Potential impacts of artificial intelligence for management accounting in the perception of professionals in the field

Impactos potenciales de la inteligencia artificial para la contabilidad de gestión en la percepción de los profesionales del sector

Potenciais impactos da inteligência artificial para a contabilidade gerencial na percepção dos profissionais da área

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Abstract
Purpose: The objective of this research is to verify the potential impacts that Artificial Intelligence (AI) can have within the field of Management Accounting (MA) in the perception of professionals in the field.

Methodology: The research is exploratory-descriptive and qualitative in nature, classified as a survey, an appropriate strategy for analyzing facts and descriptions (Martins & Theóphilo, 2009). Data collection took place through semi-structured interviews with seven professionals considered experts in the areas of study. The data was analyzed using content analysis.

Results: The results show that some AI functions could potentially interfere with the business and converge with previous investigations, namely: process mining and machine learning. Among the activities that facilitate the insertion of artificial intelligence are budget preparation, custodial management (especially task processes) and preparation and use of management relationships. Another aspect addressed is the potential of technology and expanded as the variables used for analysis, dealing with a large quantity of data, in addition to factors such as time reduction, quality increase, greater process agility and error reduction. Furthermore, let us discuss the impacts on professional training in the face of the adoption of new technologies.

Contributions of the Study: The main contribution of this research is the discussion about which MA practices can be effectively affected by AI, especially considering that it is not possible to guarantee the real impact of AI on management practices. Additionally, the opinion of experts, as people who experience or have experienced the topic closely, makes tangible knowledge that has been limited to the theoretical field in most of the research consulted during the execution of this study.

Keywords: Management Accounting, Artificial Intelligence, Machine Learning, Deep Learning, Process Mining.

Resumen

Objetivo: El objetivo de esta investigación es verificar los principales impactos potenciales que la Inteligencia Artificial (IA) puede traer dentro del campo de la Contabilidad de Gestión (CG). En segundo lugar, también se discuten los rumbos que pueden tomar los profesionales del área en cuestión ante los avances de las tecnologías estudiadas y, en base a esto, qué nuevas mejoras son posibles para la profesión en la percepción de los profesionales del sector.

Metodología: La investigación es de carácter exploratorio-descriptivo y cualitativo, clasificada como encuesta, estrategia adecuada para el análisis de hechos y descripciones (Martins & Theóphilo, 2009). La recolección de datos se realizó a través de entrevistas semiestructuradas a siete profesionales considerados expertos en las áreas de estudio. Los datos se analizaron mediante análisis de contenido.

Resultados: Los resultados muestran que algunas funciones de la IA podrían potencialmente interferir con el negocio y converger con investigaciones anteriores, a saber: minería de procesos y aprendizaje automático. Entre las actividades que facilitan la inserción de la inteligencia artificial se encuentran: elaboración de presupuestos, gestión de custodia (especialmente procesos de tareas) y preparación y uso de relaciones de gestión. Otro aspecto abordado es el potencial de la tecnología y ampliado como las variables utilizadas para el análisis, al tratarse de una gran cantidad de datos, además de factores como reducción de tiempos, aumento de la calidad, mayor agilidad de los procesos y reducción de errores. Además, analicemos los impactos en la formación profesional ante la adopción de nuevas tecnologías.

Contribuciones del Estudio: La principal contribución de esta investigación consiste en la discusión sobre qué prácticas de CG pueden verse efectivamente afectadas por la IA, especialmente considerando que no es posible garantizar el impacto real de la IA en las prácticas de gestión. Además, la opinión de los expertos, como personas que viven o han vivido de cerca

el tema, hace tangible un conocimiento que se ha limitado al campo teórico en la mayoría de las investigaciones consultadas durante este estudio.

Palabras clave: Contabilidad de Gestión, Inteligencia Artificial, Machine Learning, Deep Learning, Process Mining.

Resumo

Objetivo: O objetivo desta pesquisa é verificar os potenciais impactos que a Inteligência Artificial (IA) pode trazer dentro do campo de atuação da Contabilidade Gerencial (CG) na percepção dos profissionais da área.

Metodologia: A pesquisa tem natureza descritiva e qualitativa, classificada como survey, estratégia apropriada para análise de fatos e descrições (Martins & Theóphilo, 2009). A coleta de dados se deu por meio de entrevistas semiestruturadas com sete profissionais considerados experts nas áreas do estudo. Os dados foram analisados por meio de análise de conteúdo.

Resultados: Os resultados mostram que algumas funções de IA potencialmente podem interferir no meio empresarial e convergem com pesquisas anteriores, a saber: process mining e machine learning. Dentre as atividades que possuem maior facilidade para inserção de inteligências artificiais estão: elaboração do orçamento, gestão de custos (especialmente os processos de rateio) e a confecção e uso dos relatórios gerenciais. Outro aspecto abordado diz respeito ao potencial da tecnologia em ampliar as variáveis utilizadas para análise, lidando com uma grande quantidade de dados, além de fatores como redução do tempo, aumento da qualidade, maior agilidade nos processos e redução de erros. Adicionalmente, discutem-se os impactos para a formação profissional frente à adoção das novas tecnologias.

Contribuições do Estudo: A principal contribuição desta pesquisa consiste na discussão sobre quais práticas de CG podem ser efetivamente afetadas pela IA, especialmente considerando que não é possível assegurar qual o impacto real da IA sobre as práticas de gestão. Adicionalmente, o parecer dos experts, como pessoas que vivenciam ou vivenciaram de perto o tema, tangibiliza um conhecimento que tem se delimitado ao campo teórico na maioria das pesquisas consultadas durante a realização deste estudo.

Palavras-chave: Contabilidade Gerencial, Inteligência Artificial, Machine Learning, Deep Learning, Process Mining.

1 Introduction

Accounting science has been evolving and shaping itself over time, according to the needs, both from the point of view of the professional in the area and the user of the information. A key factor to be analyzed within the management accounting spectrum, for example, is the constant changes, as well as the automation and insertion of technology in this environment. Accounting then begins to not only acquire new concepts and functions, but also has part of its manual attributions facilitated or replaced by technology (Dávila, 2019, Korobeynikova, Korobeynikov, Popova, Chekrygina & Shemet, 2020, Qin, & Qin, 2021).

Artificial Intelligence (AI) is a topic that has been widely explored in the media in recent years, with the advent of ChatGPT, which was born on November 30, 2022 by the company

OpenAI, being a chatbot that uses Natural Language Processing (NLP) and the Generative Pre-Trained Transformer (GPT) language model for its operation, trying to reproduce the interaction with human beings (Open AI, 2024). Therefore, the concept of Artificial Intelligence is attributing the capacity of the human mind to systems. Thus, it is estimated that AI, in accounting, has the potential to change the way information is obtained, and decisions are made, as well as the connection with different stakeholders.

Accounting is supported by Management Information Systems, which make it possible to expand the scope of its work. Additionally, newer technologies, such as cloud computing, have been incorporated to speed up the performance achieved by accounting systems and professionals (Santos & Kozen, 2020). In this context, Management Accounting (MC) adopts an important characteristic: developing the critical and analytical sense of the accountant, who acts not only by consolidating data, but also by analyzing it, reaching conclusions and helping, in fact, to decide, which can impact the economic-financial development of institutions (Duarte, 2018).

According to accounting organizations such as the American Institute of Certified Professional Accountants (AICPA) and the Chartered Institute of Management Accountants (CIMA) (2023), the role of management accountants is changing and, it is possible to have influence on organizations in order to achieve a greater impact for sustainable value generation (AICPA & CIMA, 2023). In line with Suleiman et al. (2020), there are numerous studies on accounting information systems and databases, but few on AI applications in accounting.

Recently, however, scientific studies have given greater attention to the topic. For example, in a preliminary search for scientific productions in the Web of Science database related to the topic, it was observed that the areas have been analyzed from different perspectives such as: transition from financial accounting to MA in the AI era (Wang, 2020); relationship between AI, new retail and financial transformation (Sun, 2021); exploration of MA programming for increased automation (Korhonen et al., 2021); impact of AI on the accounting industry (Shi, 2020), among others.

However, despite the recent increase in studies on AI in this area, it is still unclear how AI tends to affect MA in practice. Additionally, there are still few studies that address the issue from an empirical rather than just theoretical point of view, both internationally and in Brazil, which is therefore an important gap in studies on MA and AI. In this context, the following research question guides this paper: **What are the potential impacts that Artificial Intelligence (AI) can bring within the field of Management Accounting (MA), in the perception of professionals in the area?**

Therefore, the objective of this research is to verify the potential impacts that Artificial Intelligence (AI) can bring within the field of Management Accounting (MC), in the perception of professionals in the area. Following, it is understood that this study is relevant, especially due to what was exposed by Stodder (2018), when elucidating that organizations are eager for advances in AI, big data and cloud-based services. Such trends restructure the way companies define their Business Intelligence (BI) strategies, data analysis and manipulation.

In addition, both AI and big data technologies and platforms are creating opportunities and challenges that can generate positive impacts on the development of several areas, such as MA. Additionally, Suleiman et al. (2020) predict that accounting resumes will soon also need to include topics related to programming and the use of AI for routine accounting functions. Changes in accounting resumes will not only ensure the survival of accounting professionals but also increase their productivity and enhance their skills (Suleiman et al., 2020).

Therefore, the approach proposed by this paper is justified by enabling a reflection on the profession, providing some direction towards professionals capable of meeting the demand of new technologies in an optimized way, as well as reflecting on education and development of accounting theory as a whole in the face of such demands. Regarding the research, the study contributes to bringing to the discussion the effective impacts that AI can bring to MA in professional practice, both from a theoretical and practical point of view.

The research is structured into five main chapters. In addition to the introduction, are presented: chapter 2, related to the theoretical framework; chapter 3, dedicated to methodological aspects; chapter 4, which concerns the main results of the research; and chapter 5, which deals with the final considerations.

2 Literature Review

2.1 Management Accounting

According to AICPA and CIMA (2023), the main functions of the MA are related to: cost management, preparation of external reports, creation of the financial strategy, evaluation and management of investments based on the strategic plan, projections and financial studies carried out, budget control and management, product pricing, management of resources, risks and taxes, among others. Still on the functions of the MA, considering what was exposed by Atrill and McLaney (2017), within an organization it helps people to make decisions focused on the business in a well-structured way.

Thus, the function of accounting, in all its models, is to collect and analyze financial information and pass it on to decision-makers. The authors also state that it can generate responses to decision-makers problems, such as: solving issues such as whether or not to manufacture new products, varying the production's price or quantity, requesting or not financing activities or expansions, changing production capacity or even changing the method with which the organization carries out its operations, that is, changing the organizational strategic structure (Atrill & McLaney, 2017).

Therefore, taking the above into consideration, it is clear that MA is capable of generating a compilation of financial information capable of guiding decisions and changing the future of the organization. The impact caused by its use within an institution can be significant, as it indicates, plans, budgets, and organizes relevant information, creating possible scenarios and providing managers with projections of the future, consequences of their choices. Such projections are further refined, as they no longer depend on a previously structured model, but can learn from the volume of data itself, as proposed by the new technologies (Dávila, 2019).

According to Kruskopf, Lobbas, Meinander, Söderling, Martikaine and Lehner (2019), there is a problem for accountants today when considering the amount of information available. This makes it clear that there is a need to recognize information that is, in fact, relevant for decision-making. Stodder (2018) identifies the skills required to correctly manage the range of available data as a challenge for corporations. Through MA, it is possible to see that there are recurring problems that hinder the process of organizing relevant data.

According to Guo (2019), thanks to AI, financial accounting is undergoing a process of change and is gradually becoming managerial, becoming an indispensable product in the market. The author also concludes that accounting professionals should invest in improvements focused on management, since the profession tends to survive in the future only in the

managerial sphere. However, despite computerization and the insertion of technological tools in the accounting field, reservations can be found in the specialized literature, especially regarding the scope, reliability, and effectiveness of the interaction between MA and technology.

De Mendonça, Rodrigues, Aragão and Del Vecchio (2018) highlight that human intelligence cannot be easily replaced, and that the human condition generally tends to improve previously developed technologies, making people's daily lives easier. Thus, it is noted that the changes observed in the MA field can bring positive results, in addition to being necessary, including by the job market, since they are beneficial for clients and users of accounting information, making the information reach such users more quickly and accurately.

On the other hand, it appears that such a reality also demands a rethinking and improvement of the professional who undertakes this mission, a fact reaffirmed by Zhang, Xiong, Xie, Fan and Gu (2020), when they recognize that accountants are now expected to perform more value-added tasks, such as financial management and data-based decision-making.

2.2 Artificial intelligence

According to Madhavi and Viajay (2020), AI is the part of computer science that seeks to reproduce reactions of the human mind, recognizing speech, thinking and learning. The authors define that there are types of AI produced to surpass the capacity of the human mind. They predicted that, by 2025, many things will be largely replaced by AI, including purchase negotiations, vehicles with drivers, legal processes, courts, as well as a large part of human functions in government agencies.

Between 2026 and 2030, the authors state that there will be a single means of buying and selling transactions globally and this means will guarantee, through encryption, full security for such processes. Furthermore, AI will dominate all trade and will play an important role in the decentralization of power in autonomous institutions (Madhavi & Viajay, 2020). Thus, when using AI, it is possible to have access to intelligent recommendations, in addition to greater speed in locating, accessing, and analyzing the various types of data that are needed (Stodder, 2018).

In the specific case of MA, the changes potentially brought about by AI follow some suggestions. The first of these refers to the potential that AI has to impact accounting as a whole. In other words, activities such as double-entry accounting, inventory and documentation, evaluation, calculation, budgeting, grouping, and summarizing in reconciliation accounts, preparation of balance sheets, among others, could fall within its scope. It makes sense to consider accounting as a whole when considering that MA is a user of financial accounting by definition, with its quality directly impacted by the origin of the data (CGMA, 2023).

Thus, MA itself can be detailed by analytical positions at various levels without losing its informational value (Korobeynikova et al., 2020). This relationship between MA and accounting as a whole proposes a gradual shift from financial accounting to MA (Guo, 2019). In practice, professionals in the area are expected to move away from repetitive work at a lower strategic level to actually support business decision-making (Li, Haohao & Ming, 2019).

Additionally, expected gains from the use of AI go beyond replacing tasks, since the technology breaks the barrier of fatigue associated with human activity and expands the horizon of potential performance of accounting professionals in their roles (Chandrasekaran et al., 2019). In this sense, the prediction capacity and tasks associated with classification can be

exercised with a higher level of assertiveness (Chandrasekaran et al., 2019). Such changes, as stated by Schildt (2016), mean that managing algorithms and increasing transparency due to computerization are actions that shape the objective conditions of workers, in addition to inevitably changing the view that members of an organization have of themselves and their work.

Furthermore, the support for decision-making corroborated by the analysis of large volumes of data provides an additional gain (He, 2020, Korobeynikova et al., 2020), in addition to the upgrade that can be provided to expert systems, increasing accuracy, and reducing delays (Qiu, 2020). An example of this is the budget that, if linked to BI systems within this new technological perspective, can, in fact, bring savings to organizations (Qin & Qin, 2021). Therefore, everything that involves intelligent systems, pattern recognition, machine learning, problem-solving and intelligent information retrieval, as well as artificial neural networks, would be within the field of AI (Qiu, 2020).

In detail, according to Wang (2019), the area of computer science and information technology considers that AI is generally recognized by the techniques developed from its existence, that is, its extensions. The author also states that, as these techniques are based on a diversity of theories, they are applicable to different problems and, consequently, different forms of AI application emerge, some of which are: knowledge representation, machine learning (which includes deep learning) and process mining (Table 1).

Table 1
Some AI applications

Term	Concept	Source
Knowledge representation	It is the representation of a set of data that are related to each other. It is carried out in a way that provides a view of the data through several different metrics. By providing such knowledge, it is possible to shape business concepts and structures. The information is managed in a way that opens up a range of possibilities for users, including shaping companies and how they relate to each other.	Liu, Lin, and Sun (2020).
Machine learning	This involves building systems that have the ability to learn from data, identify patterns and gradually acquire the ability to predict future results, enabling decision-making. This technology requires a little human intervention, as the learning process may or not occur under such supervision.	Stodder (2018).
Deep learning	It consists of a series of machine learning techniques that analyze information in greater depth, processing several layers of data and non-linear information. This results in the extraction and modification of features, thus enabling the analysis and classification of patterns.	Deng and Yu (2014).
Process Mining	It consists of tracing the path of the activity performed as it occurred, from its origin to its recording. It quickly extracts information to understand the data generated and stored in corporate information systems, so that the processes executed can be analyzed and decision-making can be supported, which increases business competition. It is also used to find patterns in the paths that the data takes and, thus, relate them, enabling exploration, better organization, and definition of a data path model.	Rojas, Munoz-Gama, Sepúlveda, & Capurro, (2016).

Source: *research data.*

It is possible to realize that AI seeks to map the processes that occur in the human mind. By assimilating the data connected to it, the machine learns and equipped with knowledge, can act as humans who have the same repertoire would act. It is also important to emphasize that human errors exist, and technology has always acted to reduce such errors when it replaces

them. Thus, in addition to behaving like a human being with experience in a certain area, technology also works to eliminate human cognitive errors (Chandrasekaran et al., 2019).

The knowledge representation method is present in several sectors around the world, such as question-and-answer activities, in addition to information retrieval, which are already automatic processes. Web search tools themselves can prove that intelligently structuring data supports knowledge-oriented tasks (Liu, Lin & Sun, 2020). The machine learning concept is not just about databases, even though it is also part of AI, and it is possible to see the impact of this topic on the structure of information technology and systems, which may undergo a major change (Alpaydin, 2020).

The learning process in machine learning can be of three types: 1) supervised learning - training continues until it reaches the desired level of learning; 2) unsupervised learning - algorithms discover a data structure and group them according to their own classification, without supervision; and 3) reinforced learning - the algorithm seeks to achieve some goals that are rewarded upon achievement (Chandrasekaran et al., 2019).

According to Samuel, Cormier, Fascendini, Stubanas and Yacko (2018), using machine learning and deep learning methods in the business environment is affecting many functions of Technology and Information Systems. Bridging the gap between the database and planning the action requires reviewing the development models. In the case of machine learning, one of the main advantages is related to the lack of need for a predefined model of variables, meaning that the only prior concern is to maintain a large data input (Samuel et al., 2018).

Furthermore, ex post information, such as cost behavior and profitability analysis, can rely on qualitative data sources, such as social media, internal reports, or customer feedback, to better understand resource use (Dávila, 2019). In manufacturing, the use of technologies such as big data, machine learning and cloud computing is also seen as having the capacity to improve and add intelligence to decision-making processes, which involve sensitivity analysis, decision-making and action, mainly considering the large amounts of data to be analyzed, as well as the complexity of current processes (Chen, 2017).

In the same vein, according to Suleiman et al. (2020), large databases, i.e. big data technology, alone, do not facilitate decision-makers in any way. Proper handling of such data is necessary, and one of the possible solutions is to introduce AI, with an emphasis on developing a system that is capable of functioning and reacting like a human, in addition to performing tasks such as problem-solving, planning, learning, and speech recognition.

In line with Deng and Yu's (2014), deep learning is formed by a wide range of in-depth knowledge using machine learning techniques, functioning as an extension. There are several stages of data processing, which advance as learning becomes more profound. Thus, knowledge is processed increasingly richly and independently of human action, since the processing will follow the patterns that have already been learned by the machine (Deng, & Yu, 2014).

Another aspect worth highlighting in relation to technologies such as deep learning is that it has reduced the chances of errors by more than ten times, compared to previous technologies, since they learn by being provided with examples and have a loop to provide continuous feedback in the assimilation process (Chandrasekaran et al., 2019). In business forecasting and planning, AI makes it possible to move from two-dimensional calculations, which are most often performed in Excel tables, to multidimensional mathematical models, enabling the analysis of scenarios and the extension of the time horizon of analysis, a very useful fact, for example, in the budgetary context (Korobeynikova et al., 2020).

Finally, despite the benefits mentioned so far, adoption of new technologies has historically been scarce and difficult, especially in emerging countries, and is still considered

an early-stage technology in this environment (Al-Emran, Malik, & Al-Kabi, 2020). As shown in Table 1, it is worth noting that AI allows information to be detailed according to the amount of data that feeds it. The use of process mining can be interesting for controlling the origin of information, which is standardized. Numbers are recorded more quickly and concisely, which also ensures that management reports are prepared more quickly and accurately.

Furthermore, the benefits of machine learning involve the fact that, by implementing an algorithm to define relevant criteria to define values, there would be, over time, greater improvement of the algorithm itself, potentially bringing efficiency to accounting-management processes (Al-Emran, Malik, & Al-Kabi, 2020). On the other hand, it is important to mention the limitations existing in the technologies studied.

Zhang et al. (2020) mention the importance of human interactivity in AI, since there are a number of risks associated with the proper management of AI and that, although computers have a greater capacity than humans to perform analyses, these analyses are useless if there is no human interpretation, creativity and imagination, in addition to consistent monitoring by experienced professionals. In addition, Lee and Yoon (2020) warn that, although there are many opportunities offered by new technologies, there are also risks such as errors, server failure, data backup, and so on. Therefore, opportunities and challenges are still associated with the full use of AI.

2.3 Technology and Management Accounting

It is well known that technologies such as AI, blockchain, big data and related technologies are gaining relevance within MA, as they can change the paradigms by which information and respective analyses are generated and thought (He, 2020, Korobeynikova et al., 2020, Qin & Qin, 2021, Gusc, Bosma, Jarka & Biernat-Jarka, 2022). Lee and Yoon (2020) reinforce that the main ideas of accounting technologies already studied in the literature were cloud, big data and blockchain.

Chinese economic development has reached its critical point and, in order to maintain competitive and comparative advantages, companies need to adopt the latest AI-based technologies. This is also true for the accounting sector, as it is already in the transition phase and market forces are demanding the adoption of the latest practices and technologies (Suleiman et al., 2020).

According to De Lima and Macedo (2018), information technology is present and has a growing trend since people are increasingly dependent and in need. This way, there would be a guarantee of activities conducted more precisely, quickly and without the risk of human error. The authors define accounting as a science whose objective is to produce financial and asset information, which has been following such technological advances, as they help to achieve objectives, producing relevant information for decision-making.

By increasing the technological capacity of accounting software, reports containing financial information are increasingly being produced in real time and with more qualified and understandable information, which impacts the vision of decision-makers and, consequently, their management in the organization in which they carry it out (De Lima & Macedo, 2018).

In addition, Moll and Yigitbasioglu (2019) state that blockchain technology will further contribute to the big data phenomenon, making it increasingly intelligent and enabling analysis through cloud and AI software, which will be able to connect data and become accessible to a wide range of organizations. These technologies will promote new types of automated

accounting and auditing services, being almost real-time, improving performance and data assurance (Moll & Yigitbasioglu, 2019).

De Lima and Macedo (2018) also address another aspect, which is that systems only process data according to what professionals define. In each company, there is a range of different information, which also ends up weighing differently in the decision-making process. In addition, the responsibility for conducting procedures in accordance with current accounting standards lies with professionals, and this aspect influences the decision-making process, timeliness and reliability.

In this sense, problems arise with the accounting-technological evolution, such as the low qualification of professionals related to the area, such as analysts, managers, collaborators and even users of information. This problem leads to the systems not being properly filled, in addition to problems in handling, which causes a low level of use of the available resources (De Lima & Macedo, 2018).

In this sense, Losbichler and Lehner (2021) suggest that the best results will likely come from human-machine interaction, since accurate predictions remain a somewhat unattainable ideal, while machine-generated predictions may have some gains in terms of control, using a lower level of effort. In addition to changes in technical skills, it is important to look at governance issues.

Mill and Yigitbasioglu (2019) argue that innovative models of governance may be needed in response to AI, particularly given the ease with which individuals within the organization can blame the IT system for poor decisions, arguing that such decisions are automated and not subject to any interference on their part. Financial institutions' operations have changed rapidly with the introduction of AI due to cost savings and operational efficiencies (Suleiman et al., 2020). In addition, the use of AI in accounting is already generating tangible benefits by increasing the potential of accountants to cross-reference data appropriately in order to analyze big data and prevent intentional and unintentional fraud activities (Sherif & Mohsin, 2021).

Zhang et al. (2020) state that there is no doubt about the future replacement of humans by robots in basic accounting, with such robots being an important part of the accounting scenario. Still on the subject, Moll and Yigitbasioglu (2019) argue that many of the advances in AI techniques are fostered by supervised learning, and accounting professionals will be very well positioned to ensure that the data used in these developments make sense with the proposal and meet the specific need.

Furthermore, the limitations of information processing by humans are being considered. The authors also state that accountants will need to develop critical thinking and observation skills, as there is a need to detect and correct erroneous insights and suggestions provided by AI (Zhang et al., 2020). Following this line, Suleiman et al. (2020) state that the application of AI tools and techniques in the world of finance and accounting can be very beneficial, despite the limitations contained in the field of AI that make it unsuitable for carrying out some activities and, in addition, risks associated with managing AI in an organization.

Samarghandi, Askarany, and Dehkordi (2023) apply Actor-Network Theory to examine the impact of machine learning modules on predicting the roles of human actors in accounting information systems in organizations. To do so, they brainstormed with 44 professionals, raising 35 characteristics of the actors involved, of which 11 were selected for the study. Using a questionnaire with 120 valid responses from managers of a company, they assessed the impact of the following characteristics: age, gender, level of education, field of study, age group, general professional history, professional history in middle management positions, professional

history in senior management positions, organizational function, degree of familiarity with accounting information systems, and time of use of accounting information systems.

The findings of the work by Samarghandi et al. (2023) show that two human factors (familiarity with accounting information and time spent familiarizing themselves with it) are the most influential elements in predicting the behavior of actors. The study also suggests that investing only in technology or human resources is not enough, since the construction of the network emerges from the interaction between both: people and technology. Other contributions of the research involve the review of the criteria for selecting people based on the characteristics found with significance, the effective role of systems in organizations, as well as the influence of network agents on the behavior of actors.

From a scientific perspective, the increase in production involving MA and AI themes has been increasing relevance over the years, especially between 2020 and 2022, as illustrated in Figure 1.
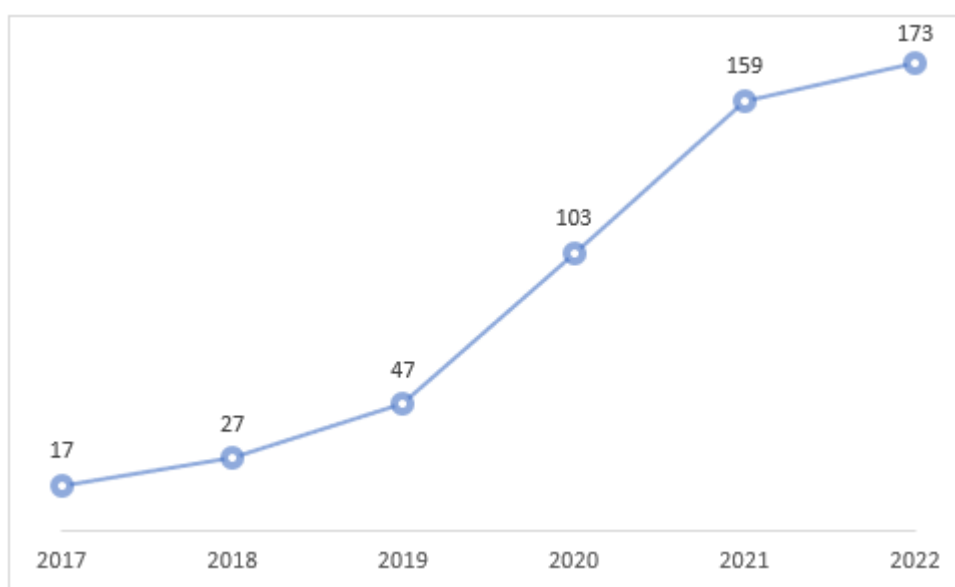

Figure 1 Amount of scientific productions on MA and AI over the years.
Source: *Web of Science (2023).*

It can be seen, then, from the analysis of Figure 1, that there has been an increase in scientific production involving the two topics in question, MA and AI, especially since 2020, when there was a 119% increase in the number of academic works published on the subject, according to analyses carried out using the Web of Science database. Likewise, this information is ratified by Atanasovski and Tocev (2022), who elucidate that, in the last 5 years, the number of articles published on the potential that technology brings to accounting has been considerable.

Silva's thesis (2019) concluded that there was little Brazilian research on the insertion of technology in the business environment, in general. The author also stated that it would be necessary to study what universities are teaching students, in order to verify whether this is really what the job market demands. In this sense, he believes that, although technical skills continue to be necessary and important to perform controllership, soft skills and mastery of technology for decision-making are fundamental, as well as skills that were already relevant:

strategic vision of the business and data analysis for decision-making, which emerge as even more important than technical knowledge.

In view of the discussion held so far, despite facing modifications, MA will still maintain human activity, as machines require human action to function effectively, develop and undergo necessary maintenance. This is even more so if the understanding is that MA goes beyond basic accounting, as proposed by Zhang et al. (2020) regarding the robotization process. It is also observed that technology may require human interaction to be managed. Therefore, the need for professionals in the area to be equipped not only with knowledge in management, but also in science and technology comes to the fore (Guo, 2019).

A counterpoint, however, is the practical difficulty in dealing with complex systems, which makes the human-machine transition not as easy as it may seem at first (Losbichler & Lehner, 2021). Lee and Yoon (2020) argue that organizations can develop a more efficient and secure accounting system using big data and AI. This claim is also made by Zhang et al. (2020), who state that the deep integration of emerging technologies such as big data, machine learning, AI and blockchain in accounting can introduce major changes in the accounting profession, such as reforming accounting procedures, reducing errors and distortions in accounting information, improving efficiency and transforming the structure of accounting careers.

Corroborating the discussion, according to Angonese and Lavarda (2017, p. 140), "the process of change in the MA system is motivated by a particular set of external and internal pressures on organizations, each with its own intensity". Finally, also following Kruskopf et al. (2019), the digital revolution will cause time-consuming tasks to be performed by machines and, consequently, professionals will use idle time to focus on adding more value to customers.

The result can be a reduction in costs and time spent on functions, focusing on more specific tasks to meet demands. Also according to Kruskopf et al. (2019), in the future, MA tasks will be more precise and detailed, as the computer's ability to generate the information necessary for managers to make decisions will compensate for human work time.

3 Methodological Procedures

Regarding the methodological aspects of this research, in relation to its objective, it is characterized as a descriptive study, as it aims to describe a phenomenon that is the object of study, in a field of knowledge that is still growing (Marconi & Lakatos, 2003). Regarding its approach, it is understood as a qualitative study. According to Fontelles, Simões, Faria and Fontelles (2009), qualitative research seeks a deep understanding of complex phenomena, dealing with described, interpreted, compared facts, being less exact and more participatory. In this way, it differs from quantitative research, which is related to resources and techniques that allow the classification and analysis of quantities, which contain numerical aspects, mathematics and applied statistics.

Furthermore, this study is classified as a survey, an appropriate strategy for analyzing facts and descriptions (Martins & Theóphilo, 2009). The survey was conducted through data collection in semi-structured interviews with experts who deal with the subjects discussed here. According to Marconi and Lakatos (2003), a semi-structured interview is a research methodology conducted between two people, in which one person transmits information that they have based on their own experiences and in a professional manner to the other, in this case, the researcher. It is conducted in a methodical manner and provides the researcher with a theoretical basis and information relevant to their research.

According to Triviños (2008), the semi-structured interview is an approach that begins with fundamental questions based on theories and hypotheses that are important to the research. As the interviewee's answers are received, new hypotheses emerge that broaden the range of questions to be explored. This research chose to consult professionals who are experts in their fields (Table 2). Experts here are understood as professionals who have mastery over the subject in question, given their academic training and/or professional experience, in this case, in Management Accounting and Artificial Intelligence.

Table 2
Profile of interviewees

Identification	Description
1st Interviewee	Accountant and internal auditor for a textile fashion company, graduated in Accounting from the Federal University of Santa Catarina, participated in the development of a continuous audit project in an accounting process at the company where she works, participating in an international accounting symposium on the subject. She performs some work with internal controls in the controllership area.
2nd Interviewee	Professor of Accounting Sciences at a Federal University, he spent 6 months in the USA, at a business university, where he supervised a doctoral program in accounting information systems, observing some research in the field of Big data, Blockchain and Artificial Intelligence in Accounting.
3rd Interviewee	He is a mechanical engineer who moved into consulting, through which he became familiar with topics such as planning, budgeting and pricing. He completed an MBA in the area, a master's degree and a doctorate in Accounting Sciences, and began teaching, and is now a professor at renowned educational institutions. He works as a consultant for several companies, some since the beginning of his career in consulting, monitoring purchasing, sales, and joint venture processes. He is currently studying Artificial Intelligence.
4th Interviewee	Professor at a research laboratory in the USA (New Jersey). He studied at PUC in Rio de Janeiro and participated in the process of installing the first computer in Brazil. He wrote six books, from 1998 to 2005, on the application of artificial intelligence in accounting and auditing. Today, he has projects on analytical methods with companies in a wide range of segments, from textile fashion to investments. He has developed several projects in machine learning, one of which, at an insurance company, related to loss prediction using machine learning.
5th Interviewee	He studied Accounting and worked for about ten years in accounting, where he worked in the Controllership of an energy company. The company operated in several states and municipalities and underwent a process of debureaucratization for digital transformation. Today he is a professor at renowned educational institutions and has already participated in some projects focused on automation.
6th Interviewee	He worked in production planning and control for 3 to 4 years, moving to the area of corporate planning and management controllership. Since then, he has worked in the area of corporate planning. He currently works in commercial controllership at a former Japanese company, being responsible for pricing, sales price formation and commercial controllership. Within the commercial function, his team works to do performance analyses of the sales team, aiming at process efficiency.
7th Interviewee	Graduated in Civil Engineering, he completed a scientific initiation program to develop structural calculation software. He has a postgraduate degree in internal controls and risk management. He began working as a trainee at a large bank in 2001, where he worked for 19 years, building a career in internal auditing within this financial institution, being Head of Audit in international units, covering 19 countries where the financial institution operates. He has experience leading the implementation of data analytics in Internal Audit, including artificial intelligence, data mining and continuous auditing. Today, he serves as a member of the audit committee and audit director of a large insurance company.

Source: *research data (2023).*

Finally, the interviews were based on an initially defined script (Appendix I) and took place between July 20 and September 23, 2020, with an average duration of approximately 40 minutes. In addition, the Zoom, Skype, and Whatsapp Video platforms were used as means of communication. At the end of this stage, they were transcribed in full so that they could be categorized and coded. To analyze the data, the content analysis technique was used, which brings together procedures to verify communication and allow the inference of results from categories established by the researcher (Bardin, 2011). These categories are expressed in the following chapter.

4 Results and Analysis

4.1 Adaptations necessary for the development of professional activity

The first category that emerged from the data refers to professional development, when most interviewees defined the following as key characteristics to support technological changes and remain in the job market: ability to handle and deal with a large database; continually seeking more agile models; knowledge of technological tools; great communication skills; and always thinking about innovation. In the words of the first interviewee (2020), "there must be knowledge of tools, databases, and quick methods to search for information, extract it, and send it in a timely manner". In other words, there must be some kind of adaptation, especially in relation to professional skills, to conduct accounting activities.

The 5th interviewee (2020) also reinforces the idea that it is necessary to have communication skills. Such statements are in line with Chen's (2017) study on the complexity and excess of data involved in business processes, which make such skills even more relevant. This increase in the need for professionals' knowledge, according to Sherif and Mohsin (2021), brings a tangible benefit to companies' results since it increases employees' analytical capacity.

> The controller must know how to sell his ideas, because everyone talks about innovations today, but if the professional does not know how to explain and sell the idea, and if the director does not understand accounting, he cannot understand how important it is to implement these improvements (5th interviewee, 2020).

In the interviews, it is also clear that those who are inflexible and not susceptible to change, remaining resistant and conservative to the technical side of the business, can easily lose their position and be replaced by professionals with higher qualifications or even machines. Corroborating the line of Losbichler and Lehner (2021), in addition to resistance, there must also be the practical difficulty of man in dealing with systemic complexity. All of this makes the transition from man to machine difficult.

The 4th interviewee (2020) reiterated that professionals should memorize fewer accounting rules and develop more skills in manipulating systems and technology: "Accountants should specialize in a field; if they want to know a little bit about everything, there's Google. They should also keep studying; they cannot stop." In this sense, Kruskopf et al. (2019) already stated that the digital revolution is bringing professionals to focus on more specific functions, while machines take care of the manual work. The general perception is that the areas will be much more interconnected in the future and that professionals will spend less time on operational and bureaucratic activities, being more occupied with decision-making itself.

Among the characteristics needed to remain in the market, two traits were described: ability to handle technology tools and communication skills. This would be the new profile for the professional. In addition to communication, mention of soft skills was common. The statements of the interviewees are in line with the research by Silva (2019) on the importance that soft skills have been gaining, in addition to technical knowledge. It can be inferred, from the data, that technical knowledge must now be complemented by other skills, especially since AI and related systems are expected to perform part of the work that the professional previously performed.

The general perception is that corporations have high demands for little time: "There is little time with information to think about decision-making. With AI, there will be fewer people working with this data, on the other hand, more people working to analyze the data that the machine will bring." (6th interviewee, 2020). Adding to this aspect mentioned by the interviewees, authors such as He (2020), Korobeynikova et al. (2020), Qin and Qin (2021) and Gusc et al. (2022) highlight the relevance of technologies such as AI, blockchain and big data within MA, as they can shape the approach to data and information analysis.

Therefore, there will be less need for manual and technical activities and more demand for analytical and decision support activities. The general view is that activities related to legislation and bureaucracy tend to be replaced, which converges with Madhavi and Viajay (2020). In this context, it is possible to infer, from the material collected, that AI will not replace all tasks, however, the simpler they are, the easier they can be replaced. "It should be considered that the more complex, the more difficult automation becomes. What is left for humans is critical and analytical capacity, analysis of the manager's profile, investments, which product is better, this analysis is qualitative, not quantitative." (2nd interviewee, 2020).

In this sense, Mill and Yigitbasioglu (2019) agree with this statement, including when they mention that innovations driven by AI also bring a need for innovation in forms of governance, which must be aimed at managing a strong and influential area of Information Technology. Again, is noticeable the emphasis on critical capacity and decision-making by the accounting professional as a response to the AI movement.

The professional must then think strategically to define which choices he must make to be able to remain in the profession, adding value to the business world, which converges with the perception that one must move towards a less technical and more analytical side, understanding and distinguishing simple functions from more complex ones.

> When the first industrial revolution took place, it was said that all jobs would disappear, but people left the countryside and went to the city, where new roles emerged, such as machine maintenance, cleaning, and security. Everything adapts to meet needs. (7th interviewee, 2020).

When analyzing the readiness of professionals to embrace technological advances, it is almost unanimous that younger professionals will have an easier time, since professionals who have been in the job market for longer may have greater difficulty adapting to change. The 3rd interviewee (2020) states that technology is much more ingrained in young people, so they are more capable than older professionals; "professionals do everything they did 20 years ago, but now they have the help of technology and AI tools. However, they still don't know how to fully deal with these tools, they don't use them the way they would like." (Third interviewee, 2020).

Therefore, it is necessary to develop skills to handling technology so that one knows how to get the best out of it, as well as how to act in this new scenario. Specifically with regard to technology, the 2nd interviewee (2020) states that today there is no type of preparation in place. "If you give a spreadsheet with 2 million lines to an accountant today, he will probably

find it very difficult to work with, firstly because Excel will not open it, he will need a data system and, in addition, he will need to know how to manipulate the system and the data" (2nd interviewee, 2020).

When dealing with large amounts of data, Kruskopf et al. (2019) also state that a problem for accountants will be dealing with this mission that will be imposed on them. On the other hand, Sherif and Mohsin (2021) understand that the improvement of professionals is already increasing some skills, including analysis of voluminous data and expansion of critical capacity.

In this sense, it is understood that it would be necessary to be able to handle programming languages and systems well, starting from graduation, such as Power BI, Python, R and SQL. During the research, it was found that, in addition to being unprepared, many professionals may be resistant because they see technology as a threat to their jobs. Another point mentioned is the need for people to still be involved: "The algorithm analyzes the variables you proposed to it, but what about the others? The human being needs to be present to teach the machine, the world is constantly changing and there will always be more things to teach the machines." (3rd interviewee, 2020).

In other words, machines need constant training and innovation will come from humans, not from trained AI that is always exposed to the same data. Thus, when talking about the elimination of the need for human intervention in accounting, Zhang et al. (2020) state that there will certainly be robots performing 100% of the activities related to basic accounting. However, the authors defend the need for human intervention to ensure the mitigation of the series of imminent risks associated with the use of AI, which must be carried out with a certain degree of human interpretation, creativity and imagination.

Furthermore, monitoring by experienced professionals is required. It is interesting to note that, when exploring a machine learning process without supervision, humans are no longer a necessary element for machine processing (Chandrasekaran et al., 2019), as discussed in section 2.2. On the other hand, this view is in line with the fact that there may be difficulties in human-machine interaction, as mentioned by Losbichler and Lehner (2021). In this sense, there is a potential barrier to the accounting professionals in relation to interaction with technology and the volume of data.

When it comes to technological and personnel support for such advances in Brazil, the general perception is that it leaves to be desired. The 4th interviewee (2020), for example, mentions that techniques or prerequisites to which employees are subject greatly inhibit technological advances: "The exam for qualification (AICPA) makes no sense, it requires that they memorize accounting standards and does not involve any technology, these rules make many things difficult".

Another important point to emphasize is the characteristic linked to scientific research, on which the interviewees differ. According to the 5th interviewee (2020), companies are highly valuing professionals who have academic training such as master's and doctorate degrees, because with the issue of competition and the increasing volume of data, there is a need and demand for research for innovations and advances. In disagreement, the 4th interviewee (2020) states that academic postgraduate studies do not add anything: "There should be no more bachelor's, master's, doctorate degrees, which define nothing". In other words, there does not seem to be a consensus among the interviewees about the need for academic training, but rather, there is a consensus on the development of skills inherent to the new reality.

Comparing these findings with Silva (2019), it is argued that it is important for educational institutions to compare the curriculum of accounting courses with the demands

placed on professionals within companies. In this way, they will continue to fulfill their role effectively, without nullifying the power of academic training. The direction of professionals, in the interviewees' view, is towards the development of soft skills, the ability to think out of the box, innovation, and a focus on developing greater adherence to decision-making.

It is understandable that professionals who do not experiment with more complex activities may have their significance in the job market reduced. Furthermore, it is necessary to speak the language of machines in order to master and operate them. To achieve this, professionals with critical, analytical, research, innovative and practical skills are needed.

4.2 Intersections between MA and AI in tasks in the area

This category addresses the fields of MA where AI applications are most evident, in the view of the interviewees. More specifically, we chose to explore the links with the AI functions mentioned in Table 1. It can be stated that, the higher the level of cognitive capacity required for an activity to be developed, the more difficult it becomes to replace it with machines.

According to the 7th interviewee (2020), the controller is an intelligence area, so AI can be used to propose models for performance assessment and cost allocation, which is of great relevance, since executives are usually dissatisfied because they think that the cost allocation models created by the controller are too simplistic and do not represent the area's performance: "the traditional model looks at the past to project the future. In AI, it is the opposite: you put the data into the computer, whether related to the search or not, and the computer finds relationships between the different variables."

Therefore, it is possible to input revenue and expense data and ask the machine to propose the management result for each line of business, creating a model that is completely different from the traditional model and getting ever closer to the real result of the business. It can be realized, then, that AI models for cost allocation can be much better planned and applied, with a greater level of detail and less generalization of expenses, which certainly reflects on the company's net result.

"Instead of dividing space rental costs by square meter or number of employees by area, AI can obtain these costs in much greater detail; one person will never spend exactly the same as another." (7th interviewee, 2020). In line with the 7th interviewee, Kruskopf et al. (2019) state that the future guarantees greater detail and precision in MA activities, as machines will save human work time, generating more complete information for decision-making. In this sense, the interviewees highlight the potential practical impact that AI can have, when handling large volumes of data and proposing improvements with greater assertiveness, as in this example of cost allocation.

Another potentially impacted artifact would be the budget, which is an important part of the organization and works with forecasts based on predefined criteria. With AI, the larger the database, the more effective the model becomes, since the data may even be beyond comprehension: "The more data, the easier and faster it is to reach and surpass the human level of intelligence". The 6th interviewee (2020) argues that the budget is made by estimates and AI can help with this, as it suggests insights for process optimization, providing numbers as criteria, such as those that would take months for an employee to think about.

These findings are consistent with Chandrasekaran et al. (2019) and Qin and Qin (2021), in the sense that tasks that involve predictive capacity – such as budgeting, and classification – such as cost allocation, are candidates to be impacted by AI. In the case of the former, with proven effectiveness (Qin & Qin, 2021). It should be noted, however, that AI proposes

something that only the decision-maker can validate or endorse, based on their expertise and subjective variables intrinsic to decision-making.

Another topic addressed was the estimation of Bad Debt Expenses: "the rules for provision are based on something stipulated, there is no guarantee that in so many days there is a chance of receiving and on the next day the chance is nullified, AI collects data to analyze the profile of each payer, each criterion, including their income." (7th interviewee, 2020). Thus, it would be possible to classify each profile with a different chance of payment, classifying uncollectibles in a more precise way. Machine learning processes, whether supervised or not (Chandrasekaran et al., 2019) or even deep learning (Deng and Yu, 2014), in fact, have tools that could help with such objectives.

He (2020) also addresses this type of task by mentioning the various accounting practices that could be absorbed by such systems. Thus, it can be inferred that AI demonstrates that it has an even more complete toolkit for existing demands, which still has room for improvement. The interviewees also perceived the possibility that AI could contribute to the preparation of accounting reports, being a start to reducing or even eliminating major problems in the controllership, such as human errors.

It is also stated that this process is possible with the technology offered: "Today, everything in a company is within a system, which allows you to extract information, make the necessary cross-references and have more accurate reports, better recommendations." (2nd interviewee, 2020). In fact, it is already known that there is a potential reduction in errors – tenfold – when compared to previous technologies, in the case of tools such as deep learning (Chandrasekaran et al., 2019). It is important to emphasize that, although AI reduces errors, there is a need for monitoring the use of technologies by trained humans (Zhang et al., 2020).

Regarding the content to be covered by AI technology, it is argued that everything that is procedural in the area is likely to no longer be conducted by a human. "Machines can be introduced into any process activity, as decision tree algorithms already exist. There are companies in the legal field here in Brazil working with AI to develop solutions that have structured a base and transformed it." (3rd interviewee, 2020).

For example, the legal area is mentioned by some interviewees to illustrate that labor lawsuits are read and described, forwarding the type of text and sentence to the judge who will receive it. Similarly, the MA starts with reports, numbers and manual processes that are topics susceptible to change, and can benefit from this type of technology, which would allow the professional to focus on the analytical and strategic parts.

This converges with Silva's (2019) argument, which states that technical skills are increasingly no longer the focus of demand for professionals, losing importance in the labor market, to the detriment of more analytical and strategic skills. Therefore, the direction is towards even greater automation of processes and the need to improve decision-making skills, since this is the part that the system does not yet operate masterfully.

Regarding the AI subareas (Table 2), many mentions were made of Process mining, since the relevance of processes is cited several times. "The system that controls the entire process flow, from product entry to bill payment, is accessed by process mining, which designs each process, separating the tables that are related to each process and directing them to the right path (1st interviewee, 2020)."

This would ensure adequate data control, since the tool controls the flow, when there are orders without a request, entries in the invoice without a request/order, and other deviations from the process path, there is a determination and procedures for correction. In this way, process mining traces the entire path of each operation, making it possible to know where it

went and how it was until it got to where it is. It also states that this allows an algorithm to be applied to the process. In this sense, AI enables more assertive tracking than humans and is less susceptible to errors.

Another point mentioned is statistics, since the machine has the ability to assess the relevance of performing a task or not, which is already part of an analytical function, since, by understanding such relevance, it is possible to make a decision. The advantage is greater precision, as well as reduced employee costs, in addition to greater process agility. This statement is corroborated by He (2020) and Korobeynikova et al. (2020), when they state that the support for decision-making provided by big data technology increases its precision.

However, it is necessary to consider that, although such processes attract attention, all this development takes time, since it involves transposing tasks of a very complex nature to the systemic level, such as many of those performed by the human brain, also reinforcing the argument of Losbichler and Lehner (2021). In other words, AI will not immediately replace tasks, in this case of MA, as it requires training the machine to the level of complexity of the human brain, which does not seem to be trivial to achieve.

Even so, process mining is seen as one of the most relevant AI functions for MA by the interviewees. By monitoring the data route, it is possible to choose the best route model, monitor and correct errors more easily, and gain deeper knowledge about the data flow within a company. The machine can, on its own, correct errors that it detects, optimizing the process with agility, ease, and accuracy.

Machine learning was also mentioned as a way to further "invade" human activity, as it was seen that technology can learn to perform tasks and statistically analyze data, making actual decisions, which converges with the studies of Deng and Yu (2014), Samuel et al. (2018), Stodder (2018) and Alpaydin (2020). This finding captures some of the analytical capacity of human beings and, once again, has the potential to cut employee costs, reduce errors and perform functions more quickly. Silva (2019) also argued that machine learning is gaining importance within companies, since, if used in activities with exposure to errors, it reduces them on a large scale.

In general, considering the processes that encompass MA, three were highlighted as potential adherents to the AI propositions: cost management (more specifically the allocation processes), budget preparation and preparation of the management report, functions that are understood to be able to be impacted by the use of AI in MA. When dealing with cost management and budgeting, it is possible to make a link with machine learning, as the machine is taught to choose appropriate cost allocation criteria, feeding it with a diversity of information, which will increase the quality of the result, which is not subject to errors or fatigue (Chandrasekaran et al., 2019).

Additionally, it is important to think about the relevance of human-machine interaction in building such a process, to ensure the success of the technology implementation, as well as the roles that are expected of the human agents themselves (Samarghandi et al., 2023). The greater the wealth of detailed information, the more accurate and detailed the budget and cost allocation become, and as AI evolves, computers with greater capacity to store data and generate information for decision-making will be used, which compensates for at least part of the human work (Kruskopf et al., 2019).

It is understood that the use of AI is healthy for the economy of an organization, which needs results that are as close to reality as possible. The human being will be responsible for feeding (or not) the machines with the most diverse data, interconnected (or not) with the fact in question, and the machine will do the rest of the work.

When dealing with management reports, it can be inferred that process mining technology, by mapping the origin of each piece of data and extracting such information by following its path, as well as finding patterns and comparing them until finding the best one (Rojas et al., 2016), has the potential to leverage the quality of data production and, by generating more accurate accounting data, the management report is provided with timely, correct and transparent information, which would increase its level of quality.

In addition, insights generated and suggested by AI can also be used to complement or even confirm executives' decisions regarding management reports (Chen, 2017). Factors such as reduced errors and ease in dealing with a large and complex volume of data are motivators for opting for new technologies.

4.3 Brazilian context for the use of AI in MA

The third and final category refers to the Brazilian context that enables the effective use of AI in MA, placing Brazil in terms of its engagement with scientific research, as well as the country's preparedness to receive and practice the innovation that research brings in this area. In general, the perception of the interviewees is that Brazil is not engaged as ideally it should be. Factors mentioned include: few partnerships with universities, cultural issues or related aspects, such as taxation.

Another point highlighted is education. The 2nd interviewee (2020), for example, argues about the national gap: "In accounting courses abroad, it is possible to find subjects on data analytics, critical analysis, things that are difficult to find here in Brazil." The 4th interviewee (2020), uses a project he participated in in Brazil to compare countries: "I worked on a project in a large bank with the largest auditing in Brazil, a reference in the country, and it was still very backward, with traditional methods." (4th interviewee, 2020). The country's lack of updating and participation in the technological race is also mentioned:

> In large companies, it is noticeable that there is not much investment and yet we are creating advanced and innovative things, compared to the rest of the world. Our disadvantage is that Brazil is not up to date, nor is it leading the technological race. (7th interviewee, 2020).

As for scientific research, the national effort is recognized, even knowing that there is a path to be followed:

> Brazilian universities, including USP, have worked hard to disseminate knowledge internationally. We have professors with prominent international roles. We also have Brazilian professionals in American, British and Australian universities, contributing to this context. However, on the other hand, if we analyze the publication of international journals, there are few Brazilian names. (3rd interviewee, 2020).

In general, there was no consensus among the interviewees on the aspects mentioned above. The following excerpt summarizes this difficulty: "There is a lot of diversity, companies that are both underdeveloped and advanced, but looking abroad, we are neither too far behind nor in line with the latest developments" (3rd interviewee, 2020). It was argued that Brazil's actions are comparable to what is being developed internationally, but at its own pace. Variables such as knowledge of the English language and a focus on bureaucratic and operational processes, such as those involving taxes, were mentioned as additional difficulties in this process of national updating and scientific development.

More specifically regarding the impact of AI on MA, the interviewees' perception is that Brazil is not aligned and engaged with the advancement of AI in MA, contrary to what Stodder (2018) states about the thirst of companies, in general, for AI and big data. On the other hand, the results are consistent with Al-Emram et al. (2020), regarding the difficulties of implementing new technologies in emerging countries.

In this sense, an interesting counterpoint is Silva's thesis (2019), which also concluded that there is little Brazilian research on the insertion of technology in the business environment, in general. The author also states the need to evaluate the alignment between academic content and labor market practice. In the present study, this argument was confirmed by the interviewees, who understand that engagement in research and innovation is still below the national need, even though large companies are minimally engaged and try to lead this race.

The interviewees' perception converges with Stodder (2018), in the sense that he emphasizes that AI allows access to intelligent recommendations quickly. This statement allows us to go further, for a better and faster allocation, for example, or for a budget involving more criteria and variables in its preparation, in addition to allocating the employee to more specific activities, which also improves the result of such activities, adding value to customers (Kruskopf et al., 2019).

Another interesting aspect is to note that, in the collective imagination, AI tools that require human support still prevail, as they did in the beginning. Today, however, machines are already capable of learning and finding patterns in some processes, not necessarily requiring human intervention, as is the case with unsupervised learning possible via machine learning (Chandrasekaran et al., 2019). Overall, the national preparedness, both in academic and professional terms, for the challenges of AI is still uncertain. Even if there are local initiatives, it cannot be said that the country as a whole is prepared to manage such challenges.

5   Final Considerations

The objective of this research is to verify the potential impacts that Artificial Intelligence (AI) can bring within the field of Management Accounting (MA), in the perception of professionals in the area.

The main results show that some AI functions can potentially interfere in the business environment, within the field studied. Such functions were mentioned by most interviewees and are present in previous research, namely: process mining and machine learning. In addition, it is concluded that among the activities that have the greatest ease for the insertion of artificial intelligence are: budgeting, cost management (especially allocation processes) and the preparation and use of management reports, processes that can be considerably optimized, shaped and complemented by the use of technology. It is understood that such functions will be impacted using AI in MA.

Another aspect addressed concerns the potential of technology to expand the variables used for analysis, dealing with a large amount of data, another impact perceived by the interviewees. In addition, reduced time, increased quality, greater agility in processes and reduced errors are seen as potential benefits for the use of AI, present both in theory and in the experience or conjecture of the interviewees. Therefore, the MA professional needs to be prepared to deal with technology and develop other skills beyond the technical part, considering that AI will potentially be part of the work.

Additionally, the application of AI in MA still lacks progress, both in terms of investment in research and innovation in technology as a whole, and even more specifically in

the application of AI to MA. Thus, companies, universities and professionals have a fruitful field of action in the sense that there is a lot of work to be done for the country's real inclusion. From an individual perspective, analytical and strategic skills, consistent with the current role, are valued in this scenario, to the detriment of those of an operational nature.

The main contribution of this research is the discussion about which MA practices can be effectively affected by AI, especially considering that it is not possible to guarantee the real impact of AI on management practices. Additionally, the opinion of experts, as people who experience or have experienced the topic closely, makes tangible knowledge that has been limited to the theoretical field in most of the research consulted during the execution of this study.

As limitations, it is understood that the data collection technique used (semi-structured interviews) does not allow data extrapolation, with the results being linked to the respondents' perception. Additionally, it was difficult to find the desired expert profile, with in-depth knowledge of AI and MA, limiting the number of interviews conducted. In addition, it was difficult to find empirical work as a basis, a fact also stated by Moll and Yigitbasioglu (2019), when they emphasize the scarcity of empirical studies of this type of technology in the accounting literature, a fact that clashes with the expected interrelationship of these technologies with the work of accountants.

Regarding future studies, we suggest studies that analyze practical applications of AI, complementing MA, as well as its developments. One approach that emerged during the research was to use institutional theory to understand the process of including such technologies in routine or even the resistance (or not) of participants in relation to them. Theoretical essays that delve deeper into the concepts of AI and relate them to opportunities in MA can also help in understanding the topic. Furthermore, given the low level of argumentation about the limitations of the use of AI technologies within MA, one possibility is to analyze such limitations and how to get around them, in order to structure new possibilities that mitigate the problems in the use of AI by MA.

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Annex I – Interview guide

1. Can you tell me a little about your career path?
2. How and when did you first come into contact with AI technology?
3. What is the role of the controller in changes in the area related to technology?
4. Do you think professionals are prepared for this change?
5. Do you have any ideas for a project developed in this segment? It could be a project you have participated in or initiatives of which you are aware.
6. Which controller processes do you think could be most easily automated?
7. Among the areas within artificial intelligence, which do you think has the greatest potential to impact the controllership today? And for the coming years?
8. Regarding professionals in this field, what specializations do you think they should obtain in order to avoid losing their profession in the long term? Why?
9. In relation to the rest of the world, how do you think Brazil is doing in terms of the issue that encompasses this environment between accounting and automation?
10. How can the Brazilian experience contribute to a controllership linked to cutting-edge technology and become a world reference in this matter?

11. Do you have any contact information to recommend? I've been having trouble finding contacts in this segment.
12. Can you detail the processes that your project covered? Are they linked to decision-making (controlling)?
13. What do you consider to be the ideal continuation of your projects? What impact do you believe it should generate?
14. What were the main difficulties you faced in your project? Do you think that similar difficulties could arise in future projects similar to yours? And what difficulties, in general, could arise?