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# THE INCORPORATION OF ARTIFICIAL INTELLIGENCE AS INPUT FOR STRATEGIC DECISION MAKING IN FINANCIAL ORGANIZATIONS

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**ABSTRACT**

In today's competitive landscape, computerized contemporary organizations are relying on intelligent systems to mitigate the risks in decision making that is increasingly complex due to the large amount of data for micro and macroeconomic processing, involving a high degree of risk and uncertainty. In this context, organizations continually invest in data processing technology, with ever-increasing growth rates. The data within this scenario has an organizational asset context and in order to be converted into relevant information that can generate competitive advantage and be effective, it is necessary to establish knowledge and intelligence. Therefore, the objective of this study is to propose analysis to investigate and understand the decision making process with the aid of Artificial Intelligence in organizations' decision making, identifying concept and algorithms that offer assistance in complex decision making, turning long decisions into instant and assertive ones, reducing the momentum and influence of managers on decisions involving a large number of variables and contexts. The research is classified as a quantitative exploratory, a pre-defined questionnaire is applied for an investigation that enables the mapping of decision process analysis with artificial intelligence techniques, and how this technology can be better used for decision making in companies. financial system against the opportunities and threats of the organizational environment.



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## INTRODUCTION

Companies in the financial sector live in a scenario where the globalization of markets with marked contrasts, changes, uncertainties and increased local and international competition produces complex elements that directly or indirectly affect organizations that seek survival and growth from competitive advantages. Faced with the competitive, globalized scenario and the uncertain future, the big dilemma is how organizations can make their own decisions with assertiveness, and ensure that the best decision is made to achieve the desired outcome.
According to Bauman (2001) (apud MORITZ and PEREIRA, 2015, p. 31-44), "Globalization is the irremediable destiny of the world, an irreversible process; it is also a process that affects us all to the same extent and in the same way. " Neste contexto o processo decisório é uma habilidade indispensável para os gestores decidirem pelas melhores escolhas diante das dificuldades apresentadas diariamente.(Rainatto et all, 2019).

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For the American economist and researcher Herbert Simon (1960) (apud SANTANA and AGUIAR, 2017, p. 269), decisions are in the daily lives of people and within organizations, varying in importance and hierarchical level, being an act of managing a continuous decision-making process, not limited to the choice of alternative, but to reflection and analysis to achieve it. Within an organization, decisions are made by managers and collaborators every day, simple decisions and even choices that can affect the future of the organization such as its role in the global market, its expansion or stagnation, or even its destruction. Decisions are made by people who are affected by the environment or environment they live in, their perceptions, their experiences, their own human limitations to access all variables and cognitively process all options, lack of possibility. to have access to all data and information in a timely manner to decide, by their beliefs, cultural and affective pressures which makes the process itself extremely delicate, because there is no "perfect decision", what is there is the search for the best alternative, one that will guide the organization towards success (Simon, 1983; Lousada and Valentim, 2011; Moritz

and Pereira, 2015, Pondé, 2017). For organizations to perpetuate, a good strategic planning, efficient decision making and coherent management is necessary, thus enabling to find solutions to possible problem solving. In addition, it is important to avoid decisions that are not based on consistent data and information that ensure success in the outcome. The process in question must be agile, more accurately, without bureaucracy, which is not always possible in classical economics organizations. To contribute to assertive and agile decisions, organizations need to cultivate the culture of empowering and effectively making use of intelligent computing systems, tuned to be able to learn from experience, to provide intelligent outputs, reliable and safe indicators for the decision maker. Given this premise, it is important to emphasize that the goal at first is not to completely replace the human in decision making, but to advise on complex and difficult problems to solve.

"Artificial Intelligence involves the concept of exploring intelligent behavior that has defined characteristics as an example, learning from experience, applying empirically acquired knowledge, dealing with complex situations, solving problems when important information is missing, determining what is important, being able to reason and think, to react quickly and correctly to new situations, to understand visual images, to process and manipulate symbols, to be creative and imaginative and to use heuristics and practical norms from experience" (Stair, 1998; Laudon, 1999). Artificial intelligence (AI) is a concept that has no clear definition. There are many definitions that tell different stories. A very minimalist is given in Hoffman (2017): In its most basic definition, "artificial intelligence" (AI) is the intelligence displayed by machines. The contribution of this research study is to present a comparison of the results obtained through a quantitative method approach to decision making in classical organizations that do not use Artificial Intelligence (AI) in the financial system and in contemporary organizations that make daily use of Intelligence applications. Artificial (AI) with the focus of avoiding, or at least reducing the possibility of human failure, providing greater agility and reliability in the decision making accessor. Problema de Pesquisa. The influence of AI in the decision making process of contemporary organizations, as an input to mitigate risks in the financial sector.

**Artificial Intelligence (A.I) history and Definition:** For Russell and Norvig (2004), the first work that had relevance as an AI study was performed by Warrem Macculloch and Walter Pitts (1943). In 1950, the British mathematician Alan Turing introduced in his article "Computing Machinery and Intelligence", what today is called the "Turing Test", in which he titled the question "Can a machine think?" (TEIXEIRA, 1998). The Turing Test is an important fact that contributed to the advancement of Artificial Intelligence (AI). According to Russel and Norvig (2004), Alan Turing's test aims to analyze whether or not a system would be intelligent. Alan Turing's test is composed of communication between two people and a machine. One person is the "interrogator", the other person and the machine answers the questions asked by typing by the interrogator. The interrogator should identify whether the answers were coming from the person or machine. If the interrogator could not identify the source of the answer, the system passed the "Turing test". The term "Artificial Intelligence" artificial intelligence (AI) formally emerges in the summer of 1956 in the United States at a two-month seminar at Dartmouth University in Hanover, where among the key participants are John McCarthy, Marvin Minsky., Allen Newell and Herbert Simon. There are many variations of AI, but the concept can be broadly defined as intelligent systems with the ability to think and learn (Russell, 2010). AI aims to simulate human reasoning, mimic our ability and build intelligent entities autonomously, quickly and safely. Artificial Intelligence focuses on mimicking the characteristics and cognitive capabilities of the human brain, and is constantly designed by various intelligent techniques focused on improving understanding of data and information to be useful in complex decision-making occasions. The most commonly used techniques in the development of AI are: neural networks, genetic algorithms, induction rules, predicate logic, concurrent and parallel systems, fuzzy logic and genetic algorithms (Huang, 2003; Katarína and Koncz, 2012; Jarrod and Bhattacharya, 2016; Fliche and Yang 2018). AI acts in general areas such as speech recognition and in specific systems such as computer games, being able to automate intellectual tasks that can currently only be performed by humans, being virtually relevant to any sphere of human intellectual activity. Also according to (Russell; Norvig, 2004), AI is universal and can act in all fields of knowledge. Artificial intelligence and Expert Systems.

Expert System has experience and knowledge gained from a stored human expert and is designed to process complex level problems existing in the real world through human intelligence-based computational models using software, the result being similar to that of an experienced expert. For (BITTENCOURT, 1998) the SE is designed to meet a specific application where human knowledge is limited, and the SE is able to present a solution through its database already imputed by experienced specialists. Intelligent System is quite different from traditional systems because they are able to manipulate symbols that represent the real world, they are able to work effectively with knowledge (REZENDE, 2005). Intelligent systems are relevant for their ability to use knowledge to perform difficult tasks and their ability to deal with complex problems in real applications (REZENDE, 2005; RUSSEL, 2010). In traditional systems data entry is transformed into knowledge and outputs are reports and graphs to be used by managers to support decision making. Already in intelligent systems the available data are broken down into information generating the knowledge that is used by the system itself in intelligent decision making.

An AI system not only performs tasks common to traditional systems such as data storage and processing, but also has the ability to manipulate knowledge, infer or deduce new knowledge about new relationships of facts and concepts from the experience gained to solve. complex problems. Developing a system with AI requires coding rules and facts that are satisfactory for a given problem domain. This coding process is called knowledge engineering. The designer of an AI system has to address the main points of the project which are: knowledge acquisition, representation and manipulation and generally a control strategy or inference machine that determines the knowledge items to be accessed, the deductions to done, and the order of the steps to use. Figure 4 portrays these questions, showing the interrelationship between the components of a classic AI system (SCHUTZER, 1987). The goal of artificial intelligence is to discover adaptive mechanisms in a changing environment using intelligence, for example, in the ability to exclude unlikely solutions. Artificial intelligence methods have wide application in different fields

such as financial system, medicine, games, education or industry (Hiľovská and Koncz, 2012). This paper focuses on issues - artificial intelligence interconnection and strategic decision making in financial organizations. In Figure 1 is presented with a contemporary system with AI presents the components and their established relationships. These relationships are essential for the machine to have intelligence and to decide. The relationships established between the components that can make up a system using AI are systems capable of learning to perform a task not from explicit instructions, as in traditional programming, but through experience. The greater the quantity, quality, and diversity of data - experiences - available, the more complex the tasks learned and performed by these algorithms can be (Bigonha, 2018).

**Main techniques of the artificial Intelligence:** Contemporary computer systems help to achieve the most effective decision making. Since decision making is increasingly complex, having to consider both quantitative and qualitative aspects involving a large amount of internal and external data and information of the organization and to meet these needs, systems need to return intelligent queries, assisting the decision maker. to be assertive in decision making. Following are presented the main techniques used in Artificial Intelligence (AI), (Huang, 2003; Katarína and Koncz, 2012; Jarrod and Bhattacharya, 2016; Fliche and Yang 2018). Major Artificial Neural Networks (RNAs) - are based on concepts of human brain functioning with development of algorithms focused on cognitive tasks focused on learning and the best style of performing an activity. RNAs are mathematical models inspired by the neural structure of intelligent organisms that acquire knowledge through experience. For Goldschmidt (2010, p. 72, 73), "Artificial Neural Networks are mathematical models inspired by the working principles of biological neurons and brain structure. These models are capable of acquiring, storing and utilizing experimental knowledge and seek to computationally simulate human skills such as learning, generalization, association and abstraction. " RNAs do not require extensive prior knowledge of the difficulty of presenting a solution. RNA processing systems are similar to training, the more required, trained and supplied with new data, the stronger and more assertive your processing result will be.

Fuzzy Logic (Fuzzy Logic) - According to Goldschmidt (2010, p. 56), Fuzzy Logic "is a mathematical theory that aims to model the approximate mode of reasoning, imitating the human ability to make decisions in environments of uncertainty and inaccuracy". Fuzzy Logic is an alternative to the "if ... then ... otherwise" algorithm models, many common in traditional rules that allow only true and false results. Thus fuzzy logic allows one to work with intermediate values between values such as True and False, the results can assume any intermediate value between extremes and has the function of solving complex and unstructured problems with incomplete information. Genetic Algorithms - Simulation of genetic systems began in the 1950s and 1960s by biologists based on Charles Darwin's evolutionary twist and was refined by the American John Henry Holland in the 1970s. For Goldschmidt (2010, p. 93), "Genetic Algorithms are techniques that seek good solutions to complex problems by evolving populations of solutions encoded on artificial chromosomes." Genetic Algorithms do not require much prior knowledge of the problem to be solved and work with a set of possible solutions that, through operations inspired by genetic evolution (evaluation, selection, crossover and mutation), progressively progress towards the best solution. Predicate Logic - Predicate Logic, or Predicate Calculus, is an extension of Proposition Logic in which variables and quantifiers are considered over variables. Predicate Logic is concerned with introducing logical notions to express any set of facts through Attribute Classes and Quantifiers. The English mathematician (Alan Turing, 1975) independently showed that there is no decision procedure to check the validity of Predicate Logic formulas.

Machine Learning - is the division of artificial intelligence that researches how machines can learn from maintaining data in the system, for machine learning various algorithms are used. Machine learning can be mainly affected by the lack of confidence in the data and information available in the database, making it difficult to train and learn a task (Hall, 2000; Han and Kamber, 2001).

Decision trees - These are used for the purpose of classification. The tree is made up of leaves and decision nodes. Decision making is performed through a sequence of "if ... otherwise ..." tests, which when applied to a database record, result in the classification of that record. This technique in addition to building a classification has the ability to learn. Second (Quinlan, 1993), the basic scheme for building a decision tree from a dataset is quite simple.

**Strategical management:** According to Costa (2013), strategic management is a management process carried out by the highest management and involves all managers and employees of the organization with the objective of growth and perpetuation of the organization with capacity of its structure to respond and anticipate the external transformations of the organization. organization. Strategies are adjustments made to prevent problems identified in the diagnostic step from happening again in the future. "Strategic management is characterized by the fact that it is constantly seeking to assess future trends in the evolution of the external environment in order to identify opportunities and threats to the company in order to guide it in its long-term goals and strategies. Strategic management is therefore a management technique that is increasingly being employed by companies to enable them to properly prepare for an increasingly turbulent external environment" (LEITÃO, 1993, p. 118).

Strategic management means a continuous investigation by proactive management with planning and strategies. For (ANSOFF, 1993, p. 70), "Strategy is a set of decision-making rules to guide the behavior of an organization, that is, they are alternative modes of action, the risks, the time and the resources needed to reach specified goals" For the execution of the actions of the management process of the Strategic Planning it is necessary to consider the conditions of the internal and external environment of the organization in order to have a strategic positioning in order to the evolution of the organization using management tools. Strategic Planning must be dynamic and adaptive to the needs of organizations, making the necessary updates so that the development is continuous and correct.

**Strategic Planning & Artificial Inteligence:** With globalization, organizations are inserted in a competitive scenario of instability and insecurity of their business.

**Teste de KMO e Bartlett**

| | | |
|---|---|---|
| Measure Kaiser-Meyer-Olkin and Sample Adjustments | | ,812 |
| Sphericity test from Bartlett | Aprox. Qui-quadrado | 87,041 |
| | gl | 36 |
| | Sig | ,000 |

Source: Elborate by author on IBM® SPSS

| Communalities | | |
|---|---|---|
| | Inicial | Extração |
| AI Use(V4) | 1.000 | 0.738 |
| Impact in the financial Sector(V7) | 1.000 | 0.793 |
| Significant positive impact in the organization(V11) | 1.000 | 0.764 |
| AI brings some differential (V13) | 1.000 | 0.797 |
| AI is more assertive(V15) | 1.000 | 0.732 |
| Transformation antecipations (V18) | 1.000 | 0.749 |
| Revolution in the financial sector (V22) | 1.000 | 0.680 |
| Effetctive and precise results(V23) | 1.000 | 0.788 |
| Association between humans and smart machines (V27) | 1.000 | 0.695 |

Source: made by authors on software IBM® SPSS.

| Matrix Of Pearson Correlations | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | AI Use(V4) | Impact in the financial Sector(V7) | Significant positive impact in the organization(V11) | AI brings some differential (V13) | AI is more assertive(V15) | Transformation antecipations (V18) | Revolution in the financial sector (V22) | Effetctive and precise results(V23) | Association between humans and smart machines (V27) |
| V4 | 1 | ,636** | ,578** | ,552** | ,419* | 0.194 | 0.045 | 0.118 | 0.116 |
| V7 | ,636** | 1 | ,673** | ,461* | 0.293 | 0.182 | 0.070 | 0.049 | 0.030 |
| V11 | ,578** | ,673** | 1 | ,693** | ,506** | 0.377 | 0.224 | 0.256 | 0.323 |
| V13 | ,552** | ,461* | ,693** | 1 | ,674** | ,526** | 0.387 | ,464* | ,447* |
| V15 | ,419* | 0.293 | ,506** | ,674** | 1 | ,452* | ,435* | 0.326 | ,603** |
| V18 | 0.194 | 0.182 | 0.377 | ,526** | ,452* | 1 | 0.211 | ,559** | 0.345 |
| V22 | 0.045 | 0.070 | 0.224 | 0.387 | ,435* | 0.211 | 1 | 0.208 | ,433* |
| V23 | 0.118 | 0.049 | 0.256 | ,464* | 0.326 | ,559** | 0.208 | 1 | 0.316 |
| V27 | 0.116 | 0.030 | 0.323 | ,447* | ,603** | 0.345 | ,433* | 0.316 | 1 |

** Correlation is significant at level 0.01 (2 extremities)
* Correlation is significant at level 0.05 (2 ends)
Source: Prepared by the author on IBM® SPSS software.

**Matrix of correlation – Pearson**

| Correlation | Level |
|---|---|
| [.10, .30] | Low |
| [.30, .50] | Moderate |
| [.50, 1 ] | High |

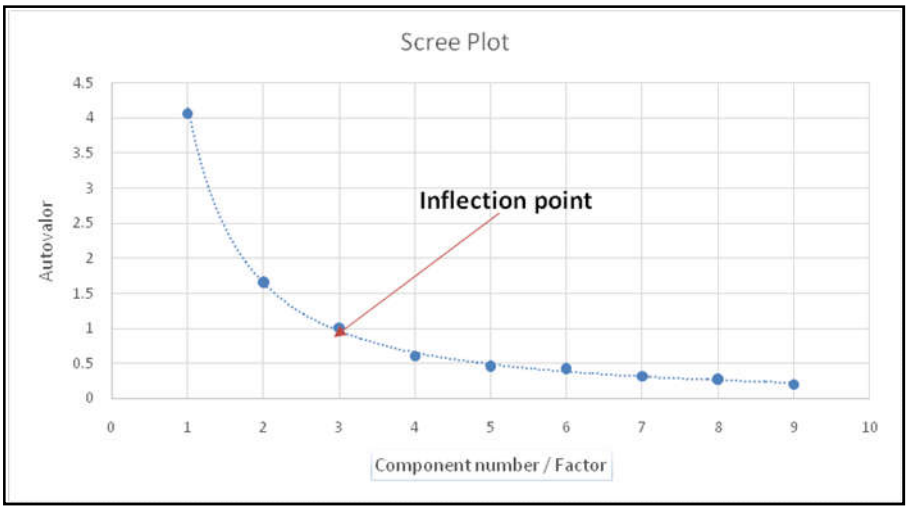
Source: Made by authors based on (Cohen, et al., 2003).

| Total variance Explained | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Componente | Initial Self valued | | | Sums of Squared Loads Extraction | | | Sums of rotation of squared loads | | |
| | Total | % of variância | % cumulative | Total | % of variance | % cumulative | Total | % of variance | % cumulative |
| 1 | 4.070 | 45.218 | 45.218 | 4.070 | 45.218 | 45.218 | 2.743 | 30.473 | 30.473 |
| 2 | 1.658 | 18.417 | 63.635 | 1.658 | 18.417 | 63.635 | 2.116 | 23.516 | 53.989 |
| 3 | 1.008 | 11.204 | 74.840 | 1.008 | 11.204 | 74.840 | 1.877 | 20.851 | 74.840 |
| 4 | 0.601 | 6.679 | 81.519 | | | | | | |
| 5 | 0.455 | 5.060 | 86.579 | | | | | | |
| 6 | 0.424 | 4.716 | 91.295 | | | | | | |
| 7 | 0.312 | 3.467 | 94.761 | | | | | | |
| 8 | 0.274 | 3.039 | 97.800 | | | | | | |
| 9 | 0.198 | 2.200 | 100.000 | | | | | | |

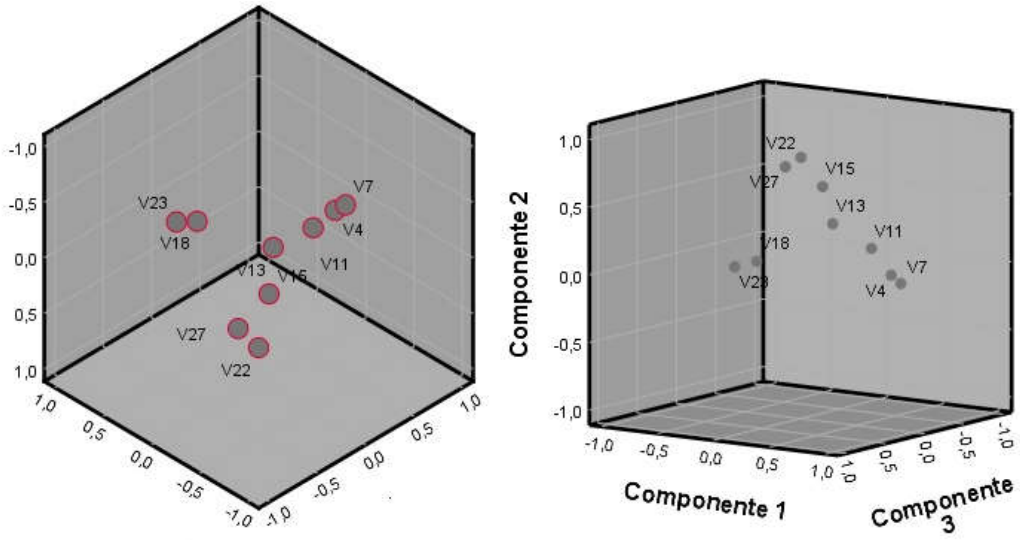
Source: Made by authors on IBM® SPSS.

| Matrix of Component | | | |
|---|---|---|---|
| | Componente | | |
| | 1 | 2 | 3 |
| AI brings some differential (V13) | 0.892 | -0.020 | -0.034 |
| Ai is more assertive (V15) | 0.802 | 0.188 | 0.230 |
| Positive impact on the organization(V11) | 0.798 | -0.356 | 0.020 |
| Transformation antecipations (V18) | 0.639 | 0.302 | -0.500 |
| Use of AI ( V4) | 0.630 | -0.584 | 0.014 |
| Partnership between humans and smart machines (V27) | 0.593 | 0.494 | 0.315 |
| Impact on the financial sector (V7) | 0.579 | -0.676 | 0.027 |
| Results more precise and effective (V23) | 0.529 | 0.416 | -0.578 |
| Revolutioning the financial sector (V22) | 0.470 | 0.434 | 0.520 |

Source: Made by authors on IBM® SPSS.




Source: Made by authors on IBM® SPSS, V25.




Source: made by authors on IBM® SPSS.

| Matrix of rotation component * | | | |
|---|---|---|---|
| | Component (Factors) | | |
| | 1 | 2 | 3 |
| AI brings some differential (V13) | 0.890 | -0.024 | -0.010 |
| Ai is more assertive (V15) | 0.856 | 0.045 | 0.063 |
| Positive impact on the organization(V11) | 0.800 | 0.262 | 0.236 |
| Transformation antecipations (V18) | 0.612 | 0.458 | 0.462 |
| Use of AI ( V4) | 0.014 | 0.824 | 0.015 |
| Partnership between humans and smart machines (V27) | 0.045 | 0.792 | 0.258 |
| Impact on the financial sector (V7) | 0.408 | 0.689 | 0.301 |
| Results more precise and effective (V23) | 0.024 | 0.140 | 0.876 |
| Revolutioning the financial sector (V22) | 0.185 | 0.190 | 0.824 |

**Determinants factors with relationship to the use of AI on the organizations of the financial sector**

| Factors Orders | Denomination ( latentes Variables) | Determinants Variables |
|---|---|---|
| 1 | AI Impact | Impact on the Financial Sector (V7) |
| | | AI Use (V4) |
| | | significantly positive impact on the Organization (V11) |
| | | AI brings some differential (V13) |
| 2 | AI Asseertiveness | revolutionizing the financial sector (V22) |
| | | Partner of Humans and Intelligent Machines (V27) |
| | | AI and more assertive (V15) |
| 3 | AI Applicability | more accurate and effective results (V23) |
| | | Anticipating Transformations (V18) |

Source : Made by authors

**Matrix Index**

| Factor | Índice | Value (% de Variânce) |
|---|---|---|
| 1 | IA Impact | 30,47% |
| 2 | AI Assertiveness | 23,51% |
| 3 | IA Applicability | 16,80% |

Source : Made by authors

The decision-making process and the elaboration of a strategic planning that is related to the market reality are activities that demand more care and agile processes. Globalization and competition have brought complex variables that directly or indirectly influence the functioning of organizations in decision making. Uncertainty forces organizations to consider different variables in decision making, making decision making difficult. In uncertainty, the probabilities of occurrence are not known and their nature hinders the way of decision making, being measured qualitatively, based on the experience of professionals who give opinions on future events (MOREIRA, 2015). AI can bring major changes in strategic planning and assist in the decision making process with large data and information by interacting with the most diverse micro and macroeconomic variables. The strategy is related to the formation of cause and effect relationship or the formation of hypotheses and can serve to point to a distribution of resources aimed at promoting the productivity of the organization. In this context, the use of one of the techniques present in AI such as Cloud Logic in the organization helps in the analysis of uncertainties, inaccuracies and what is not explicit for decision making, allowing for expected answers and a considerable reduction of risk. This technique is used for the purposes of prioritizing strategy based on the strategic positioning identified in the organization (WUERGES and BORBA, 2010, p.163-182). Artificial Intelligence techniques as a decision-making tool in the contemporary world help to lead to more accurate and effective results in the strategic management of organizations. For Dumont, Ribeiro and Rodrigues (2006), using artificial intelligence techniques, it is possible to make complex analyzes on the organization's trends, simulate various scenarios, make predictions about the future or better understand the operation of business.

**Decision Making**

In organizations, decision-making is present daily, from simpler decisions to higher-level decisions that define the future of the organization. Herbert Simon (1947), with the purpose of clarifying human behavior in organizations, presented the book Administrative Behavior and with it begins the Theory of Decisions. The decision-making process in an organization for Simon is complex because:

> "(...) a complex decision is like a great river that brings from its tributaries the countless premises that constitute or form a decision process (...) many individuals and organizational units contribute to any important decision and the issue of centralization. or decentralization is a problem of arranging this complex system into an efficient scheme ... "(SIMON, 1960).

For Certo (2003, p.125), we all face daily decision situations. Still Certo (2003, p.125) a decision is the choice made between two or more available alternatives and that "... decision making is the process of choosing the best alternative to achieve objectives [...]," or most benefit the organization. For Maximiano (2009, p.58), decisions are made to solve problems or seize opportunities.

> "(...) The decision-making process begins with a situation of frustration, interest, challenge, curiosity or irritation. There is a goal to be achieved and an obstacle is presented, or a condition must be corrected, or a fact is occurring that requires some kind of action, or an opportunity can be seized. "(MAXIMIANO, 2009 ). And for Robbins (2010, p.167) "Decision making occurs in reaction to a problem. A problem exists when there is a discrepancy between the current state of things and their desirable state [...] ".

The decision making process is error prone and in an attempt to minimize errors and get the best result one should apply the decision making process model. All alternatives must be carefully analyzed by the decision makers, who must compare all possibilities and choose the ones that are most advantageous to the organization. Following an organized and well-founded process is not a success, but it allows for logical, coherent and error-prone decision making. Decision Making is an act that cannot be shy or lacking courage in the search for the best decision, the:

"Information is an effective and inexorable resource for companies, especially when planned and disseminated in a personalized way, with unquestionable quality and preferably anticipated to facilitate decisions ..." (REZENDE, 2005 p.247). There are several decision-making process models, each of which must be used and associated with a particular situation. Among the many decision-making models, we highlight as main the rational, procedural, anarchic and political models presented by (CHOO, 2003).

By Lousada and Valentine (2011):

**Rational Model -** Compared to other models, the rational model is systematized and structured, with predefined rules and procedures, which must be followed to achieve good results. This model is distinguished by being in closed systems, in highly bureaucratic organizations with guidelines defined through formal rules, focusing on achieving goals, through problem solving, managed by standards and routines so that the organization can act logically. and rational.

**The main issues of this model are:**

- what's the problem?
- what are the alternatives?
- What are the costs and advantages of each alternative?
- and what should be observed as a standard to make identical decisions?

This methodology can be applied in different situations, as it is a structured method, with well-defined steps that must be followed by the decision maker, aiming to obtain a satisfactory result, being easy to apply and assimilate. With this model, the decision maker has to identify all possible alternatives, their possible implications and relate them to their goals, which is a difficult and impractical task. Within this context, Robbins (2005, p. 114) defines "limited rationality" as the "construction of simplified examples that attract the essential aspects of problems without capturing all their complexity". Thus the decision maker does not have the cognitive conditions to analyze all the data and information available to him, focusing only on what he considers relevant is aggregated.

**Procedural Model -** This model has several relationships with rational model and its main features are similar in many respects, but differ in one factor, being flexible, allowing managers to make adjustments when needed.

**The main issues of this model are:**

- What are the organizations that act in this type of circumstance?
- What are the routines and procedures usually used?
- what information is available?
- and what are the standard procedures used in these cases?

According to Choo (2003, p. 283), the model focuses on the activities and dynamics of decision-making behaviors.
In this model the objectives are clear and the methods and techniques for achieving them are uncertain, so there may be many interruptions and repetitions of the decision-making process for approved decision making.

**Anarchic Model** - In this model the objectives and procedures are confusing. Problems and decisions are not defined transparently. This model is known as the "garbage can model", proposed and developed by Cohen, March and Olsen (1972). According to Choo (2003, p. 295):

> "[...] the anarchic decision model can be compared to a trash can, where various kinds of problems and solutions are thrown by individuals as they are generated. The decision comes when problems and solutions coincide. "

**Political Model -** Decision making is not the result of rational choice, but rather the degree of influence that different individuals exert on decision making. Allison (1971) states that the decision is closely related to the power that each individual exercises in the sphere of organization.

**The questions of this model are:**

- What channels are used to produce actions that solve a type of problem?
- Who are the actors and what are their positions?
- and what are the pressures that are influencing?

The model is the focus of internal disputes, of power, of influence, with personal goals, damaging the organization and being more prominent in public organizations, being strongly influenced by politics. "Political decision-making does not lead to solutions that can be judged on standards of rationality; it produces agreements, conciliations and adjustments, the evaluation of which with a view to fairness, acceptability, possibility of review and meeting the variety of interests at stake is always inconclusive. "(LINDBLOM, 1981 p.110)"

For Beuren (2000, p. 20): "[...] the decision model adopted by the manager will depend on the set of variables involved, the degree of control over the variables, the level of certainty associated with the decision, the objectives of the decision maker, among others ". Decision making with Artificial intelligence. AI incorporates a heterogeneous set of tools, techniques, and algorithms for a wide range of applications that fall within the broad spectrum of machine intelligence, ranging from neural networks, speech recognition, pattern recognition, genetic algorithms, and deep learning. Jarrahi (2018) describes that Artificial Intelligence (AI) has penetrated many organizational processes, resulting in a growing fear that intelligent machines will replace humans in decision making. For Davenport & Kirby (2016), AI technologies intelligence is rapidly expanding, and they are acting as semi-autonomous decision makers in a growing diversity of complex contexts. In the financial system, the use of AI has a greater capacity for computational information processes in an analytical approach, so AI can extend human cognition by addressing complexity and not simply replacing it. Human beings can provide a more holistic and intuitive approach to dealing with uncertainty and duality in organizational decision making. Systems that make use of AI have greater analytical accuracy and should assist with "increased intelligence" to aid decision making, a complementary man-machine union in the pursuit of assertive decisions, (JARRAHI, p.1 - 4 , 2018).

These applications that make use of this technological denial (AI) can make an analysis within a very broad context of traditional (non-AI) systems, integrating large amounts of data and variables to produce analyzes that help to evaluate options for decision alternatives. Human cognition and decision making is not a direct result of the deliberate collection and processing of information, but rather arises from the subconscious in the field of intuition (Dane, Rockmann, and Pratt, 2012). In the context of decision making, intuition is defined as an ability to generate knowledge or direct understanding and reach a decision without relying on rational thinking or logical inference (Sadler-Smith & Shefy, 2004). Intuition can be understood as an "instinct" or "business instinct" mitigating the outcome of an investment or new product. According to Jarrahi (2018) decision making through

"intuitive intelligence" includes imagination, sensitivity, reflection and creativity. In the intuitive approach, the individual relies on past embodied practices, experience, and judgments to react or decide, and analytical decision-making approaches rely on advanced data analysis. Both styles of approaches are employed as parallel decision-making systems, not mutually exclusive. From Guszcza's (2017) point of view, while AI systems support an analytical decision-making approach, they cannot be neglected to understand "common sense situations". IBM Director of Innovation Bernie Meyerson suggests: "Human beings bring common sense to work; By its definition, common sense is not a fact-based enterprise. It is a judgment. "(CAPTAIN, 2017). In analytical approach AI can be more effective in overcoming complexity in decision making and in intuitive approach humans tend to perform better. Compared to the decision-making of the Classical School, rejecting the notion that decision-makers act with perfect rationality, Herbert Simon says that because of the cost of gathering information, the executive makes decisions with "limited rationality", contenting himself with "good enough" decisions. With a good partner of humans and intelligent machines, decisions tend to be assertive and secure, and machines must manage quantitative goals, allowing humans to focus on more creative work

**Financial Sector and the help from AI on decision making:** According to the World Economic Forum (WEF) report (2018), artificial intelligence is revolutionizing the financial sector by breaking traditional links between monetary entities, with intelligent decision-making algorithms offering new possibilities to investors and consumers. Traditionally the financial sector is human-centered in sales, trading, investing, banking and compliance. For Gupta (2018), in financial negotiations, "much of what was previously done by humans, such as trend analysis and decision-making on the best course of action, is now performed by algorithms - more efficiently and scalably." At this juncture, the financial industry is focused on implementing AI not just on financial control, with technology institutions are able to decide on better investments, better understand their clients, and thus offer agile, accurate, effective and personalized service. According to Manning (2018) this sector can make operations more impactful and hassle free. The benefit of automating these activities enables financial services industry employees to focus more on high-value tasks and help them become strategic business partners (GUPTA, 2018). Decision making with artificial intelligence support can partially eliminate the limited rationality of a decision maker to make a better decision with more relevant data and information (HIĽOVSKÁ; KONCZ, 2012). Galindo and Tamayo (2000) used model size to differentiate statistical methods from machine learning methods. For a given training sample size, there is an ideal model size. The models used in statistical methods are generally simple and tend to adapt to the data, while machine learning methods generate complex models and tend to combine the data. Some of the areas of the financial sector where artificial intelligence can be successfully applied are listed below (NOONAN, 2018; PUNAMARAJU, 2018; FLICHE and YANG 2018).

**Custom Financial Services:** AI can assist with stock market analysis and provide recommendations for individual clients' financial goals.

**Subscription:** Automation of this process is possible through the use of artificial intelligence services that can use unstructured information in the decision making process.

**Financial Services Voice Assistance:** Language processing using artificial intelligence can reduce human error and improve process efficiency. Data-driven lending and investment decisions: Assisting artificial intelligence systems in analyzing large blocks of data, performing calculations and predictions that can help develop strategies in the lending and financial investment department for better returns.

**Scanning:** Complete document scanning, developing a comprehensive platform using artificial intelligence.

**Detecting Potential Fraud**: Identifying documentary fraud and the fight against money laundering and terrorist financing are areas of recurring use of artificial intelligence. AI techniques are used in particular for the recognition, analysis and validation of the documents provided. The algorithms developed in this field are generally dean and already integrated in many control processes. In the area of payments, fraudulent transaction detection is also a significant scope of AI's real-time data analysis.

**Facilitate processes**: AI is implemented to streamline operational processes, whether to process written content more efficiently or to address fraud issues.

**Optimize time:** AI is used to better assess the risks of investment profiles and optimize internal and external module systems in real time.

**Credit and investment ratings:** With its brute force in data analysis, AI can be an important ally in credit and investment analysis, where investments are more responsive to flow and execution speed, leveraging stakeholder information that complements the traditional approach, which uses limited financial data, using "big data" approach using non-financial data. The focus of this approach is the use of external data for financial data, traditionally used for credit analysis and score calculation. This approach makes the score more accurate and complete in the sense that it could be computed even when financial history is poor or non-existent using non-financial data. Artificial Intelligence in the financial sector in its adaptation has some advantages and disadvantages associated with it, some of them are listed below (MANNINO 2015; MANNING, 2018; NOONAN, 2018; PUNAMARAJU, 2018): Some of the benefits of AI is that it can enable and accelerate automation of all processes in the industry; less room for human error; can significantly reduce the cost of financial services; It can help you systematically analyze customers' behavior patterns and offer them more personalized services to meet their needs. Using machine learning, artificial intelligence systems can identify pattern abnormalities to recognize security threats and respond to them in time. It can be disturbing for all financial processes to adopt artificial intelligence in their day-to-day operations; Full process automation will lead to no supervision; It does not have the ability to make decisions under special circumstances and requires more security protocols to develop an automated and secure environment.

**The main Challenges for the decision making process:** The challenges that plague decision making in organizations are listed below.

**Risks:** Despite the significant benefits associated with artificial intelligence, there is potential opportunity for negative connotations for humans who may be in direct or indirect contact with this technological resource. According Nadimpalli (2017), for AI to have good results it is important that the data entered in the system have good origin and not be misleading. When the data provided provides a chance to have a misleading result, there is a high possibility that it can cause serious problems, such as a wrong decision. Nadimpalli also cites the risk of using artificial intelligence to replace humans. Companies using AI rely on reducing the number of employees they are involved with. Another significant risk is pointed out by Müller (2015), the development of AI being accelerated and along with other technologies we will have "superintelligence", which Bostrom defines as "any intellect that far exceeds the cognitive performance of humans in virtually all environments." areas of interest "(Bostrom, 2014, p. 22). For Sotala and Yampolskiy (2013), there is a risk that "machines take over" and this loss of human control for machines is a significant risk, perhaps an existential risk to humanity. On the other hand, artificial intelligence when used well can transform customer engagement, make better choices and advise on complex decisions.

**Uncertaninty:** Uncertainty can result from a lack of information about internal and external organizational environments such as human resource scarcity, the emergence of disruptive technologies, new markets and competitors, and new government policies. A characteristic of uncertainty is the lack of information about all alternatives or their consequences, which makes interpretation of a situation and decision making more difficult (CHOO, 1991). According to Moreira (2015) in uncertainty the probabilities of occurrence are not known; Its nature hinders the way of decision making, and it is measured qualitatively, based on the judgment and experience of professionals who give opinions on future events (MOREIRA, 2015). AI is more assertive in analytic style, providing access to "real-time" information (eg anomaly detection). But when organizations are faced with unprecedented situations, an intuitive style of decision making may be more useful. For Guszcza (2017) cognitive technologies can analyze probability-based decision contexts, but do not have the same precision to deal with new problems and situations. Unlike board games, where the probability of the next action can be calculated, real-world decision making is confusing, and confidence in probabilistic and analytical thinking tends to be insufficient (CAMPBELL, 2016). Humans continue to excel in making decisions about real-world problems full of uncertainty.

## MISCONCEPTION

Faced with misconception in the organization, it may be necessary to build consensus among the various components involved to gain decision-making support that minimizes collisions between stakeholders. The misconception refers to the presence of several simultaneous but divergent interpretations of a domain of decision (WEICK and ROBERTS, 1993). Due to the conflicting interests of stakeholders, it arises from the misunderstanding that transforms decision making from an objective and impartial process into a particular and political process aimed at meeting the needs of all conflicting parties (JARRAHI, 2018). An analytical decision can be a disappointment in practice by parties whose power and interest are affected by the intentional and unintended consequences of a decision. AI can provide certain utilities that enable decision makers to overcome ambiguous situations and address relevant conflicting needs. According to Jarrahi (2018), humans are dominant in dealing with misconception, having greater ability to understand the political landscape inside and outside the organization, building alliances and coalitions to make, negotiate and implement decisions successfully. Organizational decision making is largely approached using a mix of analytical and intuitive approaches (Hung, 2003). Martin (2009) outlines the theme precisely: "Aspects of analytical and intuitive thinking are necessary but not sufficient for optimal business performance. The most successful businesses in the coming years will balance analytic mastery and intuitive originality". Smart machines can make the “best” decision, but they don't have the know-how to sell them to a diverse set of stakeholders.

**Complexity:** With quantitative, computational, and analytical capabilities, AI outperforms humans in complex situations involving an abundance of elements, situations that require a large amount of information to be processed, and a speed beyond the cognitive capabilities of the most intelligent human decision maker. With big data, decision-making has provided new opportunities to address complexity and provide better ways to provide human decision makers with more comprehensive data analysis (JARRAHI, 2018). In the literal context, Mariotti (2013, p. 21) reports that “complexity comes from the Latin complexus, which means 'what is woven together'. This word applies to all complex systems, which are multi-element, diverse and interconnected networks. ” AI can help reduce the complexity of a problem domain through brute force by being rigorous in retrieving and analyzing large amounts of information. For Marwala (2015), AI can serve to reduce the complexity of a problem by identifying causal relationships and stating the appropriate cause of action between various probabilities through causal looping (if so). Reid Hoffman, CEO of LinkedIn, noted that humans make better decisions because AI "can dig through vast amounts of data to highlight the most interesting things, managers can search using human intelligence to reach conclusions and take action." (Hoffman, 2016).

### Research methodology

The methodological procedures used to obtain the proposed objectives for the elaboration of this study are:

- Quantitative exploratory research,
- Research classification and its approach,
- Procedures for data collection and analysis.

In relation to its objective, this research work is initially characterized as a study of the exploratory research method, analyzing areas of knowledge where the decision-making of organizations is made in the classic and contemporary mode with the aid of intelligent systems, which offer relevant and accurate suggestions. With this approach, according to Turato (2003, p.262), "The researcher's curiosity and commitment are

focused on the process, defined as the act of proceeding of the object, what are its states and changes and, above all, what is the way the object operates ". In order to make better use of respondents' data, it became necessary to make inferences in order to produce information about a given characteristic of the population in which we are interested from information collected from a part of the sample. As only a sample of financial system organizations will be used, some testing should be performed to verify the adequacy of the data to the total population. It is worth remembering that the sample was defined from the list of financial sector organizations that answered the questionnaire about the use of AI in the financial system. The survey was sent via e-mail with a link to the electronic form to a group of 22 financial sector organizations unknown to the author of this study, and published on the web (Microsoft ® Forms) for completion by managers (financial sector). ) that are part of the decision making process of the organization. Data were collected in Microsoft ® Forms and stored, processed and tabulated in a Microsoft ® Excel program file so that it was possible to assign values to perceptions, expectations and realization of their parameterization and relationships, connecting the answers to the formulated hypotheses. Data processing also occurred in IBM® SPSS Statistics application software version 25.0 acronyms for Statistical Package for the Social Sciences. The analysis, interpretation and discussion of the collected data are guided by the theoretical framework and guided by the general objective of this research.

Firstly, the factor analysis will be presented using IBM® SPSS software, version 25. For data analysis, multivariate factor analysis techniques were used. In order to verify if the factor analysis method can be used and is a suitable method for the purposes of this study, we used KMO statistical tests, Barlett's sphericity with Chi-square approximation. Randomly and incisively 8 variables were removed in the search for a KMO above 0.8. In this research the KMO is 0.812 which indicates that the principal component analysis can be done. Bartlett's sphericity test gives a value of $X^2$ (Chi-square) = 87.041, with degree of freedom, gl = 36, rejecting the null hypothesis, that is, the variables are correlated, having the same interpretation for the value. -p (for a significance level, Sig = 0.000), which is less than 0.05, thus showing that there is correlation between some variables, thus concluding that several factors may explain a large proportion of data variability. Contemplating the Commonality of the variables analyzed, it can be observed in Table 5 that practically all variables have a high explanatory power, considering all factors obtained, except for the variables (V22 and V27), which presented an explanation below 0.70. The commonalities represent the proportion of variance explained by the extracted factor / component / dimension, ie, they indicate the weight / importance of each variable on the index construction, explaining the percentage of variability for each variable when grouped into factor. According to Schwab (2007), commonalities represent the proportion of variance for each variable included in the analysis that is explained by the extracted components. Routinely the minimum acceptable value is 0.50. In the table below commonalities, all variables present commonality above the critical value.

It is clear that the first assumption to the set of attributes (variables / questions) associated with the practice of knowledge and use of AI is significantly represented by seven original variables: use of AI; impact on the financial sector; significantly positive impact on the organization; AI brings some differential; AI is more assertive; anticipate the most accurate and effective transformations and results. The following factor is fundamentally explained by two variables: more accurate and effective results; partner of humans and intelligent machines. We found that all the variables listed above are above the critical index of 0.50 and thus these results suggest and demonstrate that the issue of AI use and acceptance in organizations is significant, constitutes a determining factor for the use of Artificial Intelligence. The correlation matrix shows the possible Pearson correlation between the variables. The correlations are mirrored and the diagonal values are equal to one, ie 100% due to the perfect correlation between the same variables. It is necessary to examine the magnitude of the correlation coefficients to assess if at least half of the coefficients is greater than 0. 30 of the Correlation Matrix, (HAIR et al. 2009). The greater the amount of correlation greater than 0.30, the more factorable is the matrix. Analyzing the correlations below or above the diagonal of the matrix, formed by coefficients of value 1.00 (correlations of each variable with itself), the mean correlation index must be greater than 0.50 (table 7) for factor analysis. Analyzing the correlation matrix (Table 6), it has many correlations with coefficients greater than 0.30, indicating that the matrix is favorable for factor analysis.

Thus, we see that the variable (AI Use (V4)) has a correlation equal to 1 with itself, an absolute value correlation of 0.636 with variable 2 (Impact on the Financial Sector (V7)), being a correlation with high, according to (COHEN, et al., 2003), the magnitude of associations between variables are shown in table 7. The correlation of variables V27 (partnership of human and intelligent machines) with V15 (AI is more assertive) demonstrates that the partnership for decision making has a moderate to strong correlation so that the use of the technology model for decision making Assertive decision-making in the financial market is likely to occur. The interaction between variables V4 (Use of AI) and V7 (Impact on the financial sector) corroborates the statements presented above, which indicate a high tendency of the use of this technological tool for decision making in the financial market. Correlations are relatively weak when they have an absolute value close to zero. In table, the variance matrix indicates the total percentage of variance obtained by the factors. The factors present cumulative variance of at least 70%, demonstrating fairly enough to proceed with the factor analysis model. The percentage of variation explained was 74.84% using three factors. The Kaiser rule suggests that only eigenvalue components> 1 should be extracted (see line parallel to the X axis in the graph). Regarding the Scree plot (Figure 9), the eigenvalue variation between the extracted components must be observed. An abrupt drop indicates that too much variance (information) has been lost, so factor / component extraction is interrupted. In summary, both cumulative variance, Kaiser rule and Scree plot examination (Figure 9) indicate that three factors / components must be extracted to represent / explain the variation of the original variables. The extraction of three factors for the nine variables indicates that the set of these variables can form three indices, which we will call AI Impact Index (IIA), AI Assertiveness Index (ASIA) and AI Applicability Index (AIA). In the last column “Sums of load squared rotation”, instead of working with 9 indicators, only three factors can be used, as these factors account for 74.84% of the total variation between the indicators. The Component Matrix in table 9 shows which

variables belong to each factor, however, it is the unrotated solution. The component matrix does not yet provide adequate information for the analysis of variables capable of being useful for the interpretation of the factors, requiring rotation by the Varimax method. We need to note that there are 3 eigenvalue factors starting at 1.0, the first three being left, demonstrating that the data set is three-dimensional. Thus, the perception is that they have reached a degree of relationship and explanation of the variables that can be useful in the evaluation. Selvalued by principal componentes - Escarpa graphic - Scree Plot. With the extraction of three components / factors in figure 10, a 3-dimensional (3D) graph is presented. Note the factorial load of each variable and its respective components in:

In the rotated components matrix, it is possible to verify which of the best factors explains each of the considered indicators and indicates which variables belong to each factor, identifying the main research indicators. In the study were considered relevant only the factor loadings (correlations) greater than 0.60, highlighted in bold in Table 10. According to the authors Hair et al (1998), the objective of all rotation methods is to simplify the rows and columns of the factorial matrix to facilitate interpretation. In a factorial matrix, the columns represent factors, and each row corresponds to the loads of a variable along the factors. The authors further assert that the Varimax method (used in this study) has been very successful as an analytical approach for obtaining an orthogonal factor rotation. The rotating component matrix variables, after matrix factor rotation (Table 10), allow a more precise classification of the variables into each of the concentrated factors, indicating each component that is composed in the Matrix of component. In the model it was possible to interpret the first factor as "AI Impact", the second factor could be interpreted as "AI Assertiveness" and the last factor being "AI Applicability", making it necessary (Table 11) to make the appointment. factors / components / dimension to identify the relationship between variables / questions / attributes, to facilitate interpretation and the importance indicators obtained in the research. The naming of the factors makes it necessary to assign a relationship with their content / meaning. The first factor "AI Impact" accounts for 30.47% of the explained variance and the second factor "AI Assertiveness" for 23.51%. The "AI Applicability" consists of 16.80% of the variance (Table 12). The "AI impact" factor is responsible for delivering 30.47% of variance bringing an importance to the data presented because it highlights the importance of using the mechanism for the arranged system. The IA-IAIA applicability is 16.80%, with data much closer to the trend line, demonstrating the degree of application to the decision making process, validating and corroborating the data presented in 3D rotational graphs.

**Conclusão e considerações finais:** Intelligent system (AI) organizations like to indicate through the results of the factorial analysis of this research, to choose better choices in their strategic decisions, suggesting a better opportunity for decisions that impact the differential for more accurate and effective results, to minimize risks. in their decisions. The analysis work was carried out by collecting data from 22 national and international small, medium and large financial system organizations that are active in the national system, starting from the assumption that the answers given by the respondents to the questionnaires via web express the truth, boiling down to an exploratory, quantitative research using the statistical method of factor analysis. Although all factors are presented, only the three most relevant are analyzed, being the most significant to measure the perception of managers of financial organizations regarding the Artificial Intelligence components.

The research achieved the objectives in full, after factor analysis it is possible to interpret that artificial intelligence has significant importance and is being used in financial system organizations, even shyly, is assertive and useful in making strategic decisions, when used together in man-machine decision making, thus more assertive in decision making. From the Factor Analysis of the results obtained, it was possible to identify the most relevant factors that influence the performance of decision making with the aid of AI in the financial sector organizations. These variables analyzed were: AI brings some differential (V13), Financial Sector Impact (V7), more accurate and effective results (V23) and significantly positive impact on the Organization (V11). Thus we can emphasize that the nine initial variables can be evidenced by three factors. The first classified as "AI Impact", the second as "AI Assertiveness" and the third as "AI Applicability". These three factors, being related, were important in explaining how decision making with AI has become a trend in today's job market, to the point that it can replace traditional decision-making data models. Conventional decision-making strategies, such as designing a pros and cons framework, and data analysis, can be shrunk with the evolution of AI and machine learning, making the decision sometimes made by the extensive bank-based machine. pre-existing data
Thus, these results seem to suggest that AI is an important complete differential in the struggle for the perpetuation of contemporary organizations in search of the best decision making.

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