterwards at higher prices

The Liquidity Preference Theory is fundamental to understanding fluctuations in demand for money, in interest rates, and consequently in economic activity. depending on the economic situation and interest rates, people may prefer to keep more or less money. If interest rates are high, people may prefer to invest in things that earn more. If interest rates are low, they may prefer to keep more money on hand. Thus, to encourage investors to commit their resources for longer periods, it is necessary to offer additional compensation by assigning a risk premium to long-term securities. According to the interpretation of Assaf Neto (2021), liquidity theory suggests that long-term assets should provide higher returns compared to short-term assets, even when reinvesting consecutively in short-term assets until maturity. Liquidity in this context is characterized by the speed with which an asset can be converted into cash, minimizing losses on the transaction. It is worth noting that the liquidity preference theory exclusively describes an upward yield curve. Although other factors related to economic policy may influence the natural imbalance of interest rates in the Brazilian market, it is concluded that the cyclical disparity, where the short-term cost of credit is higher than the long-term, represents a temporary mismatch, with the likelihood of disappearing when the economy realigns its balancing guidelines.

Figure 41 – Returns and Liquidity Premiums



Source: Own Development (2024)

Figure 4 presents the graph that illustrates the return curve based on the expectation theory that is set in a straight line, because the theory does not consider uncertainties about future rates, assuming that no changes in future interest rates are expected. The return curve with the liquidity premium highlights the need for investors to demand extra compensation due to the risk taken at longer maturities, so the curve adopts a positive slope.

The theory of market segmentation is also highlighted as an additional perspective in understanding the determination of interest rates. This theory argues that different segments in the bond market have their own supply and demand curves, influenced by the maturity of the bonds, disregarding expectations of short-term rates. This approach influences the determination of interest rates, especially in the financial and banking markets. Credit risk in different segments leads to adjustments in rates, while competition between financial institutions can also directly influence these rates, motivating adjustments to attract customers.

In addition, monetary policies, banking regulations, and fiscal policies are shaped by an understanding of the characteristics of each segment proposed by the theory of market segmentation. Thus, this approach offers a distinctive and valuable insight into the comprehensive determination of interest rates, simplifying the understanding of this complex economic phenomenon. Assaf Neto (2021) presents the theory of market segmentation by claiming that economic agents have different preferences regarding the maturity of assets and interest rates are freely determined by supply and demand mechanisms in each time segment of the market. The existence of fundraising agents and fundraisers with specific preferences regarding the maturities of transactions results in a segmented market based on the maturity of assets, where interest rates are set for each segment. The interplay between supply and demand, mediated by creditors and debtors, shapes short and long – term interest rates, and disparities may occur between market segments. Segmentation theory is criticized because of the current ability of economic agents to compare short and long-term interest rates in advance and to access markets that offer future interest rate projections, allowing agents to opt for a specific segment of the market they find more attractive.

2.6 FINAL CONSIDERATIONS

The chapter provides a comprehensive analysis of interest rates and interest curves, initially exploring the origin and theoretical function of interest, considering the contributions of major economic schools such as Classical, Keynesian and Neoclassical, as well as the function of interest in the economy. Later, he highlights the importance of the Interest Rate and its impacts, explaining the differences between Nominal and Real Interest, and emphasizes the determinant role of Selic and Copom in the formation of the other interest rates. In the Brazilian context, analyzes of interest rates are carried out in various sectors of the economy, as well as how these rates influence consumption, investments, inflation and exchange rates, offering an understanding of how interest rates influence economic dynamics in the national ambit, is also carried out a study referring to the economic cycles and their relations with interest rates, including the view of different scholars of the subject.

After a broad exposure about the interest rates, their origin, importance and impacts, the chapter delves deeper into the analysis of the Interest Curves, exploring these curves in detail, including with the presentation of graphs for a clearer visual understanding. The chapter not only differentiates between normal and inverted curves, but also introduces crucial theories, such as Theory of Expectations, Preference for Liquidity and Market Segmentation, fundamental in determining interest rates.

We conclude that understanding interest rates and interest curves is key to effective economic analysis and decision-making. This chapter provides the tools needed to assess the impact of interest rates on economic dynamics and to interpret economic forecasts on the basis of interest curves. Further elaboration on these concepts is crucial for robust financial analysis and for the development of effective economic and policy strategies.

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CHAPTER 2

SUPPLY CHAIN ANALYSIS: THE CASE OF AN OLIVE COMPANY

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ABSTRACT: This research aims to analyze the OlivoPampa organization supply chain. It analyzes the four elements of the Supply Chain Management proposed by Aragão *et al*. (2004). In order to achieve that, a descriptive analysis is used, with a qualitative approach, through the case study method. Data was collected using semi-structured interviews, field diary and observation methods. The analysis of the results allowed us to identify the business processes used by the company, as they were built over time, there is access facilitation, due to the similarity with the wine supply chain. Regarding key members, the company has a long term partnership relation with suppliers, that chooses the supplier with the shortest delivery time. In addition, the company has good relationship with customers, who are attracted by reliability, product diversity, innovation, and the belief that performance could be improved. OlivoPampa does not share information with suppliers about stock and forecast purchases, since the sharing of information regarding future sales is done when necessary. The performance indicators used by the company are based on the number of complaints, order increase flexibility and stock level. In this way, it is possible to help the company OlivoPampa to have a more refined look at the supply chain, improving the management of the organization and its own supply chain, since the business relevance for Santana do Livramento county.

KEYWORDS: olive growing, supply chain, business process integration, information sharing, performance measurement.

RESUMO: A pesquisa tem como objetivo analisar a cadeia de suprimentos da organização OlivoPampa. São analisados os quatro elementos da Gestão da Cadeia Suprimentos propostos por Aragão *et al.* (2004). Para tal, emprega-se uma análise descritiva, com abordagem qualitativa, por meio do método de estudo de caso. Os dados foram coletados a partir de entrevistas semiestruturadas, diário de campo e observação. A análise dos resultados permitiu identificar os processos de negócios utilizados pela empresa, sendo estes construídos ao longo do tempo, existe facilitação no acesso, pela semelhança com a cadeia de suprimentos do vinho. No que se refere aos membros-chave a empresa tem relação de parceria com fornecedores, esta é de longo prazo, escolha do fornecedor com menor prazo de entrega. Além disso, possui boas relações com seus clientes, os quais são atraídos pela confiabilidade, diversidade de produtos, inovação e acredita-se que o desempenho poderia ser melhorado. A OlivoPampa não compartilha informações com fornecedores sobre estoque e previsão de compras, já o compartilhamento de informação de previsão de vendas futuras é realizado somente quando necessário. As medidas de desempenho utilizadas pela empresa são o número de reclamações, flexibilidade de aumento de pedido e nível de estoque. Desta forma, é possível auxiliar a empresa OlivoPampa a ter um olhar mais afinado na sua cadeia de suprimentos, melhorando gestão da organização e de sua própria cadeia de suprimentos, pois sabe-se a importância do negócio para o município de Santana do Livramento.

PALAVRAS-CHAVE: olivicultura, cadeia de suprimentos, integração de processos de negócios, compartilhamento de informação, medição de desempenho.

1. INTRODUCTION

Brazilian agribusiness is increasingly recognized, as it has established itself over the last 25 years as the world's largest net exporter of agricultural products (balance of imports and exports) (Portal do Agronegócio, 2022). Its aim is to meet domestic demand and gain a foothold in foreign markets. It is proving to be a very strong industry, breaking export records in April 2020 (Marcelino; Sverzuti; Trizolio, 2020).

Among the states of Brazil, Rio Grande do Sul (RS) stands out, which contributed 11.5% of the country's total Gross Value Added (GVA), ranking second nationally in 2018 (Feix; Leusin Júnior; Borges, 2021). In addition to the diversification offered by viticulture (Da Silva *et al*., 2019), there are also olive groves in the south of RS. The olive tree (*Olea europeia L. subepecie europaea*) is an arboreal species of plants from the *Olaceae* family, this family is made up of more than 20 genera and is a species native to the South Caucasus (Iran, Syria and Palestine) (Tejero; Da Rosa, 2020).

In this way, supply chains in the olive sector can form a complex network with several players (Rodrigues, 2013). Agro-industrial supply chains, like olive oil supply chains, can be conceptualized as a network of organizations responsible for a series of interlinked processes that guarantee the availability of agricultural production (Batalha, 2021).

Olive-growing supply chains are relatively new in the state of Rio Grande do Sul, as olive-growing is in its expansion phase and olive-growing centers are being formed, from the planting of new groves to the production of high-quality olive oils. From 2000 onwards, a growing number of business movements interested in olive oil production decided to invest in growing olive trees and have their own production in Brazil (Pró-Oliva, 2022).

Specifically, in the municipality of Santana do Livramento, Rio Grande do Sul, on the border with Uruguay, there are a number of companies working in the olive-growing sector, one of which is OlivoPampa. This is a privately-owned family business that operates at various stages of the olive production chain, from propagating seedlings to marketing the oil (OlivoPampa, 2022).

In addition, the company is able to produce the oils from the year's harvest in the olive grove with its own machinery. As a result, the gains in the quality of the oils produced have been very significant. It is worth highlighting the existence of a

corporate name, Olivopampa Indústria e Comércio de Produtos Olivícolas Ltda. In addition to the varietal garden, nursery and production of olives (table and olive oil), the company was a pioneer in Olivo-tourism, investing in a differentiated structure for visitors, as well as offering personalized service (OlivoPampa, 2022).

Given this context, the research seeks to answer the following question: How is the OlivoPampa organization's supply chain structured? The general objective of this work is to analyze the supply chain of the OlivoPampa organization. Specifically, it seeks to analyze the integration of business processes along the supply chain, identify the key members of the supply chain, analyze how information is shared between the agents and verify the appropriate performance measures for the chain.

In theoretical terms, this work aims to replicate the research of Aragão *et al*. (2004), who created a model for analyzing supply chains, specifically for chains of vehicular natural gas storage cylinders. The model will be applied to an organization in the olive-growing sector in the city of Santana do Livramento (RS), OlivoPampa. The aim is to provide feedback for improving the management of the organization and its supply chain, as well as pointing out the specificities of the sector. As the implementation of this cultivation is recent, there is limited information available, which makes supply chain management difficult (Da Silva *et al*., 2019).

It is worth noting that there has been work carried out and published in the region on olive growing. Saueressig (2018) analyzed the development of olive growing in RS, as well as its potential and challenges. Saueressing, Pinto and Schultz (2019) researched the development of olive growing in RS, from the perspective of the formation of the agro-industrial system. Da Silva *et al*. (2019) looked at olive growing in the south of the country by studying the profile of producers and their motivations for boosting production. Tejero and Da Rosa (2020) analyzed the potential of olive growing in southern Brazil. However, no research has been identified that specifically analyzes olive growing in the municipality of Santana do Livramento, or research into its supply chain.

The evolution of olive growing in the region deserves to be highlighted, as it develops a production chain made up of input suppliers, producers, industry, retail and consumer markets, with the aim of contributing to local economic development (Saueressig; Pinto; Schultz, 2019). It is important to highlight the existence of limited local olive research, the small number of registered cultivars, partially adequate

legislation and inspection, as well as the absence of sensory inspection and a lack of references (OlivoPampa, 2022). The choice of subject is therefore justified by the importance of the business in Santana do Livramento and the scarcity of studies exploring olive growing in the region.

This article is structured in five sections, including this introduction. The second section, Theoretical Framework, summarizes the concepts of supply chain management. The third section, Methodological Procedures, outlines the main techniques used in the research method. In the fourth section, Analysis and Discussion of Results, the main results are analyzed. Finally, in the fifth section, Final Considerations, the study's considerations are presented.

2. THEORETICAL FRAMEWORK

The theoretical framework presented below is based on the most important topics in the literature related to this research topic. This topic is divided into two blocks: the first discusses definitions of Supply Chain Management and the Elements of Supply Chain Management and the second discusses Supply Chain Management in Agribusiness.

2.1 SUPPLY CHAIN MANAGEMENT

Operations management and supply chain management are important factors in improving the productivity of companies around the world. Building a creative advantage through operations requires an understanding of how operations and supply chain functions contribute to productivity growth (Jacobs; Chase, 2012).

The historical framework that gave rise to the term Supply Chain Management (SCM) is not defined in the literature. According to some authors, the term SCM was first introduced by business consultants in the early 1980s. Other authors point out that the term has been used since the 1970s to denote the necessary integration between warehousing and transportation in the distribution process (Evans; Danks, 1988; Lambert; Cooper; Pagh, 1998; Lima 2022).

However, other authors argue that SCM has been practiced for decades, but under different names and with different degrees of integration. Regardless of when

the term emerged, the fact is that it has attracted the interest of scholars since the mid-1990s (Pires, 2016).

SCM is a natural evolution of the concept of logistics. Logistics represents internal integration, includes the supply of materials and components, the movement and control of the product and support for the sales effort of the final product until the finished product is placed with the consumer (Dias, 2019). Supply chain management represents its external integration, as it encompasses the activities of the flow of materials and information to global suppliers and end customers (Paoleschi, 2014).

Since its creation, SCM has been confused with logistics. Some company executives who have implemented SCM understand that it covers a wider range of processes and functions than logistics (Pires, 2016).

Supply chain management is considered to be the method of effectively integrating suppliers, manufacturers, warehouses and commercial establishments to produce and distribute goods, in the right quantities and within the right timeframes, to delivery points, with the aim of minimizing total system costs and meeting service level requirements (Levi, 2010). For this study, the focus will be on Supply Chain Management, more precisely on the elements of Supply Chain Management.

Supply chain management can be understood through a number of elements, such as business processes, key members, information sharing and performance measures (Aragão *et al*., 2004).

In a supply chain, the purchasing, Production Planning, Scheduling and Control (PPCM), engineering, marketing, quality, finance and production sectors need to work in an integrated manner, making information available in real time so that the production process can turn inputs into outputs quickly. This flow of information will give companies the flexibility to respond quickly to customer needs and generate new business (Paoleschi, 2014).

With this, the business process is implemented as a management tool for the company, with concepts that help organize and achieve strengths. In this sense, it seeks competitiveness and improvement of internal processes, reducing failures and costs. A business process can therefore be defined as a set of dynamically coordinated activities or tasks, which must maintain a logical relationship. Activities must be carried out in order to deliver value and satisfaction to customers (Trkman, 2010).

According to Santos and Forcellini (2012), the supply chain business process is influenced in various ways, which can be by the product, the stage of the life cycle, changes in customer needs, the introduction of new technologies, regulatory pressure, market competitors, among others.

Due to the breadth and complexity of supply chains, in some cases integration and management can become difficult. In this approach, companies have understood that business processes are not just supply chain logistics processes, but all business processes. Thus, the business process has become supply chain business processes, going beyond the boundaries of the company and therefore must be managed as such (De Brito Braga; Leopoldo, 2019).

It is important to emphasize that the management of supply chain processes takes place at two levels, strategic and operational. The first is carried out by a cross-functional team, in addition to establishing a process that defines how strategic management will take place. At the second level, the processes are carried out by the managers of each functional area (Croxton *et al*., 2002).

For Pesca *et al*. (2015), improving processes and available resources, through appropriate and integrated mapping, reduces lead time, which brings together concepts related to time intervals from the order received to delivery, which can include several steps in between, such as production, shipping, storage, administration activity (Disney *et al*., 2016), avoiding waste and ensuring efficiency. By identifying the process, a path can be defined to reduce time and cost.

According to Lambert; Cooper; Pagh (1998), describing, analyzing and managing the supply chain can occur from its horizontal, vertical or supply chain structure (Costa *et al*., 2012).

The horizontal structure represents the number of levels in the supply chain, while the vertical structure refers to the number of suppliers or customers that connect at each horizontal level of the supply chain and the positioning of the focus company in the supply chain is directed by its proximity to suppliers and customers (Dos Santos *et al*., 2020).

Therefore, it can be mentioned that the main members of the supply chain are called primary and secondary. Primary members are companies fully affiliated with the production of the main product in the chain and secondary members are important for

productive processing in the production chain, but do not carry out value-producing tasks for the end consumer (Talamini; Pedrozo; Silva, 2005).

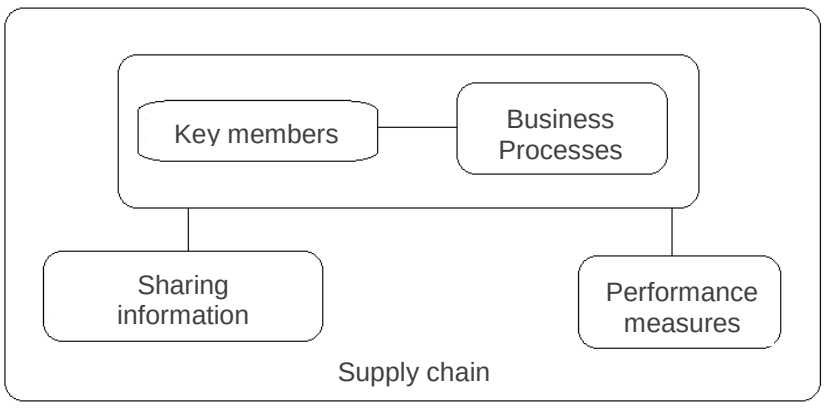
Both information on traffic consolidation and the integration of materials are important for the supply chain. At the same time, it is considered a difficult task, as it involves many aspects of hardware and software management, thus providing information exchange and support for logistics integration activities related to the physical flow of matter between members. These complex problems can only be managed where there is a long-term relationship between the members of the chain (Prajogo; Olhager, 2012).

According to Lotfi *et al*. (2013), sharing information within the chain can generate some challenges, such as the confidentiality of the information shared, the motivating questions, the reliability and cost of information technology, and timeless and accurate information. In addition, it is necessary to develop the capacity of companies to use information effectively.

Performance measurement is designed to promote understanding and integration between members of the supply chain. You can measure the efficiency and effectiveness of a process and acquire a basis for taking actions that are essential to ensuring the success of the SCM (De Brito Braga; Leopoldo, 2019). In this sense, the supply chain needs to employ performance indicators that demonstrate reality and provide information to managers (Savaris; Voltolini, 2004).

According to Waggoner *et al*. (1999) performance evaluation in the chain allows managers to monitor performance, identify areas that need attention, increase motivation, improve communication and strengthen the financial health of their company.

Figure 1 – Supply chain diagram



Source: Prepared by the author.

Figure 1 provides a schematic representation of a supply chain model and its variables. The key members may vary depending on the business process being reviewed. Therefore, business processes and key members must be integrated into the analysis. These are linked to performance measurement and information sharing to form a supply chain model.

After a brief description of Figure 1, the next section presents supply chain management in agribusiness.

2.2 SUPPLY CHAIN MANAGEMENT IN AGRIBUSINESS

According to Batalha and Silva (2014), agriculture has started to become dependent on other departments that can guarantee the production, processing and distribution of food. For these authors, it should be understood as part of a wider system which includes the input industry, rural producers, agro-industries and companies responsible for distributing and marketing products.

Thus, faced with the complexities of the new environment, the old divisions between agriculture, industry and services have lost their meaning. Marked by a series of events and actions worldwide, agricultural development in Brazil was at its most intense in the 1970s, when food stocks were needed to increase animal feed, especially in the European and North American markets. This gave less developed countries the opportunity to take advantage of their economic development by supplying these products (Teixeira; Cunha; Terra, 2012).

The so-called rural enterprise in transition uses some management and production techniques because the market is perceived in different ways with greater emphasis and demands. With this requirement and perceived level of competitiveness, it increases from moderate in the long term. Typically, these properties are part of an organized supply chain, i.e. they are links in the chain in question (Nantes; Scarpelli, 2014).

Over the years, the definition of supply chain management has changed and its scope has expanded. However, these definitions are still generally limited to manufactured goods and services, with little focus on agribusiness. The composition of agricultural products is an important part of the Brazilian and world economy with respect to raw materials for many industries (Machado *et al*., 2018).

Brazilian fruit growing has been experiencing its best moments, both because of the wide variety of production in different regions of the country and the most diverse types of climate, as well as with the increase and presentation in industrialization, leaving fruit in a prominent place in agribusiness. With the efficient planting and tracking system, acting in conjunction with socio-environmental responsibility, thus boosting the export of production chains and expanding the supply of fruit to the Brazilian population (Machado *et al*., 2018).

The importance of agribusiness is explicit in the projection to 2027, which shows a 24.2% increase in cereal harvests compared to current levels, taking into account incentives for new investments and greater government promotion, as well as greater productivity and diversification. In addition, the state has seen a diversification of agriculture, such as grape growing, which has become a local alternative for the north of RS, more recently for the south of RS, and has produced some important and award-winning wineries in the country (Da Silva *et al*., 2019).

In addition to the diversification offered by viticulture, there are also olive groves in the south of RS. The olive tree (*Olea europeia L. subepecie europaea*) is an arboreal species of plants from the *Olaceae* family, this family is made up of more than 20 genera and is a species native to the South Caucasus (Iran, Syria and Palestine) (Tejero; Da Rosa, 2020).

One of the characteristics of olive growing is its medium to long-term economic return. Trees start bearing fruit from the third year and reach their maximum potential only from the eighth, usually when they can reach 15,000 kg per hectare. The longevity of olive groves means that harvesting is still possible at the age of 70 (Cardoso; Dias, 2018).

In this way, supply chains in the olive sector can form a complex network with several players. In addition to understanding the network, there is the buyer-seller link, which must be in sync, from a perspective that goes beyond the boundaries of the company, optimizing the cost-benefit ratio of the chain (Rodrigues, 2013).

Based on this outline, the methodological procedures will be specified in the next section.

3. METHODOLOGICAL PROCEDURES

This section discusses the type of research, the method chosen and the data collection and analysis techniques. The research is descriptive in nature. Descriptive research seeks to understand the subject in question by analyzing and synthesizing ideas and concepts (Gil, 2012). It also aims to describe the characteristics of a population, phenomenon or experience (Severino, 2016). This study is based on a qualitative approach, which allows for the involvement of various practical procedures, such as interviews, personal experiences, life stories, among others, so that the research topic can be better understood through the researcher's explanation (Denzin; Lincoln, 2006).

The research method is the case study, which is an empirical investigation using an integrated approach to planning, collecting and analyzing data. When researchers wish to obtain information about a situation, the case study is generally used, emphasizing its importance to various stakeholders (Godói; Mello; Silva, 2010).

Yin (2010) defined three steps for carrying out a case study: the first step emphasizes using more than one source of evidence, not just one source; the second step deals with creating a kind of database, i.e. bringing together ideas from the case study report; in the third and final step, the author addresses the need to link and relate all the materials collected. In other words, the questions or interviews conducted, the data collected and the conclusions reached at the end of the study.

Furthermore, because they involve one or more units of analysis, case studies do not require a large sample selection or complex statistical calculations, and the results are impressive (Gil, 2009).

Yin (2010) identified five reasons for using the case study method. In this sense, this article used the case study because it represents a special case, since OlivoPampa has a differential in that it is a company, while the others are producers, dedicated to planting olive trees. In addition, the company has machinery and a coverage area for producers in the campanha region of the city of Santana do Livramento.

More Than one data collection technique has to be used in order to delve deeper and acquire details in order to compare them and verify their authenticity (Yin, 2010). This study used semi-structured interviews, non-participant observations and document analysis.

In semi-structured interviews, it is understood that the researchers have a starting point to follow, allowing conversations that are not completely scripted. Since there are questions and a predetermined order, they can be open-ended, but respondents are free to answer (Gil, 2010). The interviews were conducted in person and via Google Meet, and were recorded and later transcribed. A total of three members of the company were interviewed: the manager and two partners.

The interview script, Appendix A, was drawn up on the basis of Andrade (2021) and Aragão (2004). The interview was divided into five sections, the first contains questions about the interviewee's profile; the second is made up of questions related to the integration of business processes; the third aims to identify the relationship with key members, this is divided into two parts, the first addresses key supplier members and the second key customer members; the fourth is made up of questions to address information sharing between agents and the fifth seeks to identify performance measures used by the company.

Non-participant observation allows researchers to study and observe facts spontaneously, referring to a community, group or ongoing situation (Gil, 2010). Non-participant observation took the form of visits to the sector; there was no set number of visits; as many as were necessary for data collection were carried out. These were recorded in field diaries or observation logs. Observation records are a tool that can take on different hierarchies and can be open-ended, giving researchers freedom (Gil, 2019). Field diaries are considered to be self-reporting tools used repeatedly to verify a particular experience (Zaccarelli; Godoy, 2010).

According to Marconi and Lakatos (2021, p.44), “Direct documentation generally consists of collecting data at the place where the phenomena occur”. As a source of information for data analysis, the company's website was used, from which information can be extracted for the research.

Content analysis was used to analyze the data collected. It is applied to speech, as well as to written textual material constructed during the research, such as interview transcripts and observation protocols (Bardin, 2011).

Content analysis techniques are divided into three stages: 1) pre-analysis, 2) exploration of the material and 3) treatment of the results, reasoning and interpretation. Pre-analysis aims to build on the ideas proposed by the theoretical framework and establish evidence for interpreting the data collected. The exploration of the material

involves the construction of coding operations, considering the definition of counting rules, textual forms in registration units and classifications and sets of information in representative or thematic classes. Treatment of the results, reasoning and interpretation includes understanding the apparent and underlying content contained in all the material collected, such as interviews, documents and observations (Bardin, 2011). The following section presents the main results of this investigation.

4. ANALYSIS OF THE RESULTS

Below are the sections that make up the analysis and discussion of the results. The first section is a presentation of the case study, the second section a brief description of the profile of the interviewees. The third section deals with the identification of the business processes. The fourth section deals with the identification of key members. The fifth section deals with information sharing. The sixth section deals with performance measures and, finally, the seventh section presents a summary of the results.

4.1 CASE STUDY

The company under study is OlivoPampa, a family-run olive-growing company. Located in the Pampa Biome, in the municipality of Santana do Livramento, RS. Founded in 2008 with the acquisition of a rural property, the owners decided to invest in Santana do Livramento, RS (parallel 31 south), after looking for the best conditions for growing olive trees in Brazil. The company considered the successful wine-growing enterprises in the region to be important references, due to the affinity in soil and climate conditions that exist between olive growing and viticulture. The gently undulating topography, represented by the sandy coxilhas and surrounded by the beautiful “cerros”, constitute a striking landscape that harmonizes with the olive groves creating a privileged natural beauty (OlivoPampa, 2022).

OlivoPampa found it difficult to find seedlings of varieties suitable for planting in this area, due to climatic variables, and detected the need for seedlings that were more developed and resistant to the adversities encountered. Thus, in 2009, the seedling nursery and olive grove was created, which is pioneering and unique in the region. In

March 2014, the company produced its first olive oils from healthy olives picked by hand at their best point of maturity and processed as soon as they were picked. In 2015, after investing in their own modern mill, ideal for producing quality olive oils, they were able to produce the oils from the year's harvest in the olive grove. With this, the gains in quality were very significant, as the olives were processed in the olive grove within a few hours of being harvested. In addition to the nursery and the production of olives (table and olive oil), OlivoPampa is expanding into olive-growing tourism with personalized service for visitors (OlivoPampa, 2022).

The company has several areas of activity, such as the nursery, table and olive oil cultivation, agronomic consultancy in the planning, execution and management of olive groves, production of extra virgin olive oils under the Ouro de Sant'Ana brand, olive oil extraction services for third parties, dissemination of the world of olive oils and Olivo – Tourism. Its main products are olives, olive oils, handmade soaps and nuts (OlivoPampa, 2022).

After a brief presentation of the case study, the next section presents the profile of the interviewees.

4.2 PROFILE OF THE INTERVIEWEES

A total of three members of the company were interviewed: the manager and two partners. They will be named by numbers from 1 to 3. All three interviewees have been with the company since it opened. Interviewee 1 has a degree in agronomy, a master's degree in international administration and is the managing partner. Interviewee 2 has a degree in biology and is operations manager. Interviewee 3 has a degree in accounting, speech therapy and data processing and holds the position of accountant.

After a brief presentation of the interviewees' profiles, the next section discusses the identification of business processes.

4.3 IDENTIFYING BUSINESS PROCESSES

The application of the model presented by Aragão (2004) is based on the business processes of the supply chain. Once these processes have been identified,

the subsequent stages of the application will be linked to them. Therefore, the business processes chosen for supply chain analysis were customer relationship management and supplier relationship management.

Agribusiness supply chain management requires the adoption of strategies and engagement to improve the company's performance (Machado *et al*., 2018).

Through the interviews, it was possible to observe that there is no supply chain management process. According to Interviewee 1:

> Let's say that we have been building this business model over the years, our business model included a nursery to propagate seedlings, it included a plantation, we advised some producers in their beginnings, we limited it by the lack of, because it was a family project and it demanded a lot of time from us, we were decreasing the attention to third parties to focus more here inside. We made a business model to have table olives and olive oil, these two models. Now we've evolved into tourism. (Interviewee 1)

Meanwhile, interviewee 2 says: “we are a small company, we monitor stocks empirically”, and interviewee 3 adds: “we are a small family business, we do it empirically. When we run out of supplies, we order more”. Through observation, it is possible to confirm the descriptions given above: the company has a nursery, a plantation and a factory where the olives are processed.

The supply chain consists of all the links in a defined central production activity (Mendes *et al*., 2021). In order to implement partnerships or study the possibilities of alliances, it is extremely important to be clear about the current structure of the company's supply chain. When interviewed about the current structure of the GCS and its links, the interviewees answered that there is a sector that would be planting, which produces olives, then there is the olive harvest, which is what starts the whole process, then there is all the processing in tanks.

Once you know the structure of the supply chain and the processes that make it up, you have to pay attention to how to operate and manage the organizational, decision-making and management processes in terms of the principles, guidelines and standards used in organizational dynamics (França Filho; Rigo; Souza, 2020). It is worth noting that, during the interview, the interviewees shared that the dynamics of the operation of the different sectors of the company is carried out by three managers, as interviewee 1 reports:

> We have a group of managers who are three, the industrial area which is mine, the accounting area which is my wife (we also have an external accountant) and the technical area which is managed by my son-in-law. My wife also controls production at the factory. (Interviewee 1)

In the same vein, Interviewee 3 mentions that:

> We also have consultants that we hire when we need them, in the case of table olives, we hired a professional who works in the area and trained her, the law required us to have a technical manager, we trained her to help us with the handling and weighing of everything in this area. She comes here periodically. (Interviewee 3)

From the observation carried out, it is possible to confirm the descriptions given above, since in one of the observations the company was providing training with an experienced professional from Uruguay. Therefore, implementing advanced practices in different areas of supply management helps to improve results in the field itself and indirectly contributes to a company's success (Baptista; Nogueira; Alves Filho, 2018). As well as observing the current structure of the supply chain to visualize possible opportunities for improvement.

With regard to opportunities for improvement in the structure of the company's supply chain, the interviewees mentioned the need to implement the inventory control that already exists in Enterprise Resource Planning (ERP) and the use of a computerized supply system. ERP systems can simplify, organize and manage a company's activities by seeking to integrate its various activities, keeping them in a single place, in a single database (Brum, 2015).

There are various motivational factors for promoting supply chain management, but it should be noted that the motivation for promotion is intrinsic to each company (De Campos Almeida, 2022). In other words, each company adopts its own motivational factors for promoting supply chain management according to its reality, its goals and objectives.

In this case, Olivopampa knows what the motivating factors were for trying to carry out the promotion. During the interviews, it was reported that one of the motivating factors was the vision of an entrepreneur, since they consider themselves to be entrepreneurs. Interviewee 1 says: “There was no quality olive oil market, it was a lack in the Brazilian market [...] the high quality olive oil market segment was lacking, it didn't exist. So we bet on this market”.

Through the interviews, it was possible to see that the respondents consider the benefit of supply chain management to be its similarity and proximity to wine supply chain management. Supply chains that manage to build, coordinate and manage interactions with partners, committed to closer and more flexible relationships with end customers, will be more successful than their competitors. In fact, other elements stand out in collaborative management, such as the creation of an expanded vision of the chain, management of requirements in terms of planning and monitoring activities carried out throughout operations and propensity to a culture or suppliers (Vitorino Filho *et al*., 2016). According to interviewee 1: “[...] we are using a lot of what is already used for wine, which already exists here in the state, labor, stainless steel barrels or tanks, fillers, transporters, it's all there. It's a very accessible region. In other words, it could be suggested that access to these resources is facilitated by the very location of the wine chain.

Collaborative management in supply chains has been explored as integration between the links in the chain, sharing information with each other, with strategic objectives in terms of investment in new technologies, lower costs, higher quality, greater process flexibility and better delivery performance. However, it is considered important to evaluate the areas that make up the supply chain, thus verifying possible improvements or, in some cases, the replacement of this member by another (Vitorino Filho *et al*., 2016). When asked if there was any area of the supply chain that the company would like to improve, interviewee 2 commented: “we would like to make joint purchases with service customers and other producers”. In the same vein, interviewee 3 pointed out: “we intend to get a group of small producers together so that we can directly import the most important inputs such as bottles and caps”. In this sense, the vision of implementing partnerships and aligning its processes with: suppliers, production, distribution centers, retailers, wholesalers, warehouses and customers can be considered a supply chain strategy, seeking efficient management and integration between all the actors in the chain so that products are delivered at the right time, in the right quantity, in the right place, minimizing the total cost of the final product (Da Silva, 2018).

In addition to the motivational factors for promoting supply chain management being unique to each company, the use of management can generate strategic information for investment decisions, production rearrangements, storage locations,

new product development and sources of supply. Hundreds of companies are part of a complex and extensive network that includes various levels of suppliers and customers. In this context, organizations need to be increasingly attentive to risks of various kinds: external, internal, process and control and environmental risks (Brunnquel *et al*., 2018).

According to the literature, being part of a network in which there are several factors that can influence the construction of a supply chain requires a lot of attention to the environment and all kinds of difficulties that may arise. When asked what were the main difficulties they faced, the interviewees responded with a lack of support from the local government and a lack of access to local research. Interviewee 1 comments "...we rely a lot on research from the Uruguayan research center. Here, we've pretty much built on what we saw in Uruguay". Interviewee 3 added: "The main difficulty is with primary packaging, because the containers are imported and because we're small, we can't import directly from the manufacturers and we buy from local distributors, which is expensive". It is known that the primary packaging has the function of identifying the product, informing its corresponding characteristics, indicating how to use it and having a suitable appearance for its presentation. Packaging costs affect all logistics activities, from stock control to the way it is transported to its final destination (the consumer) (Paoleschi, 2014).

After discussing the business processes, the next section identifies the main key members of the chain.

4.4 IDENTIFYING KEY MEMBERS

The relationships that companies build with suppliers enable them to gain a competitive advantage over their competitors, add greater value to customers and increase customer satisfaction. It can be said that suppliers are highly important in almost all areas of industry. Since they are associated with the components that form the basis of every company's business activities (Gaspar, 2018). In this sense, interviewee 3 reports on the organization's good relations with its suppliers, "however, products are often in short supply and we are left without action". He also commented on the existence of these occurrences due to the COVID-19 pandemic. To avoid these situations, the company must choose a new supplier, look for as many suppliers as

possible and filter out the best ones. The possibility of always having three suppliers in a position to provide immediate service guarantees that the company will not run out of supplies (Paoleschi, 2014). Interviewee 2 adds:

> Most suppliers have remained the same since the beginning. The difficulty for them is the constant supply due to the absence of goods on the international market. (Interviewee 2)

The absence mentioned by interviewee 2 also refers to the COVID-19 pandemic, during which many import-dependent countries were severely affected. They import their needs from major exporters such as China, India and Japan, and rely heavily on these countries for their consumption needs. With China closing many export factories, fewer goods flowing through global supply chains and China's heavy reliance on imported goods has led to shortages in import-dependent countries (El Khatib, 2020).

Inter-organizational relationships are described as continuous transactions, i.e. relational negotiation. These are less concerned with financial results and more concerned with people and long-term relationships. They aim to provide benefit and burden sharing, and increase risk reduction in exchange relationships (Cislaghi *et al*., 2019). Based on this, when asked how they would classify transactions with suppliers, all three interviewees said that the relationship was a long-term partnership with all suppliers.

It is increasingly important to manage supplier relationships in order to make the supply chain competitive. With this in mind, the selection and development of suppliers has been consolidated as one of the main stages to be undertaken in the management of an organization (Campelo Filho; Barbosa, 2018). According to interviewee 2, one of the main criteria the company adopts for choosing suppliers is the best timeframe, as long as the cost doesn't vary too much. From the same point of view, interviewee 3 adds: “there are few options on the market, so we end up choosing the one that can serve us most quickly, provided, of course, that the cost is viable.”

Customer acquisition needs to be focused on relational and permanent aspects in order to keep them loyal and avoid losing customers who have already been won. Therefore, attention must be paid to service excellence, which is the starting point of this process (Las Casas, 2021).

When asked how their relationships with their main customers are, the interviewees commented that they are “generally good” and “simple, personal relationships with a lot of face-to-face contact”. Through observation, it can be seen that there is an informal, attentive and communicative relationship with customers at olivo-turismo.

Service excellence focuses on customer service. Excellent customer service is a set of activities carried out by market-oriented organizations to identify customer needs, seek to meet their expectations and create or increase their satisfaction (Las Casas, 2021).

In this sense, interviewee 1 comments:

> I think reliability, because the company can't let them down, we have good diversity, innovation, new and different products. We are always producing and innovating some kind of new oil. (Interviewee 1)

In the same vein, interviewee 2 comments that one of the criteria customers use to choose the products offered by the company is “the search for quality”, while interviewee 3 adds “I think price comes first”.

The next section discusses information sharing in the chain.

4.5 INFORMATION SHARING IN THE CHAIN

The perspective of viewing suppliers as an extension of the company and a process-oriented view, adds communication and information exchange so that everyone involved can plan and work together consistently towards achieving shared goals in the supply chain (Melo, 2019). To avoid supply shortages, it is important for the company to share information with its suppliers. According to the interviews conducted, the company shares information infrequently with its suppliers on purchasing forecasts. Interviewee 1 said:

> It depends on my harvest, they are usually seasonal stocks. For example, right now, I have a lot of bottles, but I'm going to use them when I bottle them and I'll need to order more for the start of the harvest. (Interviewee 1)

In this sense, interviewee 3 comments: “Sporadically, at the start of the harvest we communicate our forecast of future needs”. With this, it can be said that it depends on the

harvest and the stock that the company has in order for it to share forecast purchases with its suppliers. With regard to stock, the interviewees commented that the company does not usually share stock quantities with suppliers. According to interviewee 1, they don't share this information because “I sell what's running out and there's usually no shortage”. He also pointed out that he doesn't talk to suppliers about the quantities sold “I don't talk about how much I sell to my suppliers, I order as I need it”.

Companies use information systems called supply chain management systems, which share various information about orders, production and stock levels, with the aim of improving the efficiency of delivering products and services to meet customer needs in the right quantities, at the right time and at an affordable price. The use of systems improves transportation and manufacturing costs and guides management decisions (Laudon; Laudon, 2014).

When asked to describe the sharing of information about future projects with suppliers, the interviewees reported that there is no sharing of information, but rather a field study to find out whether the supplier in question will meet future demands or supply what is required. This can be seen in interviewee 1's account:

> I start looking for other suppliers, for example, now I want to make a new product, so I'll need the food processor and if they put it in small glasses, it's more canning, so you have to look for other glass suppliers to put it in, usually it's the same manufacturer sometimes it's another one. (Interviewee 1)

As mentioned above, the company does not share information with its suppliers, and it is believed that this is due to the size of the company, which is considered a small family business. The larger the organization, the more complex the connections between the components of the chain. From this perspective, the lack of models that allow integrative factors to be associated with the integration itself can lead this situation to affect organizational results without allowing for a forceful immediate or preventive response (De Brito Braga; Leopoldo, 2019). The company carries out its activities in a functional manner, as there has been no major need to modify or implement other resources, such as information sharing.

In addition, OlivoPampa has a long-term relationship with its key members, and both parties are familiar with this relationship, so they consider it to be adequate. The company has two types of customers, the end consumer – the business-to-customer (B2C) – (Coda; Castro, 2019) and retail companies – the business-to-

business (B2B) (Coda; Castro, 2019). The final consumer (B2C) is divided into two types, face-to-face and virtual. The face-to-face type takes place in the immediate vicinity of the company, where the owners take a tour of the olive groves, explaining the history and how the company works. During the tour, customers can try the olives and the oil itself, all with the aim of providing a different experience for the consumer and selling the product at the end of the tour. Virtual customers are those who buy products via the company's online site.

The company's website is also set up to sell to retailers who are not end consumers, they are (B2B). Retailers can place their orders via email, Whatsapp, phone call or with the sales promoter. The company's suppliers include caps, bottles, labels, boxes, packaging and filters. As you can see, OlivoPampa has a small number of key members, which explains the lack of information sharing between members.

The next section discusses the performance measures in the chain.

4.6 PERFORMANCE MEASURES IN THE CHAIN

Performance evaluations serve several functions, the most important of which are to monitor the company's progress and correct any shortcomings. In addition, managers can prepare to face changes in the environment through performance evaluations, especially in terms of the changing nature of competition and the creation of value for customers (Lugoboni *et al*., 2018). Thus, regarding how the company assesses the performance/customer relationship, interviewee 3 reports the existence of a number of factors that could improve performance. However, he points out that “our biggest obstacle is the distance and the size of the company, which doesn't have sales promoters to motivate our retail sales more”. According to interviewee 2, there is a good performance/customer ratio, but he adds that “we could increase our presence with customers to improve product turnover”.

In the same vein, interviewee 1 comments:

> I am one of those who believe that price is related to perceived value. Price is a function of perceived value. If the customer perceives that the product offers something different and good, they'll buy more, i.e. if they don't perceive that it has value, it's the same thing as buying from others. I have to add value to the sales price by showing that my product is different, and that's where a lot of different things come in. (Interviewee 1)

Practices related to performance evaluation and management are prevalent in all business areas. Performance indicators are used to evaluate, control and improve production processes to ensure that goals and objectives are achieved (Castanha; Ensslin; Gasparetto, 2019). Therefore, suppliers should also be evaluated using performance indicators. The OlivoPampa company considers deadlines, different supplier possibilities, the number of complaints, flexibility to increase orders and stock levels as performance measures.

With regard to deadlines, interviewee 2 reports that he considers the performance of suppliers to be average and points out that “mainly the bottle suppliers. Suppliers of packaging materials work with longer lead times, but they usually meet their targets”. With regard to the different possibilities of suppliers, during the interviews, interviewee 3 pointed out that “I would very much like to have more options for bottle and cap suppliers. As they are imported materials, with relatively high costs, few people are interested in supplying them”. As for the number of complaints, the interviewees commented that the complaints rate is low, but it is a performance measure. In this sense, interviewee 1 points out:

> Yes, but sometimes it's the fault of third parties. The complaint isn't about the product but about the breakdown in the supply chain, the logistics and the carrier who was carrying out this type of transportation. I manage to qualify the most reliable carriers to transport certain products for customers. (Interviewee 1)

With regard to flexibility, all three interviewees said that it was a performance measure that the company used a lot. Interviewee 2 commented that “sometimes we need to ask for more than we had already agreed”. Interviewee 3 added:

> Yes, there are some gourmet supermarket chains that tell us: “I'm going to try your product for x period, with a chain of 20 stores they put me in 5 stores and it worked. (Interviewee 3)

With regard to considering the level of stock in the link, interviewee 1 comments:

> We have various levels of stock, according to demand we bottle but we always have a minimum of stock. We rush to bottle when an order comes in. Our orders are sometimes one or two cases, six cases isn't much. (Interviewee 1)

Therefore, it is a challenge to adopt criteria for selecting and evaluating suppliers constantly in search of a partner that meets the requirements for supplying goods and services, factors such as quality, low cost and on-time delivery (Do Bomfim; Callado, 2019). It is known that suppliers make up the supply chain and that evaluating their performance is of paramount importance, as is evaluating the performance of the other members of the chain. However, it is worth highlighting the importance of evaluating the supply chain being used by the company using performance indicators.

Many companies fail to maximize the potential of their supply chains because they don't implement the performance measures needed to fully integrate the chain and maximize efficiency and effectiveness (Da Silva; Silva, 2020). When asked which performance measures are used by the company to assess the performance of the links in the supply chain, the three respondents gave different answers. Interviewee 2 commented that they do not have performance measures to evaluate the supply chain, while interviewee 1 considers cash generation to be a measure of supply chain performance and explains that:

> Right now we are at a crucial stage, we have to generate income to pay for inventories. We have to focus on doing more business to be able to generate cash and meet obligations and depend less. (Interviewee 1)

Furthermore, interviewee 3 adds that “in an ideal situation, we would like our inputs to always be available and we wouldn't need to stockpile large amounts of them”. However, evaluation criteria, management practices and control are sometimes not possible in the context of inter-organizational partnerships due to the lack of closer relationships between the partners (Silva Filho *et al*., 2017). Selecting appropriate performance measures for supply chain management is a difficult process, mainly due to the complexity of these organizational systems (Da Silva; Silva, 2020). In addition, the literature does not consider cash generation as a measure of supply chain performance.

Table 1 summarizes the results.

4.7 SUMMARY OF RESULTS

Table 1 – Summary of the main elements of the Supply Chain

<table>
<tr><td rowspan="3">Identification of business processes</td><td colspan="2">- Business process built up over time;
- Inventories are monitored empirically;
- The company has a nursery, a plantation and a factory;
- Harvesting the table olives is what triggers the entire production process;
- Three areas: industrial, accounting and technical.</td></tr>
<tr><td>Difficulties

- Buying inputs direct from the manufacturer.</td><td>Benefits

- Easier access, due to the similarity with the wine supply chain.</td></tr>
<tr><td colspan="2">Improvements

- Possibility of making joint purchases with other producers;
- Stock control in the ERP and the use of a computerized supply system.</td></tr>
<tr><td>Identification of key members</td><td>Suppliers

- Good relations with suppliers;
- Long-term suppliers;
- Partnership relationship with suppliers;
- Choice of the supplier with the shortest delivery time;
- Supplier performance is average.
- Cap supplier;
- Bottle supplier;
- Label supplier;
- Box supplier;
- Packaging supplier;
- Filter supplier.</td><td>Customers

- Good customer relations;
- They are attracted by reliability, product diversity and innovation;
- Performance could be improved: the biggest obstacle is the distance and size of the company.
- Business-to-customer;
- Business-to-business.</td></tr>
<tr><td>Information sharing</td><td colspan="2">- Does not share stock information;
- Information on purchasing forecasts and future sales forecasts is only provided when necessary;
- Field study (to find out if the supplier can meet demand).</td></tr>
<tr><td>Performance measures</td><td colspan="2">- Number of complaints;
- Flexibility to increase orders;
- Stock level in the link.</td></tr>
</table>

Source: Own elaboration.

The results of this research confirm the assertion that, although the concept of SCM has existed and been well known since the 1980s, it is far from being implemented in practice, as other studies have concluded, including Poirier & Quinn (2003), Scavarda *et al*. (2004) and Aragão (2004). It is important to emphasize that there is a lack of knowledge on the part of managers of the current structure of the supply chain to which the company belongs. This may be due to the company's small size, the fact that it is an innovation in the campanha region or the lack of interaction between its members.

The following section presents the final considerations.

5. FINAL CONSIDERATIONS

The aim of this research was to analyze the supply chain of the OlivoPampa organization, based on the integration of business processes, key members, information sharing between agents and the performance measures used in the chain.

OlivoPampa is a family business that has been growing olives and producing olive oils in the Campanha Gaúcha region for over 14 years. The analysis of the results showed that the business processes were improved over the years since the company opened, but in an empirical way, without prior planning or organization of the activities carried out. When the company opened, events occurred and its employees were allocated according to their area of greatest affinity. The company's supply chain can be seen to be facilitated by its similarity to the wine supply chain, which shares links, such as bottle suppliers, cap suppliers, label suppliers, box suppliers and labor, which is shared because the harvests are carried out in different seasons.

Looking at it from the perspective of the key members, the company has good relationships with both its suppliers and its customers. The relationships with suppliers are long-term, and they have a partner relationship with them. The company selects them on a cost-benefit basis, i.e. it considers the shortest delivery time and price offered, since their performance is considered average. Customer relationships are built on reliability, product diversity and innovation. The olive groves are set up in seasonal areas, as the climate is very favorable for growing olives, which allows for the production of high-quality oils. However, the distance from customers and input suppliers means that distribution channels are very limited.

As far as information exchange is concerned, the company does not exchange information on stock, sales forecasts or purchase forecasts. This lack of information exchange represents a lack of cooperation and information exchange between the links in the existing supply chain, as the company does not involve its suppliers in the process of developing new products or new solutions.

However, performance measures are used in the processes analyzed. The company considers deadlines, different supplier possibilities, the number of complaints, flexibility to increase orders and stock levels to be performance measures. It is important to note that the managers do not understand the current structure of the

supply chain to which the company belongs. This may be due to the company's small size, innovation in the campaign region or the lack of interaction between members.

This research can help the OlivoPampa company to take a closer look at its supply chain, improving the management of the organization and its own supply chain, as it is known how important the business is to the municipality of Santana do Livramento. As for the theoretical contributions, the main one is that this research provides a first look at olive growing in the municipality of Santana do Livramento, specifically at its supply chain. Analysis and understanding of supply chain integration presents a lack of detailed evaluation and understanding in order to make more strategic decisions that reduce costs for the organization. Therefore, it is suggested that a comparative study of the satisfaction of supplier companies be carried out to determine the differences between them. In addition, it is suggested that future research be carried out to find out the profile of the customer, to find out what factors influence them to buy the products offered by the company.

It is also recommended that a study be carried out to differentiate the supply levels in order to understand the level of satisfaction and integration between them. It is also suggested that future research carry out an analysis of supply chains in organizations focusing on other sectors such as clothing, pharmaceuticals, public institutions, etc., as each chain has particularities that can add value to the chain. Finally, quantitative research to measure the level of excellence of the components of the supply chain is another recommendation for future research.

The limitations of the research include the interview respondents, i.e. the members who took part in the research were only those from the company under study, so it is suggested that future research include the primary members of the supply chain. In addition, a limitation of the research is the lack of specific work on olive growing in the region. As a result, the study identified the need and relevance of new, in-depth work on the subject, for example, research involving a more detailed investigation of the sector's strengths and weaknesses and the transactions between agents. It is considered important to continue analyzing the potential and challenges of the olive-growing process in Rio Grande do Sul, as well as investigating the growth of the sector with the support of public and private initiatives.

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APPENDIX

INTERVIEW SCRIPT

The information will be used solely and exclusively to carry out this research. Therefore, the information can only be disclosed anonymously.

	Interviewee profile
1.	What is your current position?
2.	How long have you been with the company?
3.	What is your education?

	Business Process Integration
1.	What has the Supply Chain Management process been like since its inception? When? How was the company's management involved in SCM?
2.	What motivated the company to promote GCS?
3.	What were the main difficulties you faced?
4.	What benefits does the company get from its GCS?
5.	Are there any areas of the supply chain that the company wants to improve? What can it improve?
6.	What is the current structure of the GCS and its links?
7.	Are there opportunities for improvement in the company's supply chain structure? What could be improved?
8.	Could you describe the dynamics of how the different sectors of the company work?
9.	Who coordinates the company's internal processes?
10.	Is there any training for the areas to establish an efficient SCM? Which ones?

	Key members: suppliers
1.	Comment on the relationship with the main suppliers since the beginning of the process.
2.	Has there been a reduction or expansion in the number of suppliers? (With this in mind, try to find out whether the company's policy is to have few or many suppliers).
3.	How would you classify transactions with suppliers? (Cooperation, partnership, simply market, other).
4.	What criteria does the company use when choosing suppliers?
5.	What actions does the company take if a supplier delays delivery of inputs?
6.	How does the company evaluate the performance of its suppliers? What can be improved?

	Key members: customers
1.	Comment on your relations with your main clients.
2.	Has there been a reduction or expansion in the number of clients? (This is to find out whether the company's policy is to have few or many clients).
3.	How would you classify transactions with customers? (Cooperation, partnership, simply market, other).
4.	What criteria does the company believe customers use to choose the products it offers?
5.	What actions does the company take if a customer is late picking up products?
6.	How does the company evaluate the performance/customer relationship? What can be improved?

Sharing information between agents	
1.	How would you describe sharing information about your stock with suppliers?
2.	How would you describe sharing information about your sales with suppliers?
3.	How would you describe sharing information about your sales forecast with suppliers?
4.	How would you describe sharing information about your purchasing forecast with suppliers?
5.	How would you describe sharing information about your future projects with suppliers?
6.	How is information shared? Online via the system? WhatsApp? E-mail? Phone?

Performance measures	
1.	Does the company consider the variation of damaged products received from the supplier as a performance measure?
2.	Does the company consider the number of complaints as a performance measure?
3.	Does the company consider the supplier's compliance with the delivery schedule as a performance measure?
4.	Does the company consider the flexibility to increase orders as a performance measure?
5.	Does the company consider the level of stock in the link as a performance measure?
6.	Does the company take stock turnover into account as a performance measure?
7.	What performance measures does your company use to evaluate the performance of the links in the supply chain?

CHAPTER 3

CONSUMER PERCEPTIONS OF ONLINE RETAIL DURING THE CORONAVIRUS PANDEMIC

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ABSTRACT: The coronavirus (Covid-19) pandemic faced globally in 2020, which closed high street shops for months and encouraged people not to leave their homes, has caused companies to reinvent themselves in order to continue operating, this process has further accelerated the migration of retail to digital platforms, but were online retailers prepared for the sudden increase in demand for e-commerce? The aim of this survey was to verify how the transition from physical to virtual retail, imposed by the pandemic, is taking place according to customers' perceptions, as well as to identify opportunities for improvement and points of attention that can help or indicate ways for retailers to mitigate the pain of these customers and improve the consumer experience. The data collected by the survey showed that online shoppers still fear receiving a product that is different from the one they purchased, or that is defective, or even that they won't receive the product or service they bought. There are important opportunities for improvement and points for attention if the online retail market is to consolidate and overcome the various barriers it still faces, such as the difficulty of reaching audiences over the age of 50 and gaining consumer confidence. In addition, more than half of those surveyed have already faced some kind of problem when buying online. This is an issue that requires a lot of care, as we are living in a time when customers are increasingly disputed, considering the power that has been conferred on them by social networks. Another factor identified and which is proving decisive for the advance of online commerce is delivery time, one of the factors most pointed out by those surveyed as being relevant to whether or not they buy online.

KEYWORDS: consumer behavior, e-commerce, logistics, online retail.

RESUMO: A pandemia do coronavírus (Covid-19) enfrentada em nível global no ano de 2020, que fechou o comércio de rua por meses incentivou as pessoas a não saírem de casa, fez com que as empresas se reinventassem para continuarem no funcionando, esse processo acelerou ainda mais a migração do varejo para as plataformas digitais, mas será que os varejistas online estavam preparados para o

aumento súbito na demanda do e-commerce? O objetivo deste *survey* foi verificar como a transição do varejo físico para o varejo virtual, imposta pela pandemia, está ocorrendo segundo a percepção dos clientes, bem como identificar oportunidades de melhoria e pontos de atenção que possam ajudar ou indicar caminhos aos varejistas a fim de mitigar as dores desses clientes e melhorar a experiência de consumo. Os dados coletados pela pesquisa mostraram que quem realiza compras online, ainda teme por receber um produto diverso do adquirido, bem como defeituoso ou até mesmo não receber o produto ou serviço que comprou. Há importantes oportunidades de melhoria e pontos de atenção para que o mercado varejista online se consolide e supere as diversas barreiras que ainda enfrenta, tal como a dificuldade de atingir público de faixas etárias superiores a 50 anos e conquistar a confiança do consumidor. Além disso, mais da metade dos pesquisados já enfrentaram algum tipo de problema ao comprar pela internet, esta é uma questão que requer muito cuidado, pois vive-se o momento do cliente, cada vez mais disputado, considerando o poder que lhes foi conferido pelas redes sociais. Outro fator identificado e que se mostra determinante para o avanço do comércio online é o prazo de entrega, sendo um dos fatores mais apontados como relevante na compra ou não através da internet pelos pesquisados.

PALAVRAS-CHAVE: comportamento do consumidor, e-commerce, logística, varejo online.

1. INTRODUCTION

Retail is the sale of goods and services in small quantities, i.e. direct sale to the final buyer without intermediaries.

In the old days, the human being supplied his basic needs by means of hunting, fishing and agriculture, but with the improvement in the techniques of production, there began to be surpluses, which instead of being discarded became means of exchange.

Exchanges were made by means of barter, that is, a person who owned a quantity of a given product traded with another person who owned a different product.

Nowadays, stores and magazines have appeared with thousands of products, the concept of self-service has been consolidated, in which the customer chooses the products and pays for them when he is satisfied.

Then came the Shopping Centers, with thousands of stores in the same physical space which made life easier for consumers.

In the last few years, one of the biggest growing trends in retail has been sustainability. The theme has been widely publicized in all media and causing the consumer to be constantly exposed to this concept.

Today, information technology, with its growing development, has become crucial to the evolution of retail.

Sales in physical establishments, where the person does not need to go to a certain place to make the purchase, are already a very common reality.

In fact, retail has undergone countless changes since its inception, and in recent years with globalization and the development of the internet, it has presented a huge leap in its evolution, many trends such as virtual stores are becoming reality.

Due to widespread use of the Internet, more and more companies are using e-commerce as an additional or unique distribution channel, offering customers the opportunity to order their products directly from the online store and ship them to their home.

The global pandemic of 2020, which closed down street trading for months and encouraged people to stay indoors, caused businesses to reinvent themselves to stay afloat, further accelerating the migration from retail to digital platforms.

However, digital platforms still scare a good part of consumers, fear of not receiving what they actually bought or even receiving nothing is still a big taboo, even

with all the advances that have been made in relation to digital media and security in relation to personal data and credit cards is another big obstacle.

Thus, with the markets very competitive, it is increasingly important that the entrepreneur heed the needs and expectations of consumers before embarking on any ongoing trend.

Consumption is a sociocultural process, in which values, principles and preferences are embedded that condition customers' choices.

In this context, the objective of this article is to verify how the pandemic-imposed transition from physical to virtual retail is occurring as perceived by customers, as well as to identify opportunities for improvement and points of attention that can help or point out paths to retailers to mitigate their customer pains and improve their customer experience.

2. THEORETICAL RATIONALE

It can be said that retail has been, in a certain way, for longer than imagined in human evolution, and can correlate with barter, since people gave products in a certain quantity to receive others in a certain quantity, these being the exchange currencies of each (MATTAR, 2011).

Kotler and Armstrong (1991, p. 265), define retail as

> all activities involved in the sale of goods or services directly to final consumers for their personal, non-business use. Many institutions - manufacturers, wholesalers, retailers retail. But most retail is done by retailers, businesses whose sales come primarily from retail. And while the majority of retail is done by retail stores, recently retail without stores, direct mail-in phone sales, door-to-door contacts, vending machines, by various electronic means, has grown explosively. It includes all activities relating to the sale of goods and services directly to the final consumer, for personal use.

As can be seen from the transcript above, retail without store is not new, the innovation was the internet, so the Brazilian Retail and Consumption Society (SBVC, 2019, p.6) understands that retail "is all economic activity of selling a good or a service to the end consumer, that is, a transaction between a CNPJ and a CPF".

As time went by, retail was evolving, having its development strongly influenced by globalization, technology and internet in the last decades, which caused great impact also in retail in Brazil and worldwide, an impact that can be seen already in the

middle of the 20th century, when the sale of over the counter was ceasing to exist, the consumer having greater freedom to choose his products alone.

Thus, from the early 1990s, the use of the Internet and other computer technologies became accessible to the general population with search engines and websites making the Internet a very common source of information, which led companies to exploit this development and gain potential customers through information on the Internet, such as product catalogs (Chu *et al*., 2007).

In fact, the Internet has changed retail as more and more online stores have been created. These developments led to the so-called "dot-com" euphoria and the number of sites grew from about 3000 in 1994 to over 27 million in 2005 (Niehaus, 2005, p. 48).

In 2005, however, in the wake of the dot-com crisis, the bubble grew greatly and stock-exchange companies suffered a sharp drop in prices, followed by a phase of disillusionment and companies realized the importance of effectively connecting the online store to a company's materials management and processes in order to provide a complete customer experience (Niehaus, 2005).

Online trading or e-fulfillment has gone on to describe the complete order processing process over the internet from payment, storage, shipping, delivery to after-sales service (Nakamura, 2001).

Online retail delivery logistics are not only responsible for choosing and shipping goods, but also handling returned goods, so the process of fulfilling a purchase in e-commerce can be divided into three levels: (1) acceptance of the purchase order, (2) selection of orders, and (3) delivery of the products (Boyer *et al*., 2009).

Therefore, in e-commerce, to ensure consumer satisfaction, the full breadth of the processes must be covered, considering that the customer, when paying for their purchase, expects that the entire purchase process must be resolved and any problem needs to be addressed directly by the retailer or its partners.

In addition, the maintenance of the online store is part of the electronic realization, therefore, care should be taken to ensure that the products offered in the store are also available in stock and, if necessary, additional orders should be made to suppliers not to lose sales for lack of products (Hahne, 2001, p.37).

Retail electronic processing has the greatest potential for optimization in online commerce, as each of the three levels of the process of fulfilling the contract of sale is

important to provide excellent customer service that can be optimized to achieve a cost that customers are willing to pay (Boyer *et al*., 2009).

Today, also as a consequence of the creation of the internet that took place in the previous century, it is possible for the consumer to choose his products without leaving home, by means of websites, social media, applications and other means and to receive them with all the convenience and in the comfort of his home.

Brazil is the most important e-commerce market in Latin America. The country is estimated to account for more than one third of the region's e-commerce market (Braz, 2020).

According to data from 2018 of the Brazilian Institute of Geography and Statistics - IBGE, compiled from the study called "The Role of Retail in the Brazilian Economy" (SBVC, 2019), the Brazilian retail sector, had the impact of 20% (twenty percent) of the domestic product Bruno (PIB), with the volume of R $ 1.38 trillion and real growth of 2.3% formally employing more than 11.6 million people and covering more than 7.5 million families, and the study mentioned estimated that the aggregate value of retail in GDP Brazilian would correspond to approximately 8.12% of the GDP, this taking into consideration the GDP and IBGE data of 2018.

In the area of e-commerce, Brazil is growing fast. While online sales reached $15 billion in 2014, in 2015 they reached $23 billion (Amazon, 2015).

Meanwhile, every second a Brazilian has access to the Internet, and the density of mobile devices is constantly increasing with about 10% of e-commerce sales being generated through mobile transactions (Amazon, 2015).

The coronavirus (COVID-19) outbreak has affected Brazilian e-commerce for the better, as more than a third of netizens said they wanted to buy more online due to restrictions imposed by the pandemic, and online sales of hand sanitizer soared above 600% (Hoefel; Tripoli, 2020).

In this scenario and with more and more customers choosing to buy their products online, there are many critical issues for retailers to be observed, especially with regard to shipping the ordered products, so that the customer experience is evaluated positively. Churchil Jr. and Peter (2005, p. 151) warn:

> After purchasing a product, consumers formally or informally assess the outcome of the purchase. In particular, they consider whether they are satisfied with the purchasing experience and the good or service they have acquired. This post-purchase assessment phase is critical for marketers, as if

> a consumer has repeatedly favorable experiences with a particular brand, they can develop loyalty to it. Consumers can also talk to (and influence) family friends and acquaintances about these experiences of buying and using products.

There is therefore a critical connection between ordering customers online and delivering products that is often referred to as the last mile. In this last stage, there are special requirements for business logistics, crucial aspects for the global success of the company's online commerce (Esper *et al*., 2003).

In fact, e-commerce involves all kinds of economic activities carried out through electronic links, so manufacturers and distributors of products are increasingly integrating and discovering the Internet as a direct distribution channel, whose goal is to open up new markets and maintain relationships with existing customers, simplifying access to information and products (Delfmann *et al*., 2002).

E-commerce is not just a channel change, it is a paradigm shift. For example, if in traditional commerce, the transport of the products in the last mile is assumed by the customer who takes the product home, this is quite different in e-commerce because in this case the customer selects his products in the online store and the online dealer is responsible for the delivery in the last mile (Delfmann *et al*., 2002).

According to Niehaus (2005, p.69):

> e-commerce is having effects, as well as influences on the structure of the supply chain. This can lead to a significant shortening of this, which is referred to as disintermediation. The supply chain on the distribution side is shortened by up to 2 levels because producers directly place their products to sell to customers without a trader's intermediary. The reasons for this are clear, as each stage of the supply chain generates costs in the form of profits and transaction costs.

However, a producer who distributes his products directly to customers via the Internet needs to ask himself if the additional costs associated with home delivery are lower or greater than the savings that can be made by reducing the supply chain, and only if these additional costs are lower does this direct marketing make sense.

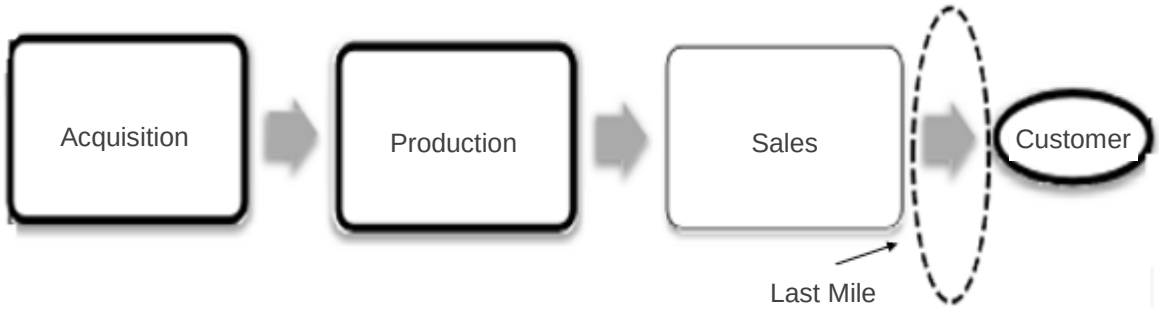
Kull (2007) also argues that the growth and growing popularity of e-commerce has strongly influenced the buying behavior of many customers.

There are more opportunities and purchasing decisions, more directly accessible information, and an overall simplification of purchasing.

A critical success factor and, at the same time, one of the biggest challenges within electronic realization is delivery to the end customer (NIEHAUS, 2005).

Although there is little common definition, the critical link between the ordering process on the Internet and delivery to the customer is often referred to as the last mile or last mile.

Figure 1: The Last Mile Position in the Retail Supply Chain



Source: Adapted from Niehaus (2005, p. 16).

Figure 1 shows the exact last mile position between product sales and the customer as the point of receipt for the products. The last mile thus involves transporting the product to the point of delivery and is considered the most important element of the whole order process and at the same time is one of the biggest challenges in B2C e-commerce (Punakivi *et al*., 2001).

In recent years, many companies have developed a direct-to-consumer service model that allows customers to order their products online and take them directly to their home. The last mile means a significant increase in service for customers, but at the same time it is associated with many challenges for companies operating online (Niehaus, 2005).

There are two main contradictory arguments for the last mile distribution process. On the one hand, it decisively determines how customers perceive the quality of service. On the other hand, companies should minimize their costs because they work at very narrow margins.

Significant costs are mostly frequent stops, delivery attempts and failed returns (Niehaus, 2005).

So, in the last mile for the customer, companies need to find an acceptable balance between customer service, distribution costs, and security.

Niehaus (2005) shows in his work, that customers of online commerce recognize very accurately the way fast and reliable delivery occurs. Logistics in the last mile becomes a critical factor for customer satisfaction and therefore also for business success.

Urban (*et al*., 2000) points out that consumers point out that their online purchasing decisions are based on trust and prior experience. The most important element is therefore the successful execution of client orders to create confidence.

The choice of carrier is therefore a strategic decision for the online reseller. If it can deliver efficiently, it creates a competitive advantage over its competitors. In addition, hauliers increasingly need to respond to increased demand for greener shipments (Petrovic *et al*., 2013).

The theme of returns, also called reverse logistics, is becoming increasingly important. If the customer receives their delivery in a damaged condition or does not like it, he can return it and the costs are usually assumed by the retailer, because the free return policy has strong advertising appeal and awakens the confidence of the customer who gets the feeling of tranquility and confidence by not taking risks. At the same time, however, the rate of return (returns) increases (Niehaus, 2005).

In addition, a longer delivery time is accompanied by a higher rate of return. Companies are therefore required to provide the fastest possible delivery, which in turn is associated with high costs.

In light of the above, it is clear that online retail, while very promising, in fact a trend that has come to stay, has many aspects that need to be carefully observed by the retailer in order not to displease their customer or incur too high costs.

3. METHOD AND RESEARCH

This is a descriptive research, as it does not claim to "explain why a fact occurred or why variables interact in a certain way", as Cooper and Schindler (2003, p. 31), but to find out what online consumers are feeling about their online purchases and thus identify what retailers can do to improve the experience of these customers.

To meet the goals of this research, which is very important at this time when the COVID 19 pandemic has led many consumers to migrate to Internet retail, a

questionnaire was prepared on Google's online forms platform, obtaining 122 responses.

All respondents agreed with the consent form, which was the only required answer, as everyone was free to stop answering any questions that caused him or her discomfort.

The researchers sent the questionnaire through their respective social networks (Whatsapp and Facebook) with the request that people respond to the electronic form made available on a link and with the request to send the same link to the people of their respective relationships.

Thus, the respondents were not chosen, but volunteered and the researchers were unable to choose or select the respondents, because those who received the links could participate freely and invite anyone who interested them directly.

It is understood that this method is simple, quick and allows to obtain responses from a very wide spectrum of respondent profiles and in no way invalidates the results obtained, according to Mattar (2012, p. 127).

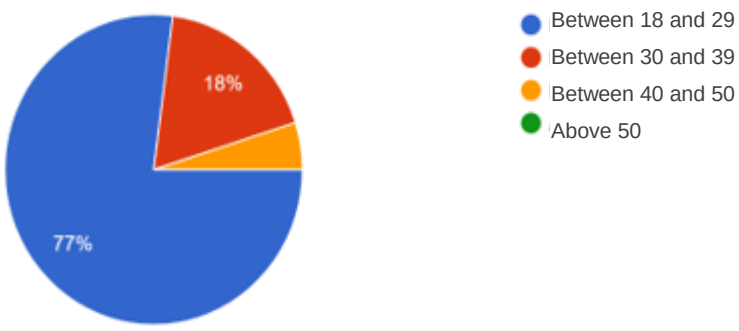
> The fourth reason [for the use of non-probabilistic sampling] concerns the time and financial, material and human resources required to conduct a search with probabilistic sampling. It may be that these resources are so large and not available that the researcher can have only two options: carrying out the research with the available resources, conforming to a non-probabilistic sampling, or simply not doing it.

Due to time constraints, the questionnaires answered up to one week after the initial messages of the researchers were sent to their networks were accepted, which occurred in October 2020, when e-commerce had already been accepted as a viable alternative to consumption in the face of the restrictions imposed by the COVID-19 pandemic.

4. ANALYSIS OF RESULTS

This section presents the data collected through graphs and performs an analysis of the responses obtained in order to highlight the concerns, dissatisfactions and concerns of online consumers, in order to raise opportunities for improvement for companies acting with sales on the internet.

Graph 1: Age Group of Respondents.



Source: Search data.

The age of the interviewees, in the majority of cases, was found to be between 18 and 29 years old, with 77% of the responses, with no replies being obtained from people over 50 years of age.

The results shown in Chart 1 seem to indicate that online shopping has not yet fully won the trust and taste of the older population, that is, despite the spread of web facilities, especially during the pandemic the internet is still an environment dominated by the younger population.

The income of the interviewees was mostly concentrated in the range of 1 to 3 minimum wages, which corresponded to 59% of the responses, indicating that people earning less are probably more likely to share their opinions through electronic research, that is, they are less afraid of electronic interactions.

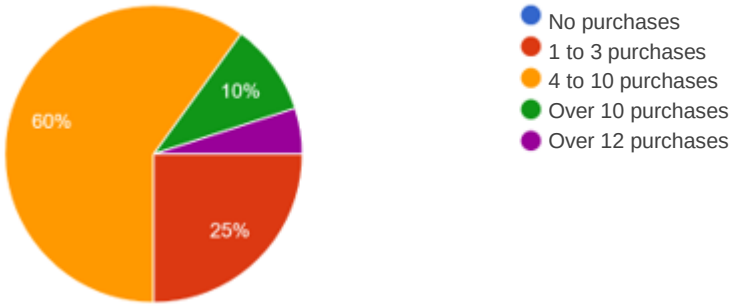
Graph 2: Income band.

Source: Search data.

It was found that 100% of respondents made at least one purchase by digital platforms in the last 12 months, which allows one to infer that online commerce is already a reality present in the life of the vast majority of the Brazilian consumer market.

The survey also showed that around 60% of consumers made 4 to 10 purchases in the last 12 months, i.e. are repeat buyers, implying that the purchases and platforms used were satisfactory.

Graph 3: Purchasing frequency.

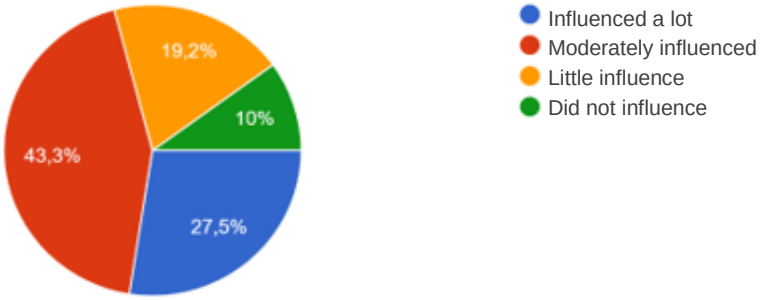


Source: Search data.

With the closure of the trade and the incentive for people not to leave home, it was pointed out in the research data that the COVID19 pandemic influenced 90% of respondents to compare more over the internet, with 43.3% responding that the pandemic influenced moderately and 27.5% that influenced a lot.

Thus, it can be said that for this group the pandemic has significantly changed the way one buys and has significantly accelerated the migration from physical retail to digital platforms.

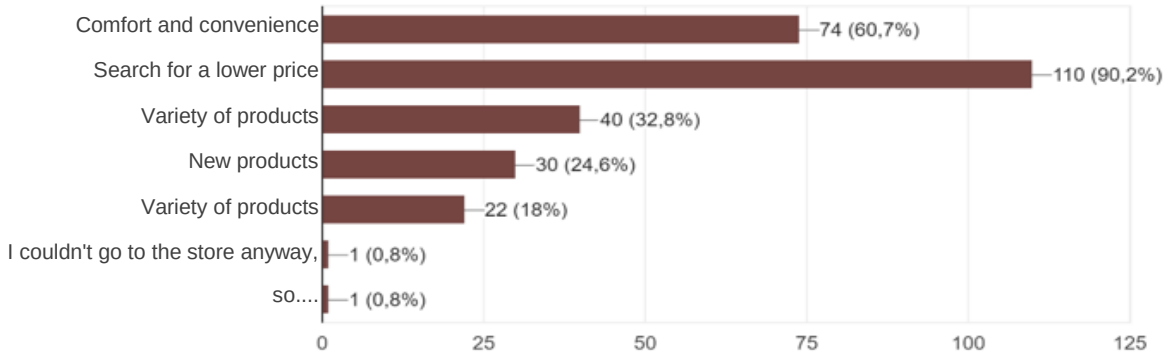
Graph 4: Impact of the Pandemic from the purchase channel decision.



Source: Search data.

Of the factors that led the researched consumers to choose by making their purchases on a given site, it was found that the main factor was the "Search for a lower price", because this was the response of 90.2% of respondents, followed by "comfort and convenience" by 60.7% and "variety of products" with 32.8% of the responses.

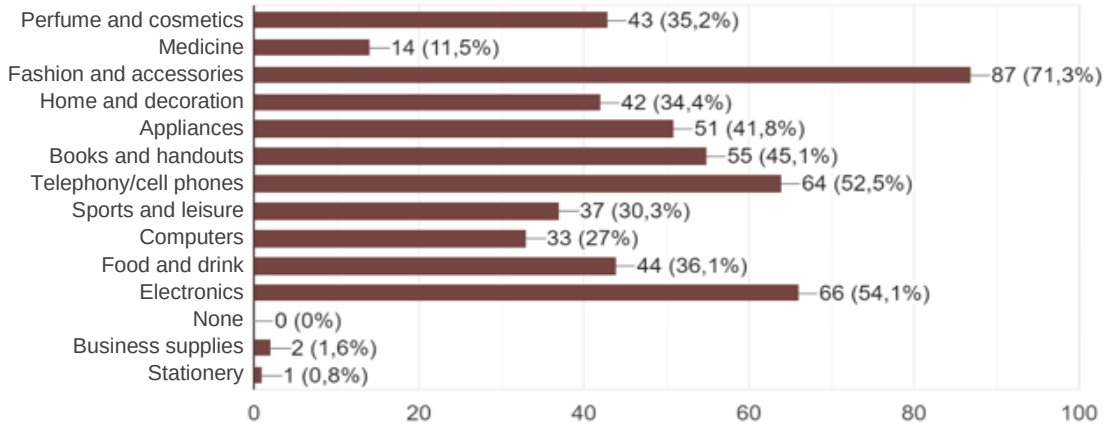
Graph 5: Factors leading to the choice of site.



Source: Search data.

With regard to what the respondents most bought over the internet, it was found that the main item was "Fashion and accessories", with the percentage of 71.3%, followed by "electronics" by 54.1% and "Telephony/Cellular" by 52.5%.

Graph 6: Products most purchased over the internet.



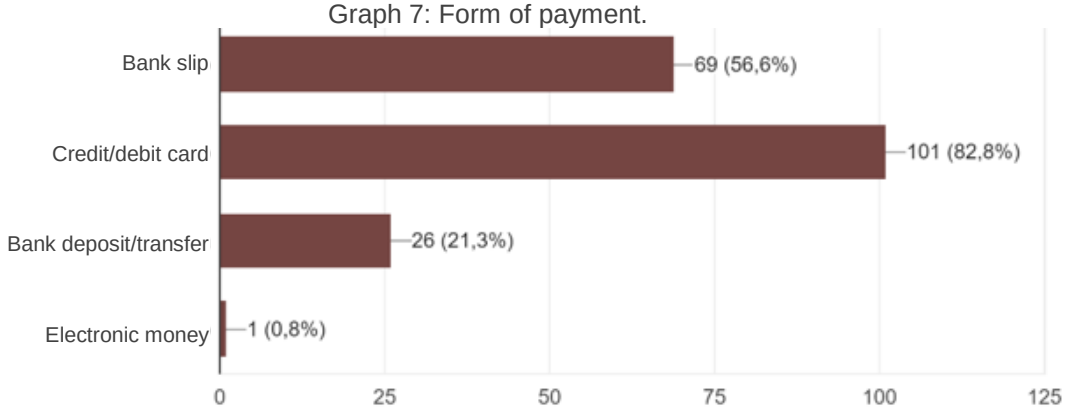
Source: Search data.

Electronics, telephony and mobile phones do not cause any surprise, because at home, in isolation, it is natural for people to buy equipment that will allow them to connect with the outside world.

Fashion and accessories make it possible to conjecture that, in spite of being isolated, people did not leave aside the esthetic concerns, if not immediate, at least for when they needed or could come out of isolation.

As for the payment method most used by respondents when buying over the internet, this was identified as the "credit/debit card" having represented the percentage of 82.8% of the replies, followed by bank report with 56.6% of the replies and deposit or bank transfer with 21.3%.

Graph 7: Form of payment.

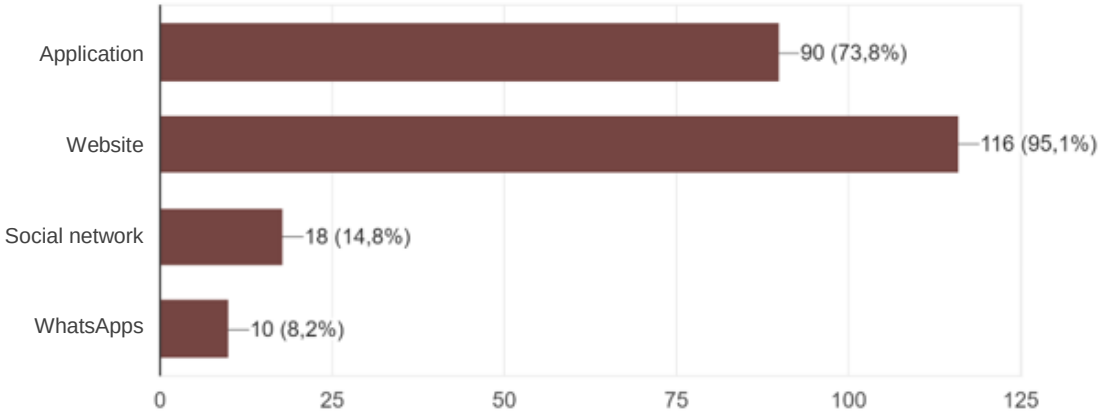


Source: Search data.

With regard to the platform most used for digital purchases, the company's website ranked first, being the preference of 95.1% of respondents, followed by apps with 73.8%, Social Network with 14.8% of responses and WhatsApp with 8.2%.

These results demonstrate a consolidation of corporate websites, on the other hand, they point to a large space for growth and investments in other platforms.

Graph 8: Medium used for internet buying.

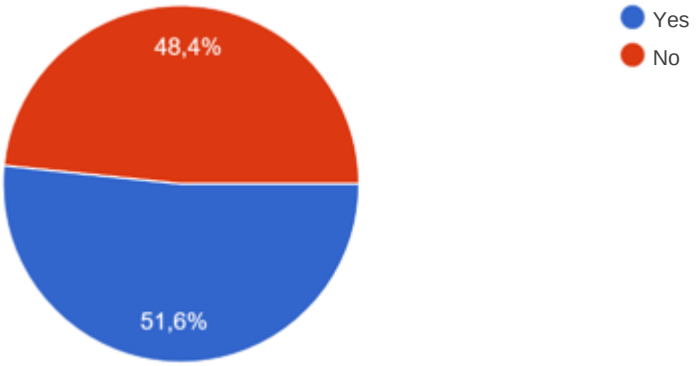


Source: Search data.

It was surprising and even strange that more than half of the respondents, i.e. 51.6%, had already said that they had some kind of problem buying over the Internet, considering that society is already in the second decade of the 21st century, times characterized by mastering technology in all areas and by the recognition of the importance of satisfied customers for business success.

Buying problems, no matter how small, can drive consumers away, something that entrepreneurs should be aware of in any situation, but especially now that many consumers are migrating to online shopping.

Graph 9: Problems buying over the internet.

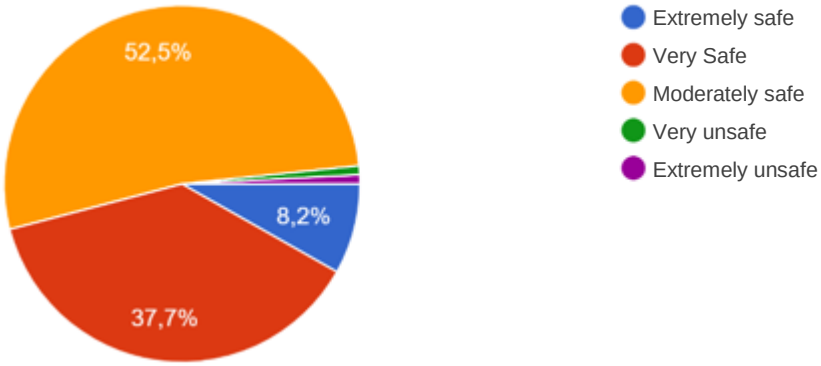


Source: Search data.

Regarding how safe the respondents felt when shopping online, most respondents, 52.5%, responded that they felt "Moderately safe," followed by "extremely insecure" accounting for 37.7% of the responses, while only 8.2% felt "Extremely safe."

This is another opportunity for improvement for entrepreneurs who are working in e-commerce, because security has to do with the perception of trustworthiness and, without trust, there is no business.

Graph 10: Feeling secure when buying over the Internet.



Source: Search data.

It is a fact that the Internet has made people's lives more practical and many operations faster, but for this to be possible, customers need to deliver their personal data to companies and service providers.

It is therefore essential that organizations ensure that this information is treated with due respect and confidentiality.

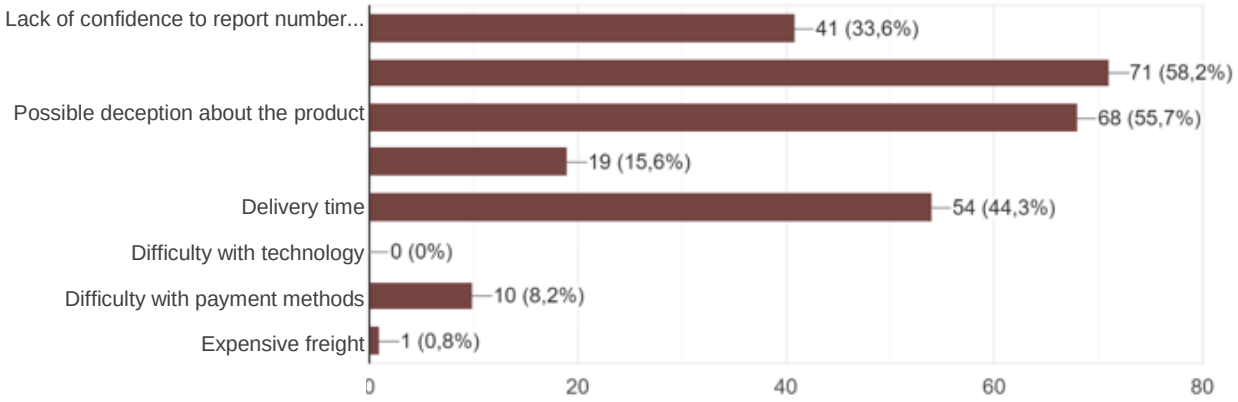
But it is not only a matter of commercial relationship, it is also a legal issue, mainly after the General Law of Protection of Personal Data - LGPD (Brazil, 2018).

Therefore, the data shown in Graph 10 sound like an important alert for companies that are active in e-commerce and for those that intend to act.

To further explore the reasons that may drive consumers away from online shopping, respondents were asked about the factors that cause friction in this type of purchase, i.e., which would be the aspects that could most drive customers away from this type of purchase.

According to the results found in the survey, the main factor that would keep them away from purchases over the internet, was the fear of "Not receiving the purchased item", pointed out by 58.2% of the respondents, followed by a "Possible deception about the product" that was pointed out by 55.7% and delivery time with 44.3% of replies.

Graph 11: Factors that move away from internet shopping



Source: Search data.

In the light of the results of the research, it can be seen that there is a growing use of digital platforms as a means of consumption, as well as in the use of digital forms of payments, so that online shopping is already a reality for the vast majority of people, who are looking for the most diverse products in e-commerce, being the main fashion, accessory, household appliances and electronics.

5. CONCLUSIONS

Retail has undergone several transformations over the centuries and is undergoing a true revolution, which is the migration to digital/virtual media, which was driven by the internet.

In addition, the pandemic has led to an acceleration of this phenomenon, which is the migration from traditional commerce to online commerce.

There are important opportunities for improvement and points of attention for the online retail market to consolidate itself and overcome the various barriers it still faces, such as the difficulty of reaching audiences over the age of 50 and gaining consumer confidence.

The research data showed that those who make online purchases still fear for receiving a product other than the one purchased, as well as defective or even not receiving the product or service they purchased.

It has been found that the security of the information shared is a fear of the consumer and, especially now that the Personal Data Protection Law is in force, this becomes a point that really requires the attention of companies in general, but especially those that act or are intending to act in e-commerce.

It has been identified that more than half of the respondents have faced some kind of problem when buying over the internet, this is also a question that requires a lot of care, because we live in the moment of the client, increasingly disputed, considering the power that has been conferred to them by the social networks.

Another factor identified and that is decisive for the advance of online commerce is the delivery time, being one of the factors most pointed out as relevant in the purchase or not through the internet by the researched.

Here it is worth noting that the delivery time depends on a complex logistics network and partnerships with a multitude of companies, it is therefore a critical success factor, because often the consumer prefers to buy personally rather than wait for the delivery product.

Undoubtedly, online retail is ceasing to be a trend and becoming the new normal, as people are increasingly connected, but it is up to the entrepreneur to analyze the fears and insecurities of the consumer, in order to create fermentations that improve these processes generating more value to the consumer.

As a limitation of this research it is worth remembering the small non-probabilistic sample, which opens up the possibility and even the recommendation of more studies that aim to identify the pain of the digital consumer and thus allow planning actions to overcome them.

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CHAPTER 4

MARKETING PARA CLIENTES MÁQUINAS: UMA MUDANÇA DE PARADIGMA NA DINÂMICA DO CONSUMIDOR

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RESUMO: Na era digital, a inteligência artificial (IA) não está apenas revolucionando as indústrias, mas também transformando o próprio conceito de consumismo. Este artigo explora o surgimento de clientes máquinas – entidades autônomas que tomam decisões de compra independentemente da intervenção humana. Esses consumidores orientados por IA, impulsionados pelos avanços no aprendizado de máquina e na Internet das Coisas (IoT), representam uma mudança significativa em relação aos modelos tradicionais de comportamento do consumidor centrados no ser humano. O estudo investiga os avanços tecnológicos que impulsionam esse fenômeno, o impacto nos modelos econômicos tradicionais e as implicações para as estratégias de marketing. Ao examinar a evolução da IA nos mercados de consumo, este artigo fornece uma compreensão abrangente de como as empresas podem se adaptar e prosperar em um cenário cada vez mais automatizado. Aborda igualmente as considerações éticas e os quadros regulamentares necessários para garantir que o consumismo impulsionado pela IA beneficia a sociedade de forma equitativa. A ascensão dos clientes máquinas desafia os paradigmas existentes, obrigando a uma reavaliação da dinâmica da oferta e da procura e exigindo abordagens inovadoras para o envolvimento do cliente e a participação no mercado.

PALAVRAS-CHAVE: clientes máquinas, inteligência artificial, comportamento do consumidor, estratégias de marketing, modelos económicos, internet das coisas (IoT), algoritmos preditivos.

ABSTRACT: In the digital age, artificial intelligence (AI) is not only revolutionizing industries, but also transforming the very concept of consumerism. This article explores the emergence of machine shoppers - autonomous entities that make purchasing decisions independently of human intervention. These AI-driven consumers, driven by advances in machine learning and the Internet of Things (IoT), represent a significant shift from traditional human-centric models of consumer behavior. The study investigates the technological advances driving this phenomenon,

the impact on traditional economic models and the implications for marketing strategies. By examining the evolution of AI in consumer markets, this article provides a comprehensive understanding of how companies can adapt and thrive in an increasingly automated landscape. It also addresses the ethical considerations and regulatory frameworks needed to ensure that AI-driven consumerism benefits society equitably. The rise of machine customers challenges existing paradigms, forcing a reassessment of supply and demand dynamics and requiring innovative approaches to customer engagement and market participation.

KEYWORDS: machine customers, artificial intelligence, consumer behavior, marketing strategies, economic models, internet of things (IoT), predictive algorithms.

1. INTRODUÇÃO

A maré implacável da inovação tecnológica está a remodelar as identidades dos consumidores, com a inteligência artificial (IA) na vanguarda desta transformação. O conceito de "Clientes Máquinas", outrora relegado ao domínio da ficção especulativa, está rapidamente a tornar-se realidade. Essas entidades autônomas, impulsionadas por algoritmos sofisticados, estão prontas para revolucionar a dinâmica tradicional do mercado e redefinir a própria noção de consumismo.

Os clientes máquinas são sistemas orientados por IA capazes de tomar decisões de compra independentemente da intervenção humana. Essa nova classe de consumidores inclui dispositivos inteligentes, como geladeiras que reordenam mantimentos e impressoras que compram tinta automaticamente quando os suprimentos escasseiam (Zulaikha *et al*., 2020). O advento desses sistemas inteligentes marca um afastamento significativo dos modelos tradicionais centrados no ser humano, forçando as empresas a repensar suas estratégias de marketing e métodos de engajamento do consumidor.

A integração da IA na vida diária através da Internet das Coisas (IoT) e os avanços no aprendizado de máquina abriram caminho para o surgimento de clientes máquinas. Essas tecnologias permitem que os dispositivos prevejam as necessidades de manutenção, otimizem o gerenciamento de estoque e executem transações com o mínimo de supervisão humana (Prakash *et al*., 2023). A transição para o consumismo automatizado desafia os modelos económicos existentes e exige uma reavaliação dos princípios que regem a oferta e a procura.

A ascensão dos clientes máquinas também introduz novas considerações éticas. À medida que os sistemas de IA se tornam mais autônomos, questões sobre privacidade de dados, viés algorítmico e o impacto social mais amplo dessas tecnologias tornam-se cada vez mais pertinentes (Sabbeh, 2018). A abordagem destas questões é crucial para garantir que os benefícios do consumismo orientado pela IA são distribuídos equitativamente e que os danos potenciais são atenuados.

À medida que nos aprofundamos nos meandros do marketing para clientes máquinas, este artigo tem como objetivo fornecer uma compreensão abrangente dos avanços tecnológicos que impulsionam esse fenômeno e suas implicações para a dinâmica tradicional do mercado. Ao examinar a evolução da IA nos mercados de

consumo, exploraremos como as empresas podem adaptar suas estratégias para prosperar em um cenário cada vez mais automatizado. Esta exploração inclui uma análise detalhada das dimensões tecnológicas, econômicas e éticas do marketing para entidades não humanas, oferecendo insights sobre o futuro do consumismo em um mundo impulsionado por IA.

2. TRAÇANDO A NOVA FRONTEIRA DO CONSUMISMO: CLIENTES MÁQUINAS

2.1 DEFINIÇÃO DE CLIENTES MÁQUINAS

No cenário digital em rápida evolução, o conceito de "Clientes máquinas" está emergindo como uma força transformadora na dinâmica do consumidor. Os clientes das máquinas são entidades autónomas alimentadas por inteligência artificial (IA) que tomam decisões de compra sem intervenção humana. Estas entidades operam dentro de um quadro de preferências pré-programadas e algoritmos avançados para executar tarefas tradicionalmente tratadas por consumidores humanos. Exemplos incluem geladeiras inteligentes que reabastecem de forma autônoma mantimentos e impressoras que reordenam cartuchos de tinta quando os níveis estão baixos (Zulaikha *et al*., 2020).

A evolução dos clientes máquinas marca um afastamento significativo dos modelos de compra centrados no ser humano. Ao contrário dos consumidores humanos, cujas decisões são influenciadas por emoções e preferências pessoais, os clientes máquinas dependem de algoritmos orientados por dados para tomar decisões de compra precisas e eficientes. Esta mudança para a automação desafia as estratégias de marketing tradicionais e obriga as empresas a adaptarem-se a uma nova era de comportamento do consumidor impulsionada pela IA (Prakash *et al*., 2023).

O aumento de clientes máquinas é facilitado pelos avanços na Internet das Coisas (IoT) e no aprendizado de máquina, permitindo que dispositivos inteligentes prevejam necessidades de manutenção e solicitem peças de forma autônoma (Sabbeh, 2018). À medida que essas tecnologias continuam a evoluir, espera-se que o papel dos clientes máquinas no mercado se expanda, integrando ainda mais a IA nas atividades diárias do consumidor.

Os clientes máquinas representam uma mudança de paradigma que exige uma reavaliação da dinâmica do mercado e das relações de consumo. As empresas devem desenvolver novas estratégias para se envolver com essas entidades autônomas, aproveitando a análise de dados e a IA para atender às necessidades precisas dos clientes máquinas. Esta transformação abre novas oportunidades para a inovação no desenvolvimento de produtos, gestão da cadeia de abastecimento e envolvimento do cliente (Dong, 2024).

Ao compreender e abraçar o conceito de clientes máquinas, as empresas podem posicionar-se na vanguarda desta revolução tecnológica, impulsionando o crescimento e a vantagem competitiva num mercado cada vez mais automatizado.

2.2 EVOLUÇÃO TECNOLÓGICA

A evolução tecnológica subjacente ao aumento dos clientes máquinas está enraizada em avanços significativos em inteligência artificial (IA), aprendizado de máquina e Internet das Coisas (IoT). Essas tecnologias coletivamente permitem que os dispositivos operem de forma autônoma, tomando decisões que tradicionalmente exigiam a intervenção humana. Esta seção explora os principais avanços tecnológicos que abriram caminho para que os clientes máquinas se tornassem participantes integrais no mercado de consumo.

2.2.1 O papel da IA e do Machine Learning

A inteligência artificial e a aprendizagem automática estão no centro do fenómeno do cliente das máquinas. Os sistemas de IA são projetados para processar grandes quantidades de dados, aprender com padrões e tomar decisões com alta precisão e eficiência. Os algoritmos de aprendizado de máquina, um subconjunto da IA, permitem que os dispositivos melhorem seu desempenho ao longo do tempo com base em experiências passadas e novos dados. Essas tecnologias permitem que os dispositivos prevejam as necessidades de manutenção, otimizem os níveis de estoque e até tomem decisões de compra (Volkmar *et al*., 2022a).

As técnicas de aprendizado de máquina têm sido extensivamente aplicadas às estratégias de retenção de clientes, mostrando seu potencial para prever

comportamentos do consumidor e adaptar os esforços de marketing de acordo. Essas aplicações demonstram as capacidades mais amplas do aprendizado de máquina na condução da tomada de decisões autônomas em mercados de consumo (Sabbeh, 2018).

2.2.2 Integração com a Internet das Coisas (IoT)

A IoT revolucionou a forma como os dispositivos interagem entre si e com o seu ambiente. Os dispositivos IoT são equipados com sensores e conectados à internet, permitindo a troca e análise de dados em tempo real. Essa conectividade permite que os dispositivos operem perfeitamente dentro de uma rede, executando tarefas de forma autônoma e eficiente. Por exemplo, geladeiras inteligentes podem monitorar os níveis de alimentos e reordenar automaticamente os mantimentos, enquanto as impressoras podem detetar baixos níveis de tinta e fazer pedidos de substituição sem intervenção humana (Dong, 2024).

A integração da IA e da IoT deu origem a ambientes inteligentes onde os dispositivos não só comunicam, mas também tomam decisões informadas. Esses avanços transformaram o cenário de consumo, tornando os clientes máquinas uma realidade viável e cada vez mais prevalente.

2.2.3 Agentes Autónomos em Ação

Agentes autônomos, alimentados por IA e aprendizado de máquina, são capazes de executar tarefas complexas sem a intervenção humana. Esses agentes aproveitam a análise preditiva para antecipar necessidades e tomar as ações apropriadas. Por exemplo, assistentes pessoais orientados por IA, como a Alexa da Amazon e o Google Assistant, podem gerenciar tarefas domésticas, fazer compras e fornecer recomendações personalizadas com base nas preferências do usuário e padrões de comportamento (Kumar *et al*., 2021).

A implantação de agentes autônomos em vários setores destaca seu potencial para aumentar a eficiência e a precisão nas interações com o consumidor. Ao aproveitar insights orientados por dados, esses agentes podem otimizar as operações da cadeia de suprimentos, melhorar o atendimento ao cliente e simplificar os processos de compra.

2.2.4 Perspetivas e desafios futuros

Embora os avanços tecnológicos que impulsionam o aumento de clientes máquinas sejam impressionantes, eles também apresentam desafios. Questões como o enviesamento algorítmico, a privacidade dos dados e as implicações éticas da tomada de decisão autónoma têm de ser abordadas. Garantir que os sistemas de IA funcionem de forma transparente e justa é crucial para ganhar a confiança do consumidor e maximizar os benefícios dessas tecnologias (Akter *et al*., 2022).

À medida que a tecnologia continua a evoluir, as capacidades dos clientes máquinas se expandirão, integrando ainda mais a IA nas atividades diárias do consumidor. As empresas devem manter-se a par destes desenvolvimentos e adaptar as suas estratégias para aproveitar todo o potencial da IA e da IoT no envolvimento com os clientes das máquinas.

2.3 MODELOS CENTRADOS NO SER HUMANO VS. AUTONOMIA DA MÁQUINA

O advento dos clientes máquinas requer uma reavaliação fundamental dos modelos tradicionais de comportamento do consumidor centrados no ser humano. Historicamente, a dinâmica do mercado tem estado profundamente enraizada nos processos de tomada de decisão humanos influenciados por emoções, fatores sociais e preferências pessoais. Em contraste, os clientes máquinas operam em algoritmos baseados em lógica e informados por dados, apresentando oportunidades e desafios para os profissionais de marketing.

2.3.1 Modelos tradicionais centrados no ser humano

Os modelos de comportamento do consumidor centrados no ser humano são caracterizados por uma interação complexa de fatores emocionais, psicológicos e socioeconômicos. Esses modelos enfatizam a importância de entender as motivações humanas, as influências culturais e as preferências pessoais na formação das decisões de compra. As estratégias de marketing tradicionais têm se baseado na segmentação dos consumidores com base em dados demográficos, psicográficos e padrões comportamentais para adaptar mensagens e produtos de acordo (Ma & Sun, 2020).

As decisões humanas no mercado são muitas vezes influenciadas pela fidelidade à marca, conexões emocionais e compra por impulso. Os profissionais de marketing há muito aproveitam esses aspetos por meio de publicidade, promoções e experiências personalizadas do cliente. No entanto, o surgimento de clientes máquinas desafia a eficácia dessas abordagens tradicionais.

2.3.2 A mudança para a autonomia da máquina

Os clientes máquinas operam de forma fundamentalmente diferente dos consumidores humanos. Essas entidades orientadas por IA dependem de algoritmos para processar grandes quantidades de dados, otimizar a tomada de decisões e executar transações de forma autônoma. Os principais impulsionadores para os clientes máquinas incluem eficiência, custo-benefício e adesão a critérios pré-programados, desprovidos de influência emocional ou lealdade à marca (Akter *et al*., 2022).

A mudança para a autonomia das máquinas requer uma reavaliação das estratégias de marketing. As empresas devem agora considerar como apelar para algoritmos que priorizam a tomada de decisões lógicas em detrimento do envolvimento emocional. Isso requer um foco nas especificações do produto, qualidade e estruturas de preços que se alinham com as estruturas de tomada de decisão dos clientes máquinas.

2.3.3 Implicações para as Estratégias de Marketing

A transição de modelos de consumo centrados no ser humano para modelos de consumo centrados na máquina tem implicações profundas para as estratégias de marketing. Os profissionais de marketing devem desenvolver novas abordagens que atendam às necessidades e preferências dos clientes máquinas. Isso inclui otimizar dados de produtos para consumo algorítmico, garantir uma integração perfeita com ecossistemas de IoT e alavancar a IA para prever e atender às demandas de entidades autônomas (Kumar *et al*., 2021).

Um desafio significativo é a necessidade de abordar o viés algorítmico. Os modelos de aprendizado de máquina podem, inadvertidamente, perpetuar vieses presentes nos dados de treinamento, levando a resultados injustos ou subótimos.

Garantir transparência, equidade e responsabilidade na tomada de decisões orientada por IA é crucial para manter a confiança e a eficácia no marketing para clientes máquinas (Akter *et al*., 2022).

2.3.4 Adaptação a um novo cenário de consumo

A adaptação ao aumento de clientes máquinas envolve uma mudança de paradigma na forma como as empresas percebem e interagem com os seus mercados. As empresas devem investir em recursos de IA e análise de dados para entender e prever o comportamento dos clientes máquinas. Tal inclui o desenvolvimento de infraestruturas de dados robustas, a integração da IA nos processos empresariais e a promoção de uma cultura de inovação que abranja os avanços tecnológicos.

O surgimento de clientes máquinas também exige novas estruturas éticas para orientar a implantação da IA no marketing. Abordar as preocupações em torno da privacidade de dados, da segurança e do uso ético da IA será fundamental para moldar um cenário de consumo justo e sustentável (Volkmar *et al*., 2022a).

Ao reconhecer e abordar essas mudanças, as empresas podem se posicionar para prosperar em um futuro onde a autonomia das máquinas desempenha um papel central nos mercados de consumo. Esta evolução representa não só um desafio, mas também uma oportunidade significativa para inovar e liderar a economia impulsionada pela IA.

2.4 RUMO A UM CENÁRIO DE CONSUMO AUTOMATIZADO

À medida que as tecnologias de inteligência artificial (IA) e aprendizado de máquina continuam a evoluir, o cenário do consumidor está mudando constantemente para o aumento da automação. Essa transformação é caracterizada pelo aumento de clientes máquinas – entidades autônomas que tomam decisões de compra de forma independente. Esta seção explora como as capacidades de tomada de decisão da IA estão remodelando estratégias de marketing, modelos econômicos e o ecossistema de consumo mais amplo.

2.4.1 Tomada de decisão orientada por IA

A capacidade da IA de processar e analisar grandes quantidades de dados permite-lhe tomar decisões com um nível de precisão e eficiência inatingível pelos consumidores humanos. Os algoritmos de aprendizado de máquina podem prever as necessidades do consumidor, otimizar os processos de compra e executar transações de forma autônoma. Esta capacidade é particularmente evidente em aplicações como a gestão preditiva de stocks e recomendações personalizadas de produtos, onde os sistemas de IA antecipam e satisfazem as exigências dos consumidores antes de estas serem explicitamente declaradas (Prakash *et al*., 2023).

A integração da IA nos processos de tomada de decisão dos consumidores não se limita aos produtos individuais. Cadeias de suprimentos inteiras estão se tornando mais eficientes através do uso de IA, que otimiza os níveis de estoque, reduz o desperdício e garante a entrega oportuna de mercadorias. Esses avanços destacam o potencial da IA para revolucionar não apenas a experiência do consumidor, mas também as eficiências operacionais das empresas (Kumar *et al*., 2021).

2.4.2 Marketing para Entidades de IA

As estratégias de marketing devem adaptar-se às características únicas dos clientes máquinas. Ao contrário dos consumidores humanos, os clientes máquinas baseiam suas decisões puramente em dados e critérios pré-programados. Essa mudança exige que as empresas se concentrem na otimização dos dados do produto, garantindo a compatibilidade com sistemas de IA e aproveitando a análise para atender às necessidades específicas dessas entidades autônomas.

Um aspeto crítico do marketing para clientes orientados por IA é a ênfase na transparência e precisão de dados. Os clientes máquinas confiam em informações precisas e confiáveis para tomar decisões de compra. Portanto, as empresas devem garantir que suas descrições de produtos, preços e dados de disponibilidade estejam atualizados e facilmente acessíveis aos sistemas de IA (Dong, 2024).

2.4.3 Implicações económicas

O aumento de clientes máquinas tem implicações significativas para os modelos econômicos e a dinâmica do mercado. As teorias tradicionais da oferta e da procura, que se baseiam no comportamento humano, devem ser reavaliadas no contexto da tomada de decisão orientada pela IA. Os clientes máquinas operam com foco na eficiência e otimização, potencialmente levando a comportamentos de mercado mais estáveis e previsíveis.

No entanto, a automatização das decisões dos consumidores também suscita preocupações quanto à concorrência no mercado e ao papel da agência humana nas atividades económicas. À medida que os sistemas de IA se tornam mais prevalentes, existe o risco de que as empresas sem acesso a tecnologias avançadas de IA possam ficar em desvantagem, levando a uma maior consolidação do mercado e a uma menor escolha do consumidor (Akter *et al*., 2022).

2.4.4 Perspetivas e desafios futuros

Olhando para o futuro, o cenário de consumo automatizado apresenta oportunidades e desafios. Por um lado, a tomada de decisões baseada em IA pode levar a mercados mais eficientes, custos mais baixos e maior satisfação do consumidor. Por outro lado, considerações éticas, como a privacidade dos dados, a transparência algorítmica e o potencial de enviesamento nos sistemas de IA, devem ser abordadas para garantir um ambiente de mercado justo e equitativo.

As empresas devem investir em recursos de IA e aprendizado de máquina, promover a inovação e desenvolver estratégias que se alinhem com o cenário de consumo em evolução. Ao fazê-lo, podem não só manter-se competitivos, mas também impulsionar o crescimento e a inovação num mundo cada vez mais automatizado (Volkmar *et al*., 2022b).

3 O ADVENTO DA IA NOS CANAIS DE MARKETING

A integração da inteligência artificial (IA) nos canais de marketing não é apenas uma tendência emergente; É uma mudança profunda que está transformando o

cenário de interações com consumidores e estratégias de negócios. Esta seção investiga como a IA está remodelando as vias de marketing, o aumento das compras orientadas por máquinas, a importância da personalização e do marketing preditivo e as considerações éticas que acompanham esses avanços.

3.1 SURGIMENTO DE NOVAS VIAS DE MARKETING

A ascensão da IA deu origem a novos canais de marketing que aproveitam os recursos da tecnologia para melhorar o envolvimento do cliente e simplificar os esforços de marketing. As vias tradicionais de marketing, que dependiam fortemente da intuição e experiência humana, agora são complementadas por estratégias orientadas por IA que utilizam análise de dados, aprendizado de máquina e modelagem preditiva. Estas tecnologias permitem que as empresas visem os consumidores com uma precisão e eficiência sem precedentes (Prakash *et al*., 2023).

Ferramentas baseadas em IA, como chatbots, assistentes virtuais e mecanismos de recomendação personalizados, estão transformando a forma como as empresas interagem com seus clientes. Essas ferramentas não apenas fornecem respostas imediatas e experiências personalizadas, mas também reúnem dados valiosos que podem ser usados para refinar as estratégias de marketing e melhorar a satisfação do cliente (Overgoor *et al*., 2019).

3.2 COMPRAS POR MÁQUINA

As compras conduzidas por máquinas representam uma evolução significativa no comportamento do consumidor. As entidades autónomas, alimentadas por IA, são agora capazes de tomar decisões de compra sem intervenção humana. Essa mudança é facilitada pelos avanços na Internet das Coisas (IoT) e no aprendizado de máquina, que permitem que os dispositivos reordenem suprimentos de forma autônoma, gerenciem estoques e até negociem preços (Dong, 2024).

Por exemplo, geladeiras inteligentes podem pedir mantimentos automaticamente quando o estoque está baixo, e assistentes pessoais orientados por IA, como a Alexa da Amazon, podem comprar itens com base nas preferências do usuário e comportamentos anteriores. Este nível de automação não só aumenta a

conveniência para os consumidores, mas também cria novas oportunidades para as empresas se envolverem diretamente com os clientes máquinas (Kumar *et al*., 2021).

3.3 PERSONALIZAÇÃO E MARKETING PREDITIVO

O poder da IA reside na sua capacidade de analisar grandes quantidades de dados e gerar insights que impulsionam esforços de marketing altamente personalizados. A personalização e o marketing preditivo são duas áreas onde a IA tem um impacto profundo. Ao aproveitar dados de várias fontes, incluindo histórico de compras anteriores, comportamento de navegação e atividade de mídia social, os sistemas de IA podem criar mensagens de marketing altamente personalizadas que ressoam com consumidores individuais (Ma & Sun, 2020).

O marketing preditivo envolve o uso de IA para prever o comportamento e as tendências futuras do consumidor. Isto permite que as empresas antecipem as necessidades e preferências dos clientes, permitindo-lhes adaptar as suas estratégias de marketing em conformidade. Por exemplo, os algoritmos preditivos podem identificar quando é provável que um cliente volte a comprar um produto ou necessite de um serviço, permitindo intervenções de marketing atempadas e relevantes (Akter *et al*., 2022).

3.4 CONSIDERAÇÕES ÉTICAS E PANORAMA REGULAMENTAR

A integração da IA nos canais de marketing traz considerações éticas críticas e a necessidade de marcos regulatórios robustos. Questões como privacidade de dados, transparência algorítmica e enviesamento nos modelos de IA estão na vanguarda do debate ético. Garantir que os sistemas de IA funcionem de forma justa e transparente é crucial para manter a confiança dos consumidores e evitar práticas discriminatórias (Volkmar *et al*., 2022).

A privacidade dos dados é uma preocupação significativa, uma vez que os sistemas de IA requerem acesso a grandes quantidades de informações pessoais para funcionarem de forma eficaz. Os quadros regulamentares, como o Regulamento Geral sobre a Proteção de Dados (RGPD) na Europa, foram concebidos para proteger os dados dos consumidores e garantir que são utilizados de forma ética. As empresas

devem navegar por essas regulamentações cuidadosamente para evitar repercussões legais e construir confiança com seus clientes (Mogaji *et al*., 2020).

À medida que a IA continua a avançar, é imperativo que as empresas e os decisores políticos trabalhem em conjunto para criar diretrizes éticas e normas regulamentares que regulem a utilização da IA no marketing. Essa colaboração ajudará a garantir que os benefícios da IA sejam realizados, ao mesmo tempo em que mitiga riscos potenciais e protege os interesses do consumidor.

4 DECODIFICANDO AS DECISÕES DE COMPRA DA IA E O IMPACTO NO MERCADO

A integração da inteligência artificial (IA) nas decisões de compra está transformando o cenário do comportamento do consumidor e a dinâmica do mercado. As capacidades da IA em análise de dados, reconhecimento de padrões e modelagem preditiva permitem que ela tome decisões com precisão e eficiência sem precedentes. Esta seção examina os meandros da tomada de decisão baseada em IA, as diferenças entre os padrões de consumo humano e de IA, os efeitos em cascata na cadeia de suprimentos e as implicações mais amplas para os modelos econômicos.

4.1 CAPACIDADE DE DECISÃO DA IA

As capacidades de tomada de decisão da IA baseiam-se na sua capacidade de processar grandes quantidades de dados, reconhecer padrões e prever resultados com elevada precisão. Os algoritmos de aprendizado de máquina analisam dados históricos para identificar tendências e tomar decisões informadas, que podem ser aplicadas a vários aspetos do comportamento do consumidor e estratégias de mercado. Por exemplo, a IA pode otimizar preços, personalizar recomendações e automatizar processos de compra, aumentando assim a eficiência e a satisfação do cliente (Prakash *et al*., 2023).

A implementação de IA em plataformas de e-commerce permite a análise de dados em tempo real e a tomada de decisões, o que melhora a experiência geral de compra. Por exemplo, chatbots orientados por IA e assistentes virtuais podem

fornecer suporte instantâneo, responder a consultas e facilitar transações, enquanto aprendem com cada interação para melhorar o desempenho futuro (Luo *et al*., 2019).

4.2 PADRÕES DE CONSUMO HUMANOS VS. IA

Os padrões de consumo dos sistemas baseados em IA diferem significativamente dos dos consumidores humanos. Enquanto as decisões humanas são influenciadas por emoções, fatores sociais e preferências pessoais, os sistemas de IA operam com base em lógica, dados e eficiência. Esta diferença fundamental requer uma reavaliação dos modelos tradicionais de comportamento do consumidor.

Os consumidores humanos muitas vezes exibem fidelidade à marca e são influenciados pelo marketing e publicidade. Em contraste, os sistemas de IA priorizam soluções ótimas com base em critérios e algoritmos predefinidos. Essa mudança exige que as empresas se concentrem na precisão dos dados, na qualidade do produto e em estratégias de preços que se alinhem com os processos de tomada de decisão orientados por IA (Ma & Sun, 2020).

4.3 EFEITO CASCATA DA IA NA CADEIA DE SUPRIMENTOS

A integração da IA nas decisões de compra tem implicações significativas para a gestão da cadeia de abastecimento. Os recursos preditivos da IA melhoram a previsão de demanda, o gerenciamento de estoque e a logística, levando a cadeias de suprimentos mais eficientes e responsivas. Ao analisar dados históricos e tendências de mercado, os sistemas de IA podem prever a demanda do consumidor com alta precisão, reduzindo o risco de excesso de estoque ou falta de estoque (Dong, 2024).

As cadeias de suprimentos orientadas por IA também podem otimizar os cronogramas de produção, simplificar as redes de distribuição e reduzir os custos operacionais. Por exemplo, os sistemas automatizados podem ajustar os níveis de produção em tempo real com base nas flutuações da demanda, garantindo que os recursos sejam usados de forma eficiente e o desperdício seja minimizado. Este nível de otimização aumenta a agilidade geral e a resiliência das cadeias de abastecimento, tornando-as mais bem equipadas para lidar com a volatilidade e as perturbações do mercado (Kumar *et al*., 2021).

4.4 REMODELANDO MODELOS ECONÔMICOS COM CLIENTES DE IA

A ascensão da IA como decisores autónomos exige um repensar dos modelos económicos tradicionais. Os padrões de consumo orientados por IA são mais previsíveis e eficientes, potencialmente levando a comportamentos de mercado mais estáveis. No entanto, esta mudança também coloca desafios, como a necessidade de novos quadros regulamentares e o potencial de consolidação do mercado.

À medida que os sistemas de IA se tornam mais prevalentes, existe o risco de as empresas sem acesso a tecnologias avançadas de IA ficarem em desvantagem, conduzindo a uma maior concentração do mercado e a uma redução da concorrência. Os formuladores de políticas devem enfrentar esses desafios desenvolvendo regulamentações que promovam justiça, transparência e inovação em mercados impulsionados por IA (Akter *et al*., 2022).

As implicações mais amplas do consumo impulsionado por IA se estendem a vários setores, incluindo varejo, manufatura e serviços. Ao alavancar a IA para otimizar as operações e melhorar as experiências dos clientes, as empresas podem alcançar crescimento sustentável e vantagem competitiva em uma economia cada vez mais automatizada (Volkmar *et al*., 2022b).

5. ASSISTENTES PESSOAIS: A NOVA FRONTEIRA NO RELACIONAMENTO COM O CLIENTE

Assistentes pessoais inteligentes (IPAs), como a Alexa da Amazon, a Siri da Apple e o Google Assistente estão se tornando parte integrante da vida moderna, transformando-se de simples ferramentas ativadas por voz em poderosos participantes do mercado. Esta seção explora a ascensão das IPAs, seu papel em evolução como participantes do mercado, seu impacto no comportamento do consumidor e as implicações de privacidade e segurança de dados que acompanham sua adoção generalizada.

5.1 A ASCENSÃO DOS ASSISTENTES PESSOAIS INTELIGENTES

Os assistentes pessoais inteligentes evoluíram rapidamente, indo além das funcionalidades básicas para se tornarem sistemas sofisticados orientados por IA capazes de gerenciar tarefas complexas. Esses assistentes aproveitam o processamento de linguagem natural e o aprendizado de máquina para entender os comandos do usuário, fornecer informações e executar ações que vão desde a configuração de lembretes até o controle de dispositivos domésticos inteligentes. A integração das IPAs na vida cotidiana ressalta seu potencial para influenciar significativamente o comportamento e a tomada de decisão do consumidor (Ma & Sun, 2020).

A popularidade dos IPAs é impulsionada pela sua capacidade de oferecer conveniência e personalização. Ao aprender as preferências e comportamentos do usuário, esses assistentes podem fornecer recomendações personalizadas, automatizar tarefas de rotina e melhorar a experiência geral do usuário. Esta personalização é conseguida através da recolha e análise contínua de dados, o que permite aos IPAs antecipar as necessidades dos utilizadores e agir proativamente (Luo *et al*., 2019).

5.2 INCORPORAR OS ASSISTENTES PESSOAIS COMO PARTICIPANTES NO MERCADO

À medida que os IPAs se tornam mais sofisticados, eles estão prontos para fazer a transição da execução de tarefas direcionadas ao usuário para a tomada de decisões de compra independentes. Esta evolução marca uma mudança crucial no comércio, onde a tecnologia não só ajuda, mas também participa ativamente nas atividades do mercado. Por exemplo, um IPA pode reordenar suprimentos domésticos, reservar serviços ou até mesmo fazer transações financeiras com base nas preferências do usuário e comportamentos passados (Dong, 2024).

As empresas devem adaptar suas estratégias para atender a esses consumidores não humanos. Isso envolve garantir que as informações do produto sejam otimizadas para o consumo de IA, integrando-se com plataformas IPA e desenvolvendo estratégias de marketing que apelem para a lógica e a natureza orientada para a eficiência dos

sistemas de IA. A ascensão das IPAs como participantes autônomos do mercado requer uma mudança na forma como as empresas abordam o envolvimento do cliente e a prestação de serviços (Kumar *et al*., 2021).

5.3 O IMPACTO DOS ASSISTENTES NO COMPORTAMENTO DO CONSUMIDOR

As IPAs estão remodelando o comportamento do consumidor, fornecendo uma interface perfeita entre os usuários e o mercado digital. Ao analisar grandes quantidades de dados de usuários, os IPAs podem fazer previsões e iniciar transações, influenciando efetivamente as escolhas e preferências dos consumidores humanos que servem. Essa capacidade levanta questões significativas sobre autonomia, influência e o futuro da tomada de decisão pessoal em um mundo onde a tecnologia cada vez mais medeia nossas escolhas (Ma & Sun, 2020).

A influência dos IPAs vai além da simples conveniência. Eles podem impulsionar a fidelidade à marca recomendando consistentemente os mesmos produtos ou serviços, com base nas preferências percebidas do usuário. Além disso, à medida que as IPA obtêm mais confiança dos utilizadores, o seu papel na formação das decisões de compra irá provavelmente expandir-se, tornando-as poderosas intermediárias no mercado de consumo (Luo *et al*., 2019).

5.4 PRIVACIDADE DE DADOS E IMPLICAÇÕES DE SEGURANÇA

A adoção generalizada de IPAs traz preocupações significativas em termos de privacidade e segurança de dados. Esses assistentes coletam grandes quantidades de dados pessoais, incluindo gravações de voz, históricos de pesquisa e padrões de uso. Garantir a privacidade e a segurança desses dados é fundamental para manter a confiança do usuário e prevenir possíveis violações. As empresas e os fornecedores de tecnologia devem implementar medidas de segurança robustas e práticas transparentes de tratamento de dados para salvaguardar as informações dos utilizadores (Volkmar *et al*., 2022).

Quadros regulatórios como o Regulamento Geral sobre a Proteção de Dados (RGPD) na Europa fornecem diretrizes para a proteção de dados, mas o rápido avanço das tecnologias de IA exige uma avaliação e adaptação contínuas desses

regulamentos. As empresas devem manter-se em conformidade com os padrões legais em evolução e priorizar considerações éticas em suas práticas de dados (Mogaji *et al*., 2020).

À medida que os IPA continuam a integrar-se na vida quotidiana, será fundamental enfrentar estes desafios em matéria de privacidade e segurança. Garantir que os usuários tenham controle sobre seus dados e entendam como eles são usados será essencial para promover uma relação de confiança entre os consumidores e as tecnologias de IA.

6. CONCLUSÃO

O surgimento de clientes máquinas marca uma mudança significativa e transformadora na dinâmica do consumidor, impulsionada pelos avanços em inteligência artificial (IA) e aprendizado de máquina. Este artigo explorou várias facetas dessa evolução, desde a definição de clientes máquinas e compreensão dos avanços tecnológicos que permitem sua ascensão, até o exame das implicações para estratégias de marketing, modelos econômicos e considerações éticas.

Os clientes máquinas, como entidades autônomas que tomam decisões de compra, desafiam os modelos tradicionais de comportamento do consumidor centrados no ser humano. Eles operam com base em algoritmos orientados por dados, priorizam a eficiência e exigem que as empresas repensem suas abordagens de marketing e engajamento do cliente (Prakash *et al*., 2023). A integração da IA e da Internet das Coisas (IoT) lançou as bases para essas entidades, transformando a forma como os produtos são encomendados, gerenciados e consumidos.

A mudança para um cenário de consumo automatizado tem profundas implicações para a gestão da cadeia de suprimentos e modelos econômicos. As capacidades preditivas da IA aumentam a eficiência, reduzem o desperdício e garantem a disponibilidade oportuna do produto, remodelando a dinâmica tradicional do mercado (Dong, 2024). No entanto, esta evolução suscita também importantes preocupações éticas e regulamentares. Garantir a privacidade dos dados, abordar o enviesamento algorítmico e manter a transparência na tomada de decisões orientada pela IA são fundamentais para promover a confiança e a equidade nesta nova era do consumidor (Volkmar *et al*., 2022).

À medida que os assistentes pessoais inteligentes se tornam mais integrados na vida diária, o seu papel na formação do comportamento do consumidor e na participação no mercado cresce. Esses assistentes não apenas aumentam a conveniência, mas também coletam dados extensos, levantando preocupações significativas de privacidade e segurança que devem ser abordadas para proteger os interesses dos usuários (Mogaji *et al*., 2020).

Em conclusão, o aumento de clientes máquinas e a integração mais ampla da IA nos mercados de consumo representam oportunidades e desafios. As empresas devem adaptar-se, investindo em tecnologias de IA, desenvolvendo novas estratégias de marketing adaptadas a entidades autónomas e garantindo práticas éticas nas suas operações. Os decisores políticos também devem manter-se vigilantes e proativos na criação de quadros regulamentares que apoiem a inovação, salvaguardando simultaneamente os direitos dos consumidores.

Ao abraçar estas mudanças e enfrentar os desafios associados, as empresas e as sociedades podem aproveitar todo o potencial do consumismo impulsionado pela IA, impulsionando o crescimento e a inovação num mundo cada vez mais automatizado.

Para explorar e abordar ainda mais os desafios e oportunidades apresentados pelos clientes máquinas, várias vias de pesquisa podem ser seguidas:

1. **Avaliação do valor futuro das avaliações de satisfação do produto:** investigue como os sistemas de IA podem incorporar e pesar as avaliações de satisfação do cliente em seus processos de tomada de decisão. Esta pesquisa pode ajudar as empresas a entender como o feedback qualitativo influencia as recomendações e decisões de compra orientadas por IA (Prakash *et al*., 2023).
2. **Garantir um tratamento justo para novos produtos:** Desenvolver algoritmos e estruturas que garantam que os novos produtos recebem visibilidade e consideração justas pelos sistemas de IA. Esta pesquisa poderia se concentrar no equilíbrio de dados históricos com algoritmos exploratórios para promover a inovação e a concorrência leal (Dong, 2024).
3. **Ensinando as máquinas a desaprender com o advento de produtos disruptivos:** Explore metodologias para permitir que os sistemas de IA descartem informações desatualizadas e se adaptem rapidamente a produtos

novos e disruptivos. Esta pesquisa poderia envolver modelos dinâmicos de aprendizagem que priorizam dados atuais e relevantes (Volkmar *et al*., 2022).

4. **Proteção contra falhas de IA nas decisões de compra:** investigue estratégias para detetar, prevenir e corrigir decisões de compra erradas tomadas por sistemas de IA. Esta pesquisa pode incluir o desenvolvimento de fail-safes, verificações de redundância e recursos de substituição do usuário para mitigar o impacto de erros de IA (Ma & Sun, 2020).
5. **Prevenção de fraudes em compras orientadas por IA:** Desenvolva algoritmos e protocolos avançados de deteção de fraude para sistemas de IA para identificar e evitar sites fraudulentos. Esta investigação poderia centrar-se na integração de informações sobre ameaças em tempo real e processos de verificação robustos em quadros de tomada de decisão de IA (Luo *et al*., 2019).
6. **Antecipando e mitigando explorações SCAM de vulnerabilidades de IA:** Conduza uma análise abrangente de potenciais técnicas de SCAM visando sistemas de IA. Esta pesquisa poderia envolver a simulação de vários cenários de ataque para identificar fraquezas e o desenvolvimento de contramedidas para fortalecer as defesas de IA (Mogaji *et al*., 2020).

Ao adotar estas orientações de investigação, as empresas e os investigadores podem desenvolver sistemas de IA robustos e adaptáveis que satisfaçam as necessidades dos consumidores modernos, salvaguardando-se simultaneamente contra potenciais riscos e desafios. Essa abordagem proativa ajudará a aproveitar todo o potencial do consumismo impulsionado por IA, impulsionando o crescimento e a inovação em um mundo cada vez mais automatizado.

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CHAPTER 5

BUSINESS AND COMPETITIVE INTELLIGENCE IN THE MANAGEMENT OF A COMPANY'S OPERATIONS IN THE SCOPE OF DIGITAL TRANSFORMATION

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ABSTRACT: Producing in an intelligent way has become an increasingly greater requirement, previously as a strategy aimed mainly at achieving the desired profitability on the part of for-profit organizations and at achieving good service for other non-profit organizations. Currently, with globalization, which is characterized by a very

competitive market, producing intelligently has gained new momentum due to the need to also obtain competitive advantages. However, both before and in the current context, technology has always played a fundamental role in this process, also becoming a great ally of man, in the production process and in other aspects of his day-to-day life. From this perspective, with the development of Information and Communication Technologies, data, information and knowledge have become a competitive differentiator for organizations. In the sphere of the ongoing revolution of digital transformation, this research aims to analyze the contribution of digital tools, in transforming data into information, then into decisions and finally, into actions to help the organization maintain and develop distinct competitive advantages, using the entire company and its networks to gain insights into the market, competitors, customers, technology and regulators. In this study, we will direct our attention particularly to platforms known as Enterprise Resources Planning (ERP), Customer Relationship Management (CRM) and Supply Chain Management System (SCM), describing each of them and above all their impacts using only the literature review.

KEYWORDS: business intelligence, competitive intelligence, digital transformation.

RESUMO: Produzir de forma inteligente, tornou-se uma exigência cada vez maior, antes como estratégia virada principalmente, para o alcance da almejada lucratividade, por parte das organizações com fins lucrativos e para o alcance do bem servir para outras, sem fins lucrativos. Actualmente, com a globalização, que se caracteriza por um mercado bastante competitivo, produzir de forma inteligente, passou a ganhar novo ímpeto pela necessidade da obtenção também de vantagens competitivas. Entretanto, tanto antes como no actual contexto, a tecnologia, sempre desempenhou um papel fundamental nesse processo, tornando-se também, num grande aliado do homem, no processo produtivo e em outros, do seu dia-a-dia. Nesta perspectiva, com o desenvolvimento das Tecnologias de Informação e Comunicação, os dados, as informações e o conhecimento, tornaram-se um diferencial competitivo para as organizações. Na esfera da revolução em curso da transformação digital, com esta pesquisa pretende-se analisar a contribuição das ferramentas digitais, na transformação de dados em informações, depois em decisões e finalmente, em acções no auxilio da organização a manter ea desenvolver vantagens competitivas distintas, usando toda a empresa e as suas redes para obter *insights* sobre os mercado, concorrentes, clientes, tecnologia e reguladores. Neste estudo, direccionaremos as nossas atenções particularmente para as plataformas conhecidas como, Enterprise Resouces Planning (ERP), Customer Relationship Management (CRM) e Supply Chain Management System (SCM), descrevendo cada uma delas e sobretudo seus impactos usando apenas à revisão de literatura.

PALAVRAS-CHAVE: inteligência de negócio, inteligência competitiva, transformação digital.

1. INTRODUCTION

According to Pirates and Ospina (2004), technology is an individual factor of change of greater importance in the transformation of companies. Such transformations are not only restricted to the way of producing goods and services, but also lead to new processes and tools, which completely affect the structure and behavior of organizations. This transformation has a consequent impact on the companies' production results, since, as is also advocated by Da Silva, Lemos, Paulino and Kannenberg, (2016) the maxim that information is the soul of business has never been more current. This research aims to analyze how the set of business information systems, in the process of transformation of traditional production processes, in the context of Business Intelligence and Competitive, have been important factors of competitiveness in different types of organizations, agreeing this time with Valentim (2002) according to which, prospecting, filtering and transferring this set (data, information and knowledge) is essential for the consolidation of the process of organizational competitive intelligence.

Still in the eyes of Valentine (2002), through the management of information resources, it is possible to subsidize various activities, for the continuous improvement of the business of the organization, and therefore it is fundamental for the increase of productivity and quality of the organization. In this way, with the necessary relevance, we intend to answer the following starting question**: How do business intelligence tools and competitive management in the context of the digital transformation contribute to obtaining competitive advantages?**

This research, of a qualitative nature and of a pure and exploratory nature, is considered pertinent, because it seeks an understanding of the current phenomenon of the transformation of all traditional processes, of production, sale and delivery of goods and services in *bits* that allow the obtaining of necessary competitive advantages and profitability, fundamental condition for the survival and prosperity of companies. It will also contribute to the dissemination of knowledge about the process of digital transformation, and will also serve as a bibliographic basis for future studies.

The objectives of this research are to analyze the main outlines related to concepts, characteristics, functions and other related factors related to Business Intelligence, Competitive Intelligence, Digital Transformation, Integrated Business

Management Systems, Customer Relationship Management, Supply Chain Management, but above all with emphasis on the differential impacts caused by each of the three digital tools, mentioned above, in the various business processes of a company.

As for the structure, the research beyond this introduction, are composed of a review of the literature that discusses the concepts of Business Intelligence and Competitive Intelligence and Digital Transformation, including the description of the three tools, namely Integrated Business Management Systems (ERP), Customer Relationship Management Systems (CRM) and Supply Chain Management Systems (SCM), the respective benefits, topics that it is believed will certainly operationalize the reach of the research results.

2. LITERATURE REVIEW

2.1 BUSINESS INTELLIGENCE, COMPETITIVE INTELLIGENCE AND DIGITAL TRANSFORMATION

Business Intelligence (BI): BI stands for *Business Intelligence*, and is a set of technological solutions that involve processes of data collection, transformation, analysis and distribution for decision-making. This concept coincides with that of Soares (2005), which defines it as the ability of companies to access data and gather information contained, for example, in a *Data Warehouse* system (DW), analyzing this information, to support business decision-making. The BI process is based on transforming data into information, then decisions and finally actions.

Turban *et al*. (2009, as cited in Da Silva, *et al*. 2016) define *Business Intelligence* (BI) as an umbrella term, which includes architectures, tools, databases, applications, and methodologies. This view corresponds to the use of ICTs. BI's main objectives are to enable interactive access to data (often in real time), to provide manipulation of that data and to provide business managers and analysts with the ability to perform proper analysis, for subsequent decision making and actions.

For Tidd and Bessat (2019) innovation is directly linked to entrepreneurship, because it involves the ability to identify opportunities and develop new ways to take advantage of them. Rocha, Moreira, Neto and Siqueira (2024) argue that this "process

is crucial to drive innovation, since the ability to perceive and exploit opportunities creatively is essential to advance and create significant changes " (p.177).

Competitive Intelligence (CI): It can be conceptualized as a set of processes that aim to systematize the search, analysis and dissemination of useful information to decision makers, in order to eliminate or reduce surprises, reduce response time to problems and to find new opportunities in the market (Abreu, Debiasi & Krucken, 2001).

According to Jacobiak (1996, cit in Menezes, 2005), competitive intelligence can be considered a significant part of the organization's strategic management, through information that enables decision makers to anticipate market trends and competitors' positions.

However, for Kahaner (1996, cit in Menezes, 2005), competitive intelligence is a systematic institutional process for gathering and analyzing information about the activities of the competition and the trends of the specific sector and of the market in general, with the purpose of leading the organization to achieve its goals and goals. As can be seen, we find a certain convergence as to the meaning of the concepts presented above.

The focus of the IC according to Valentim (2002) is on the organization's strategies for taking actions such as: developing the creative capacity of the organization's intellectual capital; prospecting, selecting and filtering of strategic information; adding value to the information prospected, selected and filtered; using a strategic information system aimed at decision making, creating and making available specific products and services. In the context of CI, organizations produce and use data, information and knowledge of different kinds, and also use data, information and knowledge produced outside the organization that enable better performance in the market in which they operate. Among them Valentine (2002) gives some examples:

- **Strategic:** support decision-making by senior management and enable strategic analysts to define for organization, guidelines, policies, programs, lines of action, priorities, performance indicators, plans and planning, i.e. future scenarios, mission and goals, action in society and institutional image;
- **Market**: enable senior management as well as the commercial area to perceive business opportunities in both the domestic and the international market;
- **Financial:** enable financial professionals to process cost, profit, risk and control studies;

- **Commercial:** subsidize the commercial area in the export and/or import of materials, products and services, as well as subsidize the legal area in relation to the legislation of the country;
- **Statistics:** subsidize the strategic, financial, commercial and R&D areas, identifying in percentage and/or numerical terms issues linked to the organization's business such as: export indices, imports, demands and market restrictions, economic indices, purchasing power, GDP, unemployment index, trade balance, investment indices etc.;
- **Management:** meet the needs of managers and executives of the organization in the planning and management of projects, in the management of people and diverse situations;
- **Technological:** subsidize the R&D area in the development of products, materials and technological processes, as well as monitoring the competition for the various innovations;
- **General**: disseminated to all areas of the organization, enabling professionals to constantly update, such as: news, facts and/or events etc.;
- **Gray**: of any nature, for any area and for any purpose of use, which are not detected in formal information searches, for example: invisible college, memory of people, sensitive documents difficult to access, electronic informal corridors (Internet), etc.

Digital Transformation (TD): corresponds to the joining of two processes (digitalization + typing). According to Reis *et al*. (2020 cit in Souza, 2022) digitalization is about transforming physical information into a new format, digital. For example, by scanning a page in a book we are doing a scanning process. Digitization, therefore, in another strand is due to the transformation of business methods and models using digital technologies as drivers of structural change in various sectors, public or private.

For Macalintal and Chepkasova (2017), digital transformation is a paradigm shift, associated with a new way of thinking and acting within an organization, through the use of information and communication technologies (ICTs).

For Gerbina and Mizintseve (2017); Fischer *et al* (2020, cit. in Arantes, Castro, Mineiro, Pereira and Oliveira, 2021) TD changes the processes and organizational structure, as well as affecting the interactions between the various stakeholders of a company, because, according to them with the intensive use of digital technologies,

companies are experimenting with new ways to seek knowledge, make decisions, generate data, make partnerships and elaborate their strategies. This, without a shadow of doubt, is the greatest impact of TD.

However, it should be mentioned that the main dimensions of digital transformation according to Schwertner (2017 cit in Dias, 2019), are: strategy, operations, work model, talent management, digitalization of products and services, skills and leadership. But for Rogers (2016 cit in Dias, 2019), the domains of digital transformation are customers, competition, data, innovation and value.

A fully transformed company, i.e. 100% digital, is one in which virtually all business processes and relationships with partners, customers and employees are conducted digitally to create value with customers and suppliers and can include: Integrated Business Management Systems (ERP), Customer Relationship Management Systems (CRM), Supply Chain Management Systems (SCM) and Knowledge Management Systems (KMS). Let's briefly discuss each of the three chosen for the present research, taking into account that for KMS its functions can be incorporated into an ERP

2.2 INTEGRATED BUSINESS MANAGEMENT SYSTEMS (ERP)

The *current Enterprise Resources Planning* (ERP) systems for example integrate modules representing the most typical information systems needed in a company, such as: Tax Accounting, Management Accounting, Budget and Budget Execution, Cash Flow, Applications and Loans, Receivables, Accounts Payable, Travel Control, Sales Pricing Administration, Purchasing, Freight Control, Contract Control, Investment Control, Sales Quotations, Stock, Export, Billing, Storage Management, Import, Tax Obligations, Orders, Sales Forecast, Receipts, HR Information Management, Planning and Planning production, and many others. They are provided to meet the specific needs of each company, and may or may not support all the above-mentioned functionalities, as long as these functionalities are comprehensive and respect the complexity of the company.

Now Macane (2022) argues that integrated management systems play an increasingly important role in the development and support of the various business tasks, as they make it possible to process tasks and access the database easily,

quickly and quickly, communicate with the various stakeholders, improve performance, innovate, grow and gain competitive advantage.

Deloitte (1998, cit. in Souza & Zwicker 2000) defines them as "a package of *software* of business that allows a company to automate and integrate the majority of its business processes, share common practices and data throughout the company and produce and access information in real time. Already in its own view Souza and WNZwicker (2000) Therefore, the company makes it possible to: eliminate the use of manual interfaces; reduce the cost chain; optimize the flow of information and the quality of information within the organization; optimize the decision-making process; eliminate the redundancy of activities and information; reduce the limits of response time to the market, including the uncertainties of the supply time of goods and raw material; incorporate best practices into the internal processes of the company and reduce the time of management processes, the best choice of the types of transport to be used, constituting the ERP with main bases for obtaining competitive advantages.

2.3 CUSTOMER RELATIONSHIP MANAGEMENT (CRM) SYSTEMS

According to Frei (n.a. cit in Greenberg, 2001) *Software*, "Customer Relationship Management (CRM) is a set of processes and technologies that generate relationships with actual and potential customers and business partners through marketing, sales and service delivery, regardless of the communication channel".

CRM that can be collaborative, operational, analytic, or social is an approach that puts the customer at the center of business processes. It is designed to understand and anticipate the needs of actual and potential customers, so as to seek to best meet them. This definition is supported by Peppers' placement (2003 cit in De Sousa and Torquato 2013) according to which, the real competitive advantage of a company consists in having information about its customers that the competition does not have them, and being able to quickly turn that knowledge into action. It is won by those who manage to establish effective relationships with customers, and thereby also to detect business opportunities.

The benefits of implementing and using a CRM in a company are further expressed by De Sousa; Torquato (2013), namely: increasing the customer retention rate - being able to increase their participation in the business of each of their

customers over time; improving strategies necessary to protect and increase their margins per unit; obtaining *insights* that allow obtaining completely new markets for the company - individual customer markets, with wide and diversified needs; planning a feasible and systematic transition to the era of total interactivity with their customers, adopting, using and even regaling with these new technologies. It is therefore a perfect tool for relationship marketing, because one should never ignore that the customer's useful life is the main factor of profitability.

2.4 SUPPLY CHAIN MANAGEMENT SYSTEM (SCM)

To understand the SCM one first needs to understand what the supply chain is. It refers to the flow of materials, information, money and services from raw material suppliers, through factories and warehouses, to final customers. A supply chain also includes organizations and processes that create and deliver products, information, and services to end customers.

Lambert (1993, as cited in Batista, Chavão, Oliveira & Salgado, 2017) considers supply chain management, the integration of key business processes that include the chain from the end user to the original suppliers and probably sub-suppliers, which provide products or raw materials, services and information that add value to consumers and other interested parties in the business.

An interesting definition that should also be underlined is that of *Council of Logistics Management* as quoted in Carvalho, Liboreiro and Souza (2006), who look to the SCM as the strategic and systemic coordination of traditional business functions as well as the tactical actions that permeate these functions in a company and through business within the logistics chain with the purpose of improving the long-term performance of individual companies and the supply chain as a whole.

Thus, it can be evidenced that the scope of SCM aggregates the entire production chain, even the company's relationship with its customers, and not only with its suppliers. It can also provide the reach of the following benefits: Integration of all elements affecting the supply chain; better relationship with external agents as suppliers; improved monitoring of material flows (orders, shipments, transportation and deliveries); improved monitoring of material flows (orders, shipments, transportation and deliveries); production on demand, possibility of reducing transportation and

storage costs, and consequent reduction of prices and other advantages. As we can see, with the help of this tool, we are able to produce better at lower cost**,** another important condition for achieving competitive advantages. It should be noted that in some cases, SCM functions can be incorporated into an ERP and therefore this system can be dispensed with.

3. CONCLUSIONS

From the literature review performed above, the following can be concluded:

- Both the BI and the IC in the scope of TD, are processes that make it possible to obtain Competitive Advantages. This was seen in the particularized study of each case, including ERP, CRM and SCM.
- If BI is a set of technological solutions that involves a process of collecting, transforming, analyzing and distributing data for decision making and **CI**, a systematic institutional process to "mine" and analyze information about the activities of the competition and the trends of the specific sector and the market in general, with the purpose of leading the organization to achieve its goals and goals on the one hand, and TD as a paradigm shift associated with a new way of thinking and acting within an organization, through the use of information and communication technologies (ICT), then it can be concluded that the three actions, aim at the same ultimate goal, which is to produce better at lower cost, a basic condition for obtaining competitive advantages in a global market, characterized by a lot of competition;
- The TD and a materialization of the principles of Business and Competitive Intelligence;
- The CI should sequentially observe the following actions: identification of both internal and external intelligence segments; prospecting, accessing and collecting data, information and knowledge produced internally and externally; selection and filtering of relevant data, information and knowledge, both for people and for the organization; treating and adding value to the data, information and knowledge mapped and filtered, seeking user/system interaction languages; storing through IT, the data, information and knowledge, after processing, seeking quality and security; disseminating and transforming

the data, information and knowledge into final services and products with added value for the competitive and intelligent development of people and the organization; finally creating *feedback* mechanisms for generating new data, information and knowledge for feedback systems;

- It can be said that, in evolutionary terms, we move from artisanal production to mass production, to the current context characterized by mass customization, made possible by instantaneous communication of the various links of the productive chain, by the movement of TD, from development to after-sales. The exchange of information can take place in the company, among its employees, with customers and with its suppliers, optimizing purchases, sales, stocks and logistics, strengthening the relationship with these all *stakeholders*, adding value to goods and services to customers at competitive prices, but with a demand for new professional skills.

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CHAPTER 6

ANTIMICROBIAL AND SPORICIDAL EFFICACY OF UV-C RADIATION ON DENTAL AND MEDICAL MATERIALS

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ABSTRACT: Bacterial infections by multidrug-resistant (MDR) strains caused 4.95 million deaths in 2019. Nowadays, communal environments, such as doctor`s office and clinics, contaminations by MDR, which provides from health professionals and patients, that contaminate the procedures materials. An alternative for the elimination of these pathogenic agents in these materials is UV-C radiation. The photons transported by UV-C rays, which wavelength range from 100 and 290 nanometers, show a higher specificity for nucleic acids on ligations of timine with adenine. In this study, we evaluated the antimicrobial effect of a sterilizing box Plazadente® prototype, through the direct exposition of UV-C light with joined ultrasound system on contaminated dental materials. Petri dishes surfaces were inoculated with 1,5 x 10^6 colony forming units (CFU) of *Staphylococcus aureus* and 1,5 x 10^4 CFU *B. subtilis* endospores were submitted to UV-C light provided by the equipment for 3 and 10 minutes. Antimicrobial efficacy of equipment system on contaminated dental materials with bacteria and yeast were also evaluated by an accredited laboratory of microbiological analysis. The population of all tested microorganisms were eliminated (reduction of 99.999%) after 5 minutes UV-C light exposure. In this study was noted the potential of the UV-C light with ultrasound system in the sterilization of bacterial and fungi as a solution to the material contamination.

KEYWORDS: radiation, ultraviolet, sterilization, bacterial endospores, bacteria.

RESUMO: Infecções bacterianas por cepas multirresistentes aos antimicrobianos (MDR) causaram 4,95 milhões de mortes em 2019. Atualmente, ambientes

comunitários, como consultórios e clínicas, enfrentam contaminações por MDR, oriundas da microbiota de profissionais de saúde e pacientes, que contaminam materiais de procedimento. Uma alternativa para a eliminação destes agentes patogênicos presentes na superfície destes materiais é a radiação UV-C. Os fótons transportados por ondas UV-C, que variam os comprimentos de onda entre 100 e 290 nanômetros, apresentam maior reatividade para ácidos nucléicos na ligação entre timinas e adeninas. Nesse estudo, avaliamos o efeito antimicrobiano de um modelo de caixa esterilizadora por luz UV-C da Plazadente®, a partir da exposição direta de luz UV-C com um sistema de ultrassom acoplado no equipamento, em materiais odontológicos contaminados. Superfícies de placas de Petri foram inoculadas com 1,5 x 10^6 unidades formadoras de colônias (UFC) de *Staphylococcus aureus* e 1,5 x 10^4 UFC de endósporos de *B. subtilis*, submetidas a exposição direta de UV-C do equipamento durante 3 e 10 minutos. A eficácia antimicrobiana do sistema do equipamento também foi avaliada por um laboratório credenciado de análises microbiológicas em materiais odontológicos contaminadas com bactérias e leveduras. A população de todos os microrganismos testados incluindo os esporos bacterianos foram eliminados (redução de 99,999%) após 5 minutos de exposição da luz UV-C. Neste estudo foi notado o potencial da luz UV-C com o sistema de ultrassom na esterilização de bactérias e fungos como solução para a contaminação de materiais.

PALAVRAS-CHAVE: radiação, ultravioleta, esterilização, endósporos bacterianos, bactérias.

1. INTRODUCTION

Previously restricted only to hospital environments, the presence of multi-resistant bacterial strains is now found in clinics. Such pathogens can be found in healthcare professionals, doctors and patients as part of the microbiota, and transmitted by equipment such as dental turbines, tweezers, drills, among others from patients to professionals, and can cause cross-contamination (Baudet *et al.*, 2021; Kobza; Pastuszka; Bragoszewska, 2018; Kurita; Kurashina; Honda, 2006; Suleyman, Alangaden; Bardossy, 2018). In the case of patients, antibacterial treatments may result in the selection of resistant strains, which may remain as members of the microbiota for 12 months after prescription (Costelloe *et al.*, 2010; Thompson *et al.*, 2021). In relation to the different microbiota present, the oral microbiota, both commensal and permanent, is one of the most diverse in the human body (Meinen *et al.*, 2021).

The use of alternative antimicrobials has been a practice in the combat of multi-resistant microorganisms (Endo *et al.*, 2022; Kashiwaqui *et al.*, 2023). The most correct and practical way to solve the problem of infections in medical-hospital settings by avoiding the use of antibacterials, is to remove the focus of infection, considered preferable in certain contexts (Cope *et al.*, 2017; Thompson *et al.*, 2021). However, routine dental procedures for the treatment of such infections release a large volume of aerosols, which can contain such contaminants, which increases the risk of cross-infection among patients, doctors and health care professionals (Baudet *et al.*, 2021; Botta *et al.*, 2020; Pereira *et al.*, 2020; Zemuri, et al., 2017).

In order to eliminate microorganisms in medical equipment such as dental and hospital equipment, as well as fluids and aerosols that are not sterilized by other means due to factors such as thermosensitivity, UV-C-type ultraviolet radiation is used (Botta *et al.*, 2020; Darnell *et al.*, 2004; Raeiszadeh; Adeli, 2020; Walker; Ko, 2007). This radiation, whose wavelength varies between 200 and 280 nm, is present in solar rays but is filtered by the ozone layer, and is thus present in the atmosphere only by the use of special lamps (Botta *et al.*, 2020; Conner *et al.*, 1998). The antibacterial effect of this is dependent on energy incident on a body can be measured, and the incident energy (given in Joules per square centimeter) is calculated by multiplying the irradiance (in

milliwatts per square centimeter) by the exposure time in seconds (Bolton; Cotton, 2007; Raeiszadeh; Adeli, 2020).

Other uses of UV-C light include: hospital room cleaning, sterilization of circulating air, and hospital equipment (Candum *et al.*, 2020; Raeiszadeh; Adeli, 2020; Ramos *et al.*, 2020). The most common wavelength of such machinery lamps is between 220 and 270 nm, and sterilizers most commonly use lamps with a wavelength of 254 nm (Raeiszadeh; Adeli, 2020; Ramos *et al.*, 2020). As a new proposal, there is even the development of a sterilization system of emptied dental room, from exposure to UV-C light of 30 mJ/cm^2 for 26 minutes (Botta *et al.*, 2020).

In this study, we analyzed a UV-C machine model, CE 01 - 22 UVC/ULTRA, provided by the company Plazadente LTDA, as to its decontamination effectiveness against a bacterial and fungal model (including bacterial spores), by tests modeled after the ASTM protocol E-2197-11, as well as the interaction of sterilizing UV-C light with a preparation protocol of the material, seeking the feasibility of machinery.

2. OBJECTIVE

The objective of the study was to evaluate the antimicrobial and sporicidal efficacy of the UV-C light system and ultrasound from a piece of equipment under development for application in the dental and medical-hospital sectors.

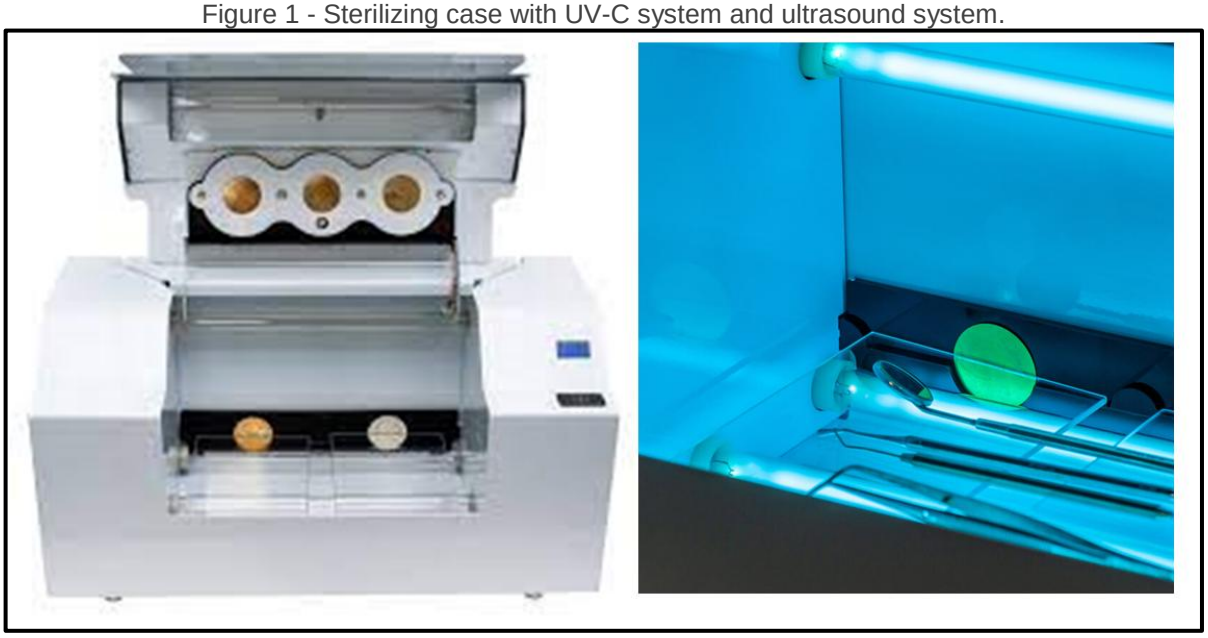
3. DEVELOPMENT

3.1 EQUIPMENT DEVELOPED

The equipment Plazadente Sterilizing Box Model CE 01 - 22 UVC/ULTRA in metal and carbon steel (external dimensions of 410 mm x 630 mm x 200 mm, and internal of 400mm x 400mm x 90mm) tested works on the basis of UV-C light 254 nm, and was notified by ANVISA as "Medical Device Class II/5106107229", through Resolution No. 613 of 23/02/2023.

The device features five UV-C Model G8T5/G15-T8-15w lamps with power of 8W/15w with durability from 5,000 to 6,000 hours of use. For material packaging, a quartz glass tray is located on the bottom of the inside of the equipment (Figure 1).

Figure 1 - Sterilizing case with UV-C system and ultrasound system.



Source: The author himself.

3.2 MICROBIAL STRAINS

The bacterial and fungal strains in table 1 were used in this study. Bacterial strains were grown in Muller-Hinton culture medium (MH - Difco®), broth and agar, and fungal strains in Saboraud medium (Difco®). The microbial strains were kept in Brain Heart Infusion (BHI - Difco®) broth, with 20% glycerol (Merck®) in biofreezers at -80ºC, until the moment of use.

Table 1 - Bacterial and fungal strains tested for UV-C radiation.

Strains	Type of micro-organism	Origin
***Escherichia coli* ATCC 8739**	Bacteria	QLCLq
***Pseudomonas aeruginosa* ATCC 9027**	Bacteria	QLCLq
***Salmonella choleraesuis* ATCC 10708**	Bacteria	QLCLq
***Staphylococcus aureus* ATCC 29213**	Bacteria	LBBA/MIB/UEL
***Staphylococcus aureus* ATCC 6538**	Bacteria	QLCLq
***Bacillus subtilis* ATCC 23857**	Bacteria (spore)	LBBA/MIB/UEL
***Candida albicans* ATCC 10231**	Fungus (dimorphic)	QLCLq
Saccharomyces cerevisiae	Fungus (leveduriform)	Commercial

Source: The author himself.

LBBA: Laboratory of Basic and Applied Bacteriology
LCQPq: Quality Control and Research Laboratory
MIB: Department of Microbiology
UEL: Londrina State University

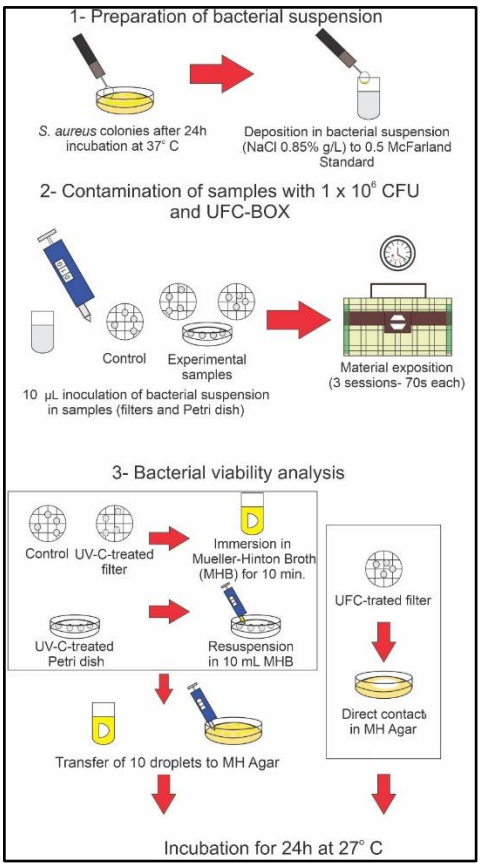
3.3 EVALUATION OF ANTIMICROBIAL EFFICACY

The UVC-BOX model (figure 1) was provided by Plazadente LTDA, for analysis of the time required for sterilization of bacterial cells in vegetative state and in spores as well as the fungicidal action.

For an initial study of the effectiveness of antibacterial activity by exposure of UV-C light from the model, sterile paper filters were contaminated with *S. aureus* ATCC 25923, by inoculation of 10 µL of a bacterial suspension (0.5 McFarland scale), followed by exposure of the UV-C light system and ultrasound, for 3 minutes. The bacterial viability assessment was performed by washing the filters inside a petri dish with a sterile saline solution, and then dilution and plating of the aliquots in MH agar. The procedure was based on the ASTM protocol E-2197-11 (Figure 2).

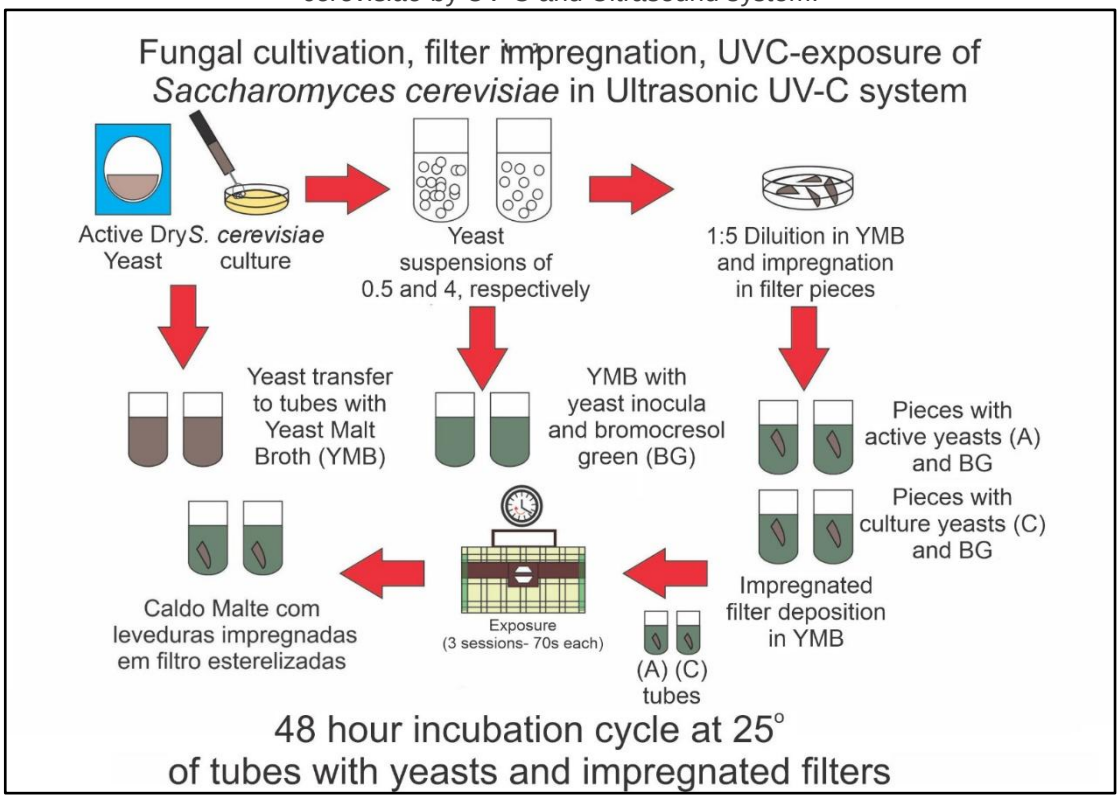
For the evaluation of antifungal efficacy, a strain of *Saccharomyces cerevisiae* (Fermix®) was grown in Saboraud agar for 48 hours at 37ºC, following the methodology outlined in Figure 3.

Figure 2. Stages of cultivation, contamination, exposure to UV-C, plating and analysis of vegetative bacterial cells.



Source: The author himself.

Figure 3. Cultivation, contamination, UV-C exposure and growth assessment of *Saccharomyces cerevisiae* by UV-C and Ultrasound system.



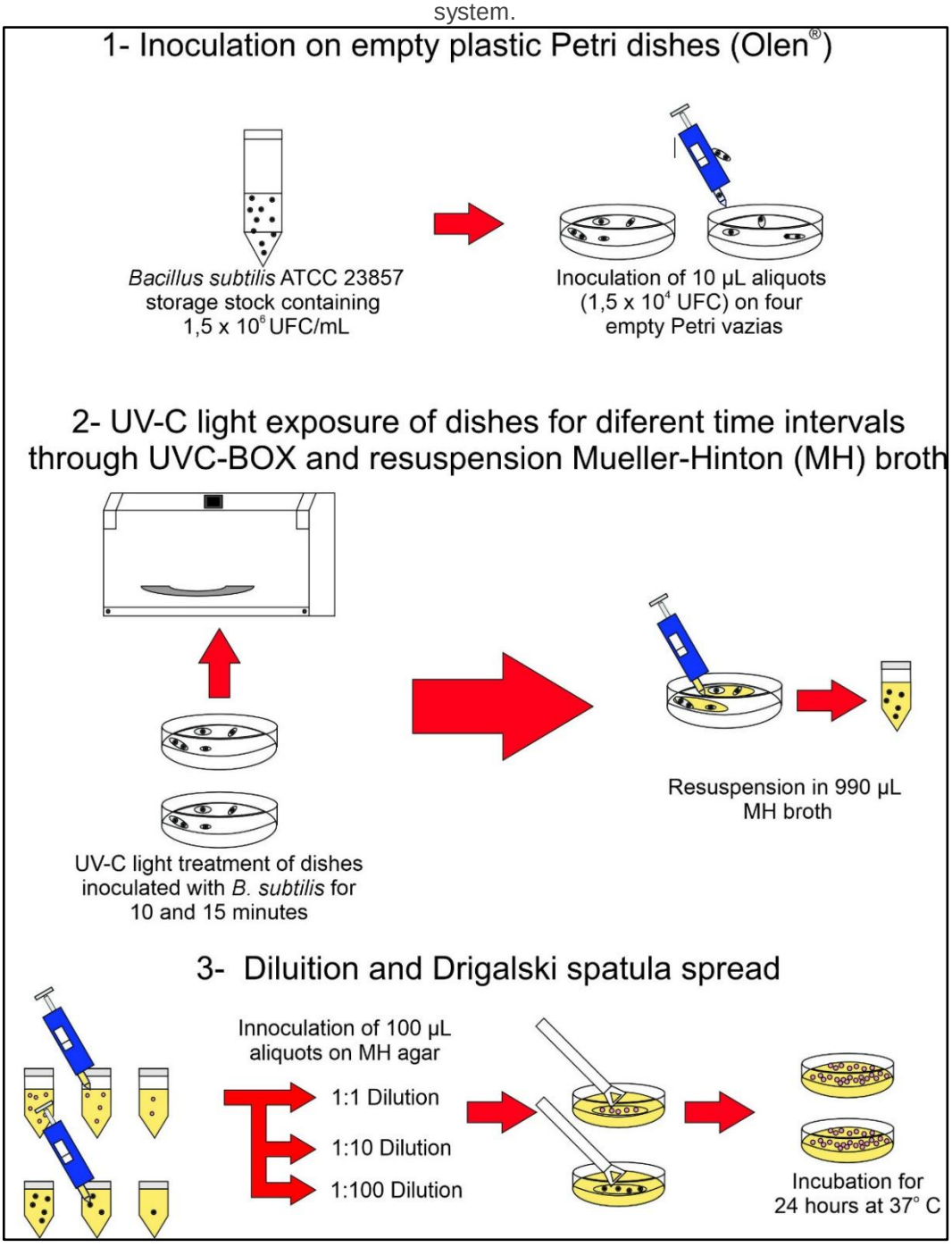
Source: The author himself.

3.4 SPOROCIDAL ACTIVITY

The test was based on ASTM methodology E-2197-11 (diagram in Figure 4), with contamination of *Bacillus subtilis* spores (1.5 x 10^6 spores/mL) in plastic plates (Olsen®).

For sporulation induction, *B. subtilis* culture was incubated in a sporulating broth (nutrient broth with 1 g/L potassium chloride and 0.49 g/L potassium chloride magnesium sulfate and 0.49 g/L magnesium sulfate), and incubated at 37 °C for 48 hours. The supernatant was then replaced with distilled water, and a 100µL aliquot was then plated in nutrient agar and incubated for 24 hours at 37 °C.

Figure 4. Cultivation steps, contamination, UV-C/ultrasound exposure, plating and analysis for validation of antibacterial and sporocidal efficacy under exposure to UV-C radiation and ultrasound system.



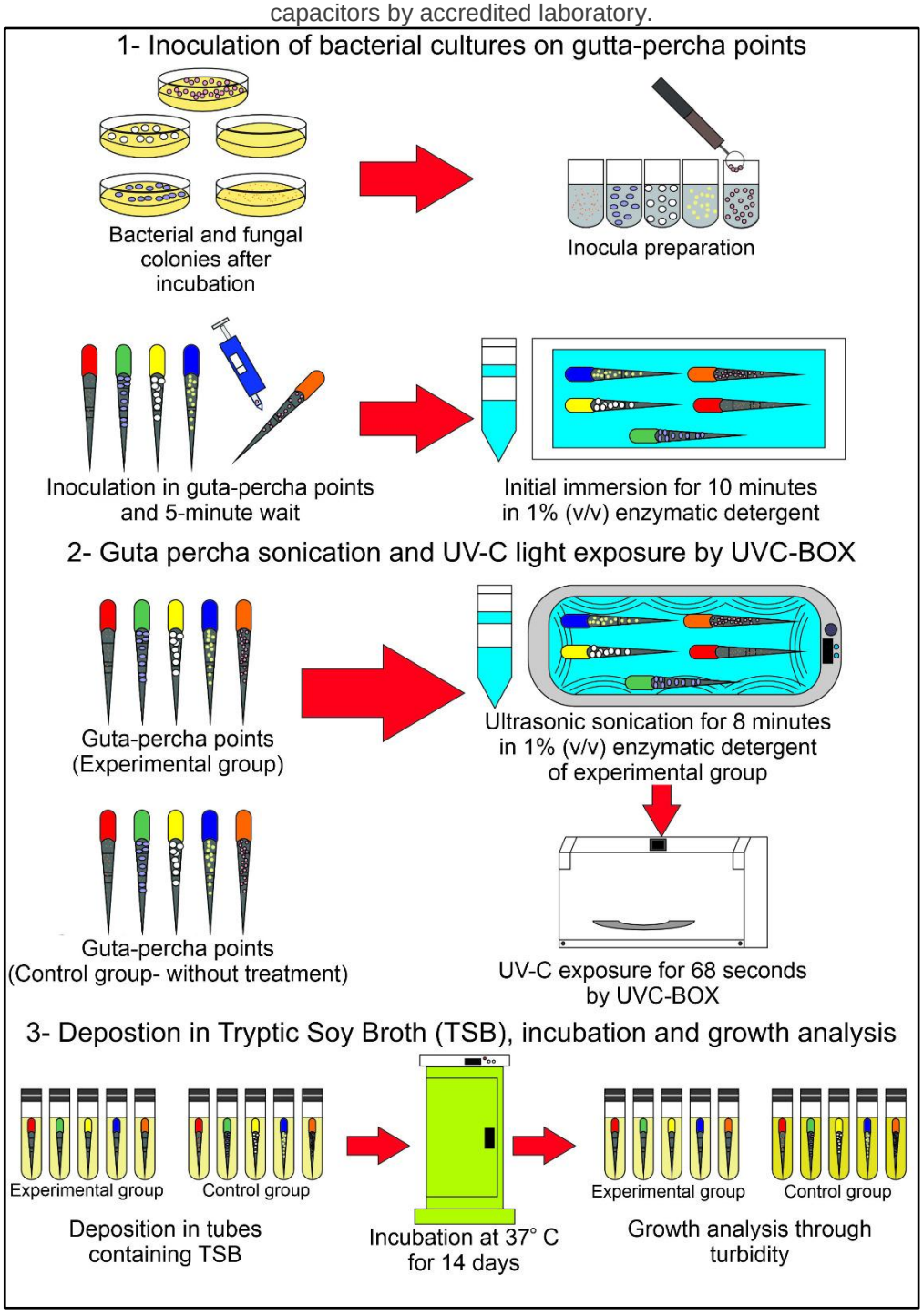
Source: The author himself.

3.5 VALIDATION OF EQUIPMENT FOR ANTIMICROBIAL ACTIVITY

The validation of the machinery's effectiveness was carried out by the Laboratory of Quality Control and Research, enabled by the Brazilian Network of Analytical Laboratories in Health (REBLAS) under code 207. In this test, the sterilization of

contaminated dental materials (gutta cone and endodontic perch condensers) with the following *antimicrobial strains: Staphylococcus. aureus* ATCC 6538, *Escherichia coli* ATCC 8739, *Salmonella choleraesuis ATCC 10708, Pseudomonas aeruginosa ATCC 9027 and (2)* The test procedures are outlined in Figure 5.

Figure 5. Steps of the evaluation of the antimicrobial activity of endodontic gutta percha cone capacitors by accredited laboratory.



Source: The author himself.

4. RESULTS

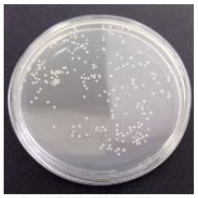
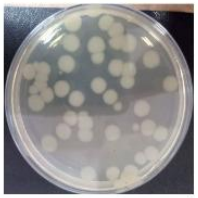
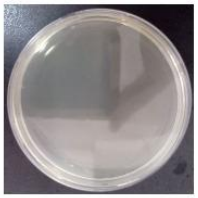
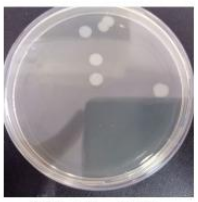
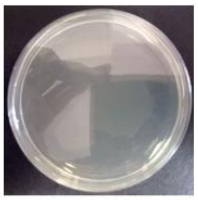
Results from the initial antimicrobial and sporocidal activity assays are shown in table 2 and figure 6. Exposure to UV-C and ultrasound system was able to completely eliminate the population of *S. aureus* and spores of *B. subtilis* in just 3 and 10 minutes, respectively. The antifungal efficacy (*S. cerevisiae* yeast) was the same for the vegetative cells of *S. aureus* (only 3 minutes of exposure).

Table 2 - Counting of colony forming units (CFU) of antibacterial and sporocidal activity at different exposure times to UV-C radiation and ultrasound system.

Bacterial strains/UV-C/ultrasound exposure time	No UV-C/ultrasound (control)	After UV-C/Ultrasound
***S. aureus* ATCC 25923 without exposure**	227,000	0
***B. subtilis* ATCC 23857 after UV-C sterilization for 3 minutes**	520,000	60
***B. subtilis* ATCC 23857 after UV-C sterilization for 10 minutes**	520,000	0
***B. subtilis* ATCC 23857 after UV-C sterilization for 15 minutes**	520,000	0

Source: Author himself

Figure 6. Images of Muller-Hinton agar from bacterial cultures after exposure at different times of UV-C and ultrasound system.

Resuspended bactreria after different UV-C exposure conditions	MH agar inoculated with bacterial resuspension
S. areus ATCC 25923 without UV-C exposure	 1:100 Dilution
B. subtilis ATCC 23857 without UV-C exposure	 1:100 Dilution
S. aureus ATCC 25923 after 3 minutes UV-C treatment	 No diluiton
B. subtilis ATCC 23857 after 3 minutes UV-C treatment	 No diluiton
B. subtilis ATCC 23857 after 10 minutes of UV-C treatment	 No diluiton
B. subtilis ATCC 23857 after 15 minutes of UV-C treatment	 No diluiton

Source: Author himself

The efficacy of UV-C radiation and ultrasound system of the equipment was validated and confirmed in the tests of antimicrobial activity (bacteria and fungi) carried out in accredited and reblamed laboratory (Table 3), demonstrating total elimination of the microorganisms tested in only 68 seconds of exposure to UV-C radiation and ultrasound system of the equipment tested.

Table 3 - Results of 14-day incubation antimicrobial activity assays conducted by the accredited laboratory.

Microorganisms tested	Inoculum (CFU/mL)	Presence of micro-organisms	
		Requirement (limit)	Result
***S. aureus* ATCC 6538**	1.0×10^8	Absence	Absence
***E. coli* ATCC 8739**	7.9×10^7	Absence	Absence
***S. choleraesuis* ATCC 10708**	1.1×10^8	Absence	Absence
***P. aeruginosa* ATCC 9027**	1.0×10^8	Absence	Absence
***C. albicans* ATCC 10231**	8.2×10^6	Absence	Absence

Source: The author himself.

5. DISCUSSION

Waves with wavelengths in the UV-C range have a more effective antimicrobial property because, as indicated in a series of studies initiated in 1968, ribonucleic acids, as well as proteins, of microorganisms are more sensitive to being affected by such rays (Botta *et al.*, 2020; Shechmeister, 1991). In the case of nucleic materials, base-pair pyrimidine junctions (such as cytosines and/or thymine) are formed after the incidence of UV-C light, called pyrimidine dimers, as well as covalent bonds between adenine and thymine pairs (Bolton; Cotton, 2007; Botta *et al.*, 2020; Madigan *et al.*, 2019; Raeiszadeh; Adeli, 2020). Thus, the nitrogenous bases are no longer capable of binding their complementary tape, resulting in reading errors in the production of proteins that are fundamental to the microorganisms (Bolton; Cotton, 2007; Raeiszadeh; Adeli, 2020). In the case of the proteins involved, they are susceptible to disulfide bonds, responsible for the tertiary structure of proteins (Nerandzic *et al.*, 2012; Ramos *et al.*, 2020).

The studies of Candum *et al.* (2020) and Beretosou *et al.* (2020), analyzed, respectively, the non-viability of bacteria in disks and sewage residues by UV-C light, and noted that exposure times (up to 6 minutes) and low energy were effective in making the growth of bacteria unfeasible. Besides these studies, a study by Dumpati *et al.* (2022) has proven the effectiveness of UV-C machines by exposing

contaminated lenses with emissions of 57.9 mJ/cm^2 over 30 seconds, inactivating microorganisms of both ophthalmological and dental interest, such as *S. aureus*, P. aeruginosa, and *C. albicans*. Another study conducted by Chen, Moraru and Protasenko (2023) showed a 6.9 log reduction in colony-forming unit count after exposure to UV-C for 3 minutes (at a cumulative dose of 20-990 mJ/cm^2). In our trials, a similar antimicrobial efficacy time (3 minutes) was found, with an estimated incidence of 239 mJ/cm^2 (Figures 02 and 06). As a reference, the maximum incidence for energy in humans allowed for radii of 254 nm is 60 J/m^2, i.e. 6 mW/cm^2 (ICNIRP, 2004; Ramos, et al., 2020).

Although many studies have proven the efficacy of different UV-C machines, there is a lack of standardization as to the dose listed in the trials (Ramos *et al.*, 2020). A study conducted by Candum *et al.* (2020), demonstrated that bacterial spores of *B. subtilis* are more resistant to UV-C light than bacteria (such as *S. aureus*) in vegetative state. In the experiment described here, the increased resistance of bacterial spores was observed, although the time of 3 minutes was sufficient to reduce the CFU count by 99.88% (table 02 and figure 08).

Such studies have even indicated favorable results for the use of UV-C light is particularly efficient when compared with other microbial control methods, such as the application of oxygenated water (Beretosou *et al.*, 2020; Weber *et al.*, 2016). In this case, the oxidative action of oxygen peroxide increases the base effect of UV-C light (Beretosou *et al.*, 2020; Giannakis *et al.*, 2016). Also, UV-C light is able to increase the speed of dissociation of peroxide in reactive oxygen species, accelerating its antimicrobial effect (Alfonso-Muniozguren *et al.*, 2021). This synergistic effect on the antimicrobial activity of UV-C light is mainly used in waste treatment networks (Alfonso-Muniozguren *et al.*, 2021; Beretosou *et al.*, 2020; Ferro RENOVATEDet al., 2016). The ultrasonic bath is capable of producing hydrogen peroxide from the "collapse" of the microbubbles formed during the process by the expansion, compression and collapse in the liquid from sonic pressure (Fruta *et al.*, 2004; Mark *et al.*, 1998; Shthishkumar, Mangalaraja, Anandan, 2016; Wang *et al., 2021).*

6. CONCLUSION

The experiments showed that the efficacy of UV-C light coupled with the ultrasonic system of the tested equipment showed antimicrobial efficacy equivalent to the sterilization process of other methods (autoclavation and ϒ radiation).It is worth mentioning, the need for the preparation of the pre-washed material with a detergent solution in an ultrasonic bath to remove dirt and dust from the materials.

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CHAPTER 7

CHARACTERISTICS AND EXPECTATIONS OF PATIENTS WITH DISTAL RADIUS FRACTURES

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ABSTRACT: Introduction: Distal radius fractures represent the most common fracture site in the upper limb, with options between surgical or conservative treatment. The inclusion of the patient's perspective, their feelings, opinion and/or well-being, seeks to discern the most effective treatments, encompassing their influences on the outcome. Understanding the nature, extent and implications of expectations and their relationship to outcomes and satisfaction are increasingly important in medical care. Objective: The general objective is to describe the profile of patients affected by distal radius fractures in orthopaedic hospitals, as well as to assess expectations about the results of their surgical treatment. Methodology: A descriptive study of patients diagnosed with distal radius fractures, seen between July 2023 and July 2024, assessing their epidemiological profile and their expectations of surgical treatment in the perilesional period. Results: 75 patients from four hospitals, 44 men (58.6%) and 31 women (41.3%), with a mean age of 46.53 years. Fractures occurred more frequently in the dominant limb, in 55.26% of cases. At least 23 patients (30.6%) had type A fractures, 21 (28%) type B fractures and 31 patients (41.3%) type C fractures. 71.05% were treated with a locked volar plate, 13.15% with K-wires and 15.68% with a mixed synthesis. There were high expectations of a return to activities of daily living and work. Conclusion: The study corroborates the epidemiological profile reported in the literature, and it is now necessary to consider the patients' expectations of successful treatment.

KEYWORDS: distal radius fractures, fracture treatment, treatment expectations, functional outcome.

RESUMO: Introdução: As fraturas do rádio distal representam o local de fratura mais comum no membro superior, com opções entre tratamento cirúrgico ou conservador. A inclusão da perspectiva do paciente, seus sentimentos, opinião e/ou bem-estar, buscam discernir os tratamentos mais eficazes, englobando suas influências no resultado. Compreender a natureza, extensão e implicações das expectativas e sua relação com os resultados e a satisfação são cada vez mais importantes na assistência médica. Objetivo: O objetivo geral é descrever o perfil dos pacientes acometidos por fraturas distais do rádio em hospitais ortopédicos, bem como avaliar as expectativas sobre os resultados nos tratamentos cirúrgicos destas. Metodologia: Estudo descritivo de pacientes diagnosticados com fraturas distais do rádio, atendidos no período de Julho de 2023 a Julho de 2024, com avaliação do perfil epidemiológico e aferição da expectativa sobre o tratamento cirúrgico, no período perilesional. Resultados: 75 pacientes de quatro hospitais, sendo 44 homens (58,6%) e 31 mulheres (41,3%), com média de idade 46,53 anos. As fraturas ocorreram mais frequentemente no membro dominante, em 55,26% dos casos. Ao menos 23 pacientes (30,6%) apresentaram fraturas tipo A, 21 (28%) do tipo B, e 31 pacientes (41,3%) do tipo C. 71,05% foram tratados com placa volar bloqueada, 13,15% dos pacientes com fios K. e 15,68% com síntese mista. Observou-se altas expectativas quanto ao retorno da realização de atividades de vida diárias e laborais. Conclusão: O estudo corrobora o perfil epidemiológico trazido na literatura, cabendo agora contemplar a expectativa dos pacientes no sucesso do tratamento.

PALAVRAS-CHAVE: fraturas do rádio distal, tratamento de fraturas, expectativa tratamento, resultado funcional.

1. INTRODUCTION

Distal radius (DRF) fractures account for approximately 16% of all fractures, and distal radius is the most common site of fracture in the upper limb[41]. The last five decades have witnessed a considerable research effort aimed at a better understanding of the biology of fracture consolidation and its relationship to how effective fracture treatment influences functional outcomes in follow-up [4].

Historically, the evaluation of the result after DRF focused on imaging and physical examination (e.g., grip strength and range of motion) [3, 20], as we see in the work of Dario P *et al. and Quax MLJet al., showing that the focus of treatment of wrist fractures was to re-establish radiographic parameters, which in turn were correlated with the results of recovery of range of motion and DASH score (Disabilities of Arm, Shoulder and Hand)164.* These assessments, however, do not represent the patient's perspective, as they do not take into consideration the patient's feelings, opinion or well-being, which are probably more important to the patient. In the last two decades, the evaluation of results has changed to a patient-centered approach, which evaluates the result based directly on the opinion of the person involved [3, 18, 35].

In the management of DRF, little information is available in the literature about the expectations of therapy [6]. In the initial phase of treatment, patients are focused on pain relief rather than long-term expectations and consequences. Long-term patient-relevant outcomes include functional recovery, return to work, and ability to perform daily activities [20].

A wide variety of patient-reported outcome measures (MRRPs) have been proposed for upper limb disorders, including those for the evaluation of wrist and hand function, but over a 25-year period, the two most commonly used outcome measures to evaluate the outcome of treatment of patients with distal radial fractures were the DASH score and the (original or modified) Gartland and Werley scoring system, although the patient-assessed wrist evaluation (PRWE) has the best measurement properties [2, 7]. In another study conducted by Kleinlugtenbelt *et al*., it was found that the Dutch versions of PRWE and DASH are valid and reliable MRRPs in assessing function and disability in patients with a deviated distal radial fracture and therefore useful in clinical research[21].

Previous reviews have described a variety of MRRPs measuring wrist and/or hand disorders in general, but not specific to distal radius fractures. A systematic review of more than 300 measures of musculoskeletal outcomes currently available for clinical and research purposes[23] revealed that there was no instrument specifically designed to evaluate patients' expectations for the final outcome of surgery in general trauma populations with scheduled surgeries.

In this context, the Trauma Expectation Factor (TEF) and Trauma Outcome Measurement (TOM) tools were created to measure the expected outcomes of patients[1]. Developed specifically for use after traumatic injury, it is proposed to investigate the patient's expectations in orthopedic trauma (compliance with patient expectations) results on the ankle and distal tibia fractures, showing themselves valid, internally consistent and reproducible, and there is no reason to expect that the questionnaires are not valid for other traumatized patients [1,22].

The TEF score - obtained after the orthopedic surgeon has informed the patient about his or her individual condition, chances of recovery and possible consequences of surgery - can safely quantify expectations about the outcome after surgery and thus produce a summarized individual expectation factor to be used as a reference to evaluate the recovery process as well as the final outcome. It is with the TOM score that, after surgery, specific indicators of the patient and of the condition of the capacity to meet these expectations can be produced [1].

The association between patient expectation, treatment outcome, and overall satisfaction has been suggested for painful musculoskeletal conditions, including back pain, knee and hip arthritis, rotator cuff syndrome, and arthritis of the finger joint [24-29]. Some studies have shown that patients with positive expectations are more likely to get better results. In addition, meeting expectations can constitute the general satisfaction of the patient [29-33]. Understanding the nature, extent, and implications of patient expectation and its relationship to outcomes and satisfaction are increasingly identified as important in the delivery of treatment [27].

2. JUSTIFICATION

The study is justified in the need to identify and describe, epidemiologically, the profile of the patients affected by a fracture of the distal region of the radius and its characteristics, as well as to verify the expectation of these about surgical treatment.

3. OBJECTIVE

The overall objective of the study is to identify and describe population characteristics in patients with distal radial fractures, and to evaluate and quantify expectations about results in surgical treatment. Thus, corroborating or disagreeing with the current epidemiology, besides stressing or removing the importance of alignment of expectations of the evolution of the frameworks and functional results.

The specific objetives, on the other hand, are to investigate whether the analysis of epidemiological data makes it possible to infer correlations, as suggested by the instrument for assessing the expectation of patients, in line with other tools already proposed.

4. METHODOLOGY

It is a descriptive study, with patients diagnosed with distal radial fractures, attended in the period from July 2023 to July 2024. A descriptive analysis was performed with presentation of frequencies, average, median, amplitude, by means of clinical and radiographic diagnosis, with application of questionnaire created by the authors and therefore non-validated, in favor of the measurement of expectation on surgical treatment, in the perilesional period, in four orthopedic hospitals in the municipality of Belo Horizonte, Minas Gerais.

The inclusion criteria were: trauma patients; with clinical and imaging diagnosis (x-rays) finding a fracture in the distal region of the radium; older than 18 years; attended to at the research sites (orthopedic hospitals of public and private networks, in the state of Minas Gerais); submitted to treatment in the period from July 2023 to July 2024.

The exclusion criteria were: patients with other associated osteomioarticular lesions; patients with cranioencephalic trauma; patients attended to in other services and then referred; abandonment of treatment in other hospitals.

The sample consisted of all patients operated by the proposing team, who met the inclusion criteria. The excluded patients were listed in separate database spreadsheet for further analysis and description, stating how many were the reason for the deletion.

The data were collected from information contained in medical records with questionnaire application (ANNEX 1). The categorical variables were expressed in terms of frequencies and percentages, and the numerical variables were presented in terms of mean, standard deviation, median, first and third quartiles.

Pearson's Chi-square test or Fisher's exact test were used to verify the hypothesis of association of study variables with treatment expectation. The significance level for the analyzes of 0.05 was considered. The analyzes were carried out in the SPSS software version 23.

Patient information archived in the database will be kept confidential, with access restricted to the researchers responsible. In this way, there was waiver of the TCLE, since the study will be retrospective, with information collected in medical records.

Considering that the study contains patient information, the study was authorized by the Ethics and Research Committee. The authors followed the norms of CONEP Resolution 674/2022, which establishes the processing of scientific research protocols involving human beings, and ensure transparency, integrity and ethics at all stages of this research process.

5. RESULTS

The total sample counted from 75 patients coming from four orthopedic hospitals in Belo Horizonte. Table 1 shows descriptive statistics for all study variables. It was observed that the mean age of the study subjects was 46.53 years, with standard deviation of 15.48 years. The remaining characteristics of the subjects can be observed in Table 1.

Table 1: Descriptive statistics of study variables.

Variable	Results
Age	46.53(±15.48); 46[33-62]
Categorical age	**75**
<50 years	43(57.3)
>= 50 years	32(42.7)
Gender	**75**
Male	44(58.7)
Female	31(41.3)
Role	**75**
Retired/Unemployed	
Manual jobs	52(69.3)
Intellectual works	12(16.0)
Dominance	**75**
Right	66(88.0)
Left	9(12.0)
AO rating	**75**
Type A Fractures	23(30.6)
Type B fractures	21(28.0)
Type C Fractures	31(41.3)
Treatment	**75**
Board	54(72.0)
Wire k	10(13.3)
Mixed	11(14.7)
EFT	**75**
0-12 - higher expectation	42(56.0)
12-28 - lower expectation	32(42.7)
28-40	1(1.3)

Frequency (%); Mean (±standard deviation); Median [1st quartile - 3rd quartile
Source: Prepared by the authors

Table 2 shows the comparison between treatment expectation groups with the other study variables. What can be seen is that there was no significant association, at the level of significance of 0.05, between the categories of the variables analyzed and the outcome of the expectation of treatment, since the value of p was >0.05 in all the comparisons carried out.

Table 2: Verification of the hypothesis of association between study variables and treatment expectation - TEF.

Variable	EFT <12 (n=42)	EFT>12 (n=33)	p-value
Age[1]	**42**	**33**	**0.328**
<50 years	22(52.4)	21(63,6)	
≥ 50 years	20(47,6)	12(36.4)	
Gender[1]	**42**	**33**	**0.439**
Male	19(45,2)	12(36.4)	
Female	23(54.8)	21(63,6)	
Function[1]	**42**	**33**	**0.249**
	7(16.7)	4(12.1)	
Retired/Unemployed			
Manual jobs	26(61,9)	26(78.8)	
Intellectual works	9(21.4)	3(9.1)	
Dominance[2]	**42**	**33**	**0.170**
Right	39(92,9)	27(81,8)	
Left	3(7.1)	6(18.2)	
AO[1] rating	**42**	**33**	**0.199**
Type A Fractures	16(39.0)	7(21.9)	
Type B fractures	12(28.5)	9(27.2)	
Type C Fractures	14(34.2)	17(53.1)	
Treatments[2]	**42**	**33**	**0.658**
Board	32(76,2)	22(66,6)	
Wire k	5(11.9)	5(15.2)	
Mixed	5(11.9)	6(18.2)	

Frequency (%); [1]Chi-square test; [2]Fisher's exact test.
Source: Prepared by the authors

The data obtained showed that only 9 patients were left-handed (11.8%), with the majority of patients right-handed (89.2%) and with more frequent fractures in the dominant limb, in 55.26% of the cases. At least 22 patients (28.9%) presented type A fractures, 21 (27.6%) type B, and 33 patients (43.42%) type C. Of the total, 71.05% were treated with blocked volar plaque, 13.15% of patients with yarn k. and 15.68% with mixed synthesis.

Through the application of the proposed questionnaire, high expectations of patients were observed as to the return of performing daily and work life activities, as well as physical and sports, in up to 1 year postoperative.

6. DISCUSSION

This work makes up the first part of a longitudinal follow-up study of patients with distal radius fracture and their expectations regarding postoperative recovery. Cross-sectional epidemiological data and assessment of patient expectations were compiled using the TEFTOM form.

Regarding the epidemiological findings, some data were found that diverged from those collected in the literature. A slight prevalence of fractures was observed in men (58.7%) and young (57.3%), and the opposite was found in other studies [38.39]. Distal radium fracture is considered a fragility fracture and therefore a higher prevalence was expected in older women, a group most affected by osteoporosis [40.] The most probable explanation for this is a sample selection bias, which relied exclusively on patients with prior surgical indication. Another explanation is the hospital care profile, since they are part of a large state emergency center, which may have selected patient profiles for more energy traumas, more typical of young men.

Still on the surgical modality, this study showed a great tendency of surgeons to opt for open reduction and internal fixation with blocked plates (71%) compared to closed reduction and percutaneous fixation (13%). This data is in line with the most recent literature. Rundgren *et al*. (2020), demonstrated plate and bolt fixation in 82% of cases and percutaneous pinching in 8.2%, while Raudasoja *et al*. (2022) reported that surgical treatments with plates and screws comprised 80% of their sample [37.38.]

With respect to fracture patterns, the distribution of this study according to the AO classification system for fractures was 28.9% for type A fractures, 27.6% for type B fractures, and 43.42% for type C. These results are in line with the prevalence of fractures found with the findings in the national literature. Nogueira *et al* (2019), presented prevalence of fracture types according to the AO classification very similar to the findings of this study: 2R3A 30.1%; 2R3B 23.3% and 2R3C 45.1%[36.] However, large-scale international studies in Sweden and Japan, respectively, found values of 60 to 78% of extra-articular patterns, of type AO 2R3A, that is, typically less complex fracture patterns associated with lower energy [38, 39]. Again, the probable explanation for this variation between the findings is that the sample had patients who already had surgical indication of their fractures, generating a possible selection bias for more severe fractures.

Meeting the patient's expectations is critical in any surgical setting. However, these subjective variables are difficult to evaluate and interpret objectively. Furthermore, its relevance to clinical practice and how to change the way patients are treated and operated in order to optimize it is not fully understood[19]. It is important to point out that the patient's expectations changed after the surgical education. Thus, if patients were informed that they had a serious injury, there was an alignment of expectations with functional outcomes more in line with the severity of the fracture. In addition, the psychosocial situation and mood of the patient can play an important role in relation to the long-term outcome of the patient. Suk *et al.* (2013) demonstrated that self-efficacy (patient confidence in the ability to perform specific behaviors) appears to be a modifiable determinant of increased functional outcomes in other disease states[22].

According to Fang *et al*. (2020), the TOM questionnaire demonstrated good criterion validity, internal consistency, reliability and responsiveness. The EFT demonstrated good internal consistency, reliability and predictive value of the TONE result in 1 year. The unique item-by-item matching capacity of the EFT/TONE allows quantification of 'expectation fulfilled' and whether this results in 'satisfaction' is an interesting topic for future studies [34].

When evaluating the expectations of patients with TEFTOM scores, there was the expectation that certain groups would present greater demands in relation to the functional result of their treatment, such as younger patients, patients whose profession requires dexterity or strength in the hands, as well as patients with profiles of less complex fractures. Suk *et al*. (2013) found a statistically significant positive association between high expectation and severity of fracture and income [22]. However, in this study, when comparing the groups with higher and lower expectations, no significant difference can be observed in any of the observed parameters. Two factors tended to show a difference, although not statistically significant: dominance and the severity of the fracture. A more robust future study with a larger sample could better elucidate the relationship between which factors interfere the most with patients' expectations.

7. CONCLUSION

The present study presents an epidemiological profile that differs from that found in the literature: the predominance of distal radial fractures with surgical indication, in adult male patients of working age. It also shows the high incidence of articular fractures, very possibly associated with the mechanisms of high energy trauma, common nowadays.

On the analysis of the expectation of patients in the success of the treatment, it was noted that the expectation of patients in general is not always aligned with that of the medical team at the moment of care, can generate disagreement. In this sense, we emphasize the importance of dialog and guidance to the patient regarding the reality of their condition, severity and prognosis, with leveling expectations and consequent satisfaction with treatment. The fundamental role of the questionnaires to quantify these expectations, as auxiliary tools in this team and patient alignment, as well as the need for improvement and/or creation of more robust and complete tools as well as assertive and simple vocabulary for patient evaluation, is also highlighted.

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ANNEXES

ANNEX 1

Questionnaire

Name: **Age:**

Occupation: **Dominance:**

Fractured limb: **Rating:**

(1) In a year (12 months) after surgery, how painful do you expect your injury to be?
0 (No pain)

1.

2.

3.

4 (Unbearable pain)

(2) Within one year (12 months) after surgery, how much do you expect your injury to interfere with your normal/usual activities required (including climbing stairs with a handrail, driving and sleeping)?
0 (Do not interfere)

1.

2.

3.

4 (Interfere Completely)

(3) Within one year (12 months) after surgery, how much do you expect your injury to interfere with your normal/usual physical activities (including work, housework, school and hobbies)?
0 (Do not interfere)

1.

2.

3.

4 (Interfere Completely)

(3) Within one year (12 months) after surgery, how much do you expect your injury to interfere with your normal/usual activities of daily living (including eating, dressing, wearing shoes)?
0 (Do not interfere)

1.

2.

3.

4 (Interfere Completely)

(4) One year (12 months) after surgery, how much do you expect your injury to interfere with your interpersonal relationships (including family, friends, and co-workers)?
0 (Do not interfere)

1.

2.

3.

4 (Interfere Completely)

(5) In relation to the necessary activities (those you have in what to do). Within a year (12 months) after surgery, how much you expect to have to reduce the physical activities you have to do (including work, housework and school)
0 (0%)

1 (25%)

2 (50%)

3 (75%)

4 (100%)

(7) Regarding optional activities (those you like to do). Within a year (12 months) after surgery, how much do you expect to have to reduce the physical activities you enjoy doing (including sports, recreation, gardening, etc.)?
0 (0%)

1 (25%)

2 (50%)

3 (75%)

4 (100%)

(8) Within a year (12 months) after surgery, how satisfied do you expect to be with the pain, physical function, and disability resulting from your injury?
0 (Dissatisfied)

1.

2.

3.

4 (Very satisfied)

(9) One year (12 months) after surgery, how satisfied do you expect to be with the appearance of your injury?
0 (Dissatisfied)

1.

2.

3.

4 (Very satisfied)

(10) Within a year (12 months) after surgery, how satisfied do you expect to be with your overall well-being?
0 (Dissatisfied)

1.

2.

3.

4 (Very satisfied)

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