BIG DATA, ARTIFICIAL INTELLIGENCE, AND MANAGEMENT ACCOUNTANT: A GLOBAL PERSPECTIVE

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Abstract: *This study aims to objectively explore the relevance of big data issues that have developed in the professional world to the best practices of the management accounting profession. The conceptual framework was developed to become the frame for consideration of making structured designs on artificial intelligence issues. Using data sources derived from literature studies and conducting various reviews of articles related to this interesting topic, conclusions are generated that refer to the implications of management accountant best practices. This study finds that the concept of management accountants is strongly influenced by the adoption of Big Data in the companies. Furthermore, we specifically define and present strategic steps that can suggest management accountants can carry out best practices in accordance with professional programs that have become an important part of practice. This study contributes to the development of the best practice of management accountants where Big Data is at the center of attention that cannot be separated from their professional practice so that it is possible to adjust the practice of management accountants that generate value. To the best of authors' knowledge, this is the first study to seek and explore the Big Data and Artificial Intelligence in the management accountant profession from global perspectives. The study provides some deep insight to the management accountants to take care for their sustainable profession in the long wave of digitalisation.*

Keywords: *Accountant Management, Artificial intelligence, Big Data, Conceptual Framework, Governance*

INTRODUCTION

Currently, accounting plays an important role in opening technological dimensional opportunities that make it easy for users to further streamline the transfer of information through external financial reports. Several financial information records were collected historically which include data collected and used to prepare financial reports for internal (eg, management) and external (eg, investors and creditors) users (Arnaboldi et al., 2017; Brown-Liburd et al., 2015). The database system carries the ability to collect and evaluate types of financial and non-financial data (Munir et al., 2022). Big Data has the ability to provide rich, diverse data sets and advanced analysis at a level never seen before. Big Data is being used in accounting more and more frequently to process information quickly and accurately (Munir et al., 2022). This will be evident in the way that information is gathered and documented, how management utilizes information to accomplish organizational goals, and how the components of reports are assembled and processed.

Accounting records encompass a compilation of raw data resulting from various financial and non-financial transactions. These records serve as a valuable source of information for users seeking financial insights (Yoon et al., 2015). Certain events or transactions within accounting are consistently expressed in monetary terms, facilitating the evaluation of their significance. This assessment of materiality plays a vital role in decision-making for users of financial information. Accounting records have moved from being primarily physical to virtually exclusively digital. For example, before 2000, only around 25% of data that was kept was digital; today, over 98% of data is saved in electronic form (Cukier & Mayer-Schoünberger, 2013). Since automated sensors and machine-to-machine communication devices continuously generate data, data flows play a major role in driving this transition.

Organizations have been collecting a lot more data in the last few years compared to the last two millennia as a result of this trend (Simnett, 1996). A significant amount of this data is unstructured and frequently comes from social media and sensor platforms, where the data's accuracy is still in doubt. Companies use this data to increase overall profitability and operational efficiency. This may show up as more opportunities for investment or as a rise in public trust. In fact, businesses can achieve 5–6% productivity benefits by skillfully integrating data and related business analytics (McAfee & Brynjolfsson, 2012). Interestingly, Big Data is comparable to brand reputation in terms of business asset (Coakey & Brown, 1993). Quickly obtaining and evaluating Big Data become essential elements in creating and maintaining a competitive advantage (Rezaee et al., 2016).

According to Wang et al. (2016), management accounting plays a critical role in modifying every facet of a company's business success. But as technology advances, the focus of management accountants' jobs will shift away from human existence and working mechanisms (Rahayuningsih et al. 2021). Eventually, artificial intelligence will take over management accountants' jobs because it has advantages over all practical aspects that management accountants do not (Hung et al., 2015). According to Wang et al. (2016), management accounting plays a critical role in modifying every facet of a company's business success. But as technology advances, the focus of management accountants' jobs will shift away from human existence and working mechanisms. Eventually, artificial intelligence will take over management accountants' jobs because it has advantages over all practical aspects that management accountants do not (Hung et al., 2015).

The amount of information available has increased dramatically over the past few decades due to technology advancements, and the cost of storing and retrieving information has decreased to the point that precise costing is now "economical and almost routine" (Kaplan & Norton, 1992). Regretfully, making smarter decisions isn't often the result of this flood of information. For instance, Macintosh (1994) points out that business divisions may grow supplier networks and product lines as a result of information overload without taking the company's overall effects into account. Thus, continuous improvement efforts, which appear to be valuable, maybe "orthogonal or subtractive rather than additive and complementary" (Phua et al., 2011). In other words, efforts to centralize information leading to a data explosion function are very possible because most information is still aggregated and seems rigid so more effort is needed to maximize the potential of the existing information.

Big Data analytics can either make things better or worse. Compared to depending only on structured data sources, it integrates structured and unstructured data to offer greater insights. For example, relying solely on structured data, such as response time, to assess the quality of customer service may fail to consider the viewpoint of the consumer. A more comprehensive picture is provided by combining unstructured consumer sentiment

data with structured response time data. Big Data's excess of useless or untrustworthy data, however, presents difficulties for businesses looking to gain actionable insights and seize new opportunities, especially with regard to blockchain and the Internet of Things technologies.

This study aims to reveal the impact of the development of Big Data on the role of management accountants in various work fields by emphasizing the aspects of using artificial intelligence in business processes. Then, we try to open up opportunities to develop the conceptual framework of artificial intelligence for the development of the management accounting profession. In order to explain the effects of artificial intelligence on management accountants and Big Data on the field of management accounting, as well as some theoretical and practical implications of these two developments, this study employs a literature review technique from a variety of sources. We hope that this research can make a theoretical and practical contribution by using data from various scientific article providers, Scopus-indexed international publications, and Google Scholar. In practical terms, this study aids in the development of the Big Data conceptual framework for the management accounting field, ensuring that it consistently equips professionals with the knowledge and skills necessary to navigate the impact of Big Data and artificial intelligence on the field. Furthermore, we provide theoretical groundwork for the construction of a practical conceptual framework that management accountants may use to map opportunities and difficulties associated with the evolution of Big Data and artificial intelligence techniques in the field of management accounting.

This study will bridge the understanding of management accountants regarding the application of Big Data and Artificial Intelligence from a global management accounting perspective. At least in a global context, Big Data accounting and artificial intelligence have become important issues that influence the performance of management accountants today, because most management accountants are faced with situations that are uncertain and full of dynamics that influence each other's information. By tracing various traces of past and current studies, this study provides a comprehensive understanding of these two things. Therefore, this study provides updates in the context of a global perspective brought to the Indonesian context so that management accounting professionals can immediately prepare various important options related to Big Data and Artificial Intelligence.

This paper will then be divided into several parts. The second part will discuss the theoretical aspects of Big Data, the opportunities and challenges of Big Data for the management accounting profession and the main points of the development of Big Data in the management accounting profession. The third section discusses the research methods used in this study. The fourth section describes the results and discussion as well as findings in the form of a conceptual framework related to the practice of Big Data in the management accounting profession and the development opportunities for management accountants as part of artificial intelligence from a practical standpoint. The fifth section presents conclusions, suggestions, and future study opportunities related to Big Data and the management accounting profession.

Literature Review and Hypothesis Development
Big Data as the Key to Change in the Management Accounting Profession

Large data collections that are unsuitable for conventional database management systems or software analysis are referred to as "Big Data" (Balakhrisnan et al., 2021). Additionally, according to Sundarasan et al. (2019), big data include both structured and unstructured data, with about 90% of the latter being unstructured. It also includes soft

information like phone calls, emails, social media posts (such as blogs, tweets, and Facebook entries), website traffic, and video streams. In light of the growing amount of unstructured data, we examine the various data kinds that are available in this study and how they enrich and supplement conventional financial data. Big Data technology allows businesses to leverage any computational method that extracts information from data in order to turn massive data sets into valuable information for making decisions. Text files, images, audio files, and unstructured video can all be considered relevant data. The information that can be obtained from this data type and how it complements financial information are covered in the sections that follow.

From its early emphasis on cost control, variance analysis, and budget control, management accounting has evolved to focus on developing and implementing strategies that improve overall business performance while skillfully managing risks (Ramli et al., 2015). Richins et al. (2017) assert that management accounting is essential to helping businesses develop and implement their strategies. As a result, managers' information needs, the larger company environment, and managerial actions all require a thorough understanding of accounting (Peecher et al., 2007). Accountants can gain proficiency in developing and executing strategies, tracking their advancement towards strategic goals, and providing advice and remedial measures as needed. Although the exact beginnings of accounting are unknown, Luca Pacioli—dubbed the Father of Accounting—is credited with producing the first account that used the double-entry system in 1494. Legal requirements have given rise to financial accounting standards over time, which has caused management accounting to rely more and more on data geared toward financial reporting. Accountants need to learn how to gather and evaluate data from a variety of sources in order to satisfy their information needs.

According to Anderson and Zeghal (1994), accountants started using outside data to inform their pricing decisions in the early 1980s. According to Sundaresan et al. (2019), accountants play a crucial role in gathering, combining, and analyzing data from many sources to shape business strategy. It has not been possible to predict future financial success using only traditional financial measurements. Innovative ways have been employed by companies such as Trax Technology Solutions (Singapore) to improve decision-making. In order to maximize labor allocation, they link sales revenue, operating costs, and product sales to individual sales teams. They also link this information to website traffic, user demographics, and regional data. Key performance indicators that are in line with the organization's strategic goals are defined with the use of this data-driven method (Balakrishnan et al., 2021; Gupta et al., 2015; Sundaresan et al., 2019).

In order to find links within structured data, Trax Technology Solutions uses a problem-solving methodology. This information is then interpreted in light of the financial objectives of the organization. The ability of accountants to include unusual data elements in their analysis, including internet traffic, is demonstrated by this example (McAfee & Brynjolfsson, 2012). Accountants not only design strategies but also actively participate in their implementation and continuous assessment. Accounting instruments provide a framework for evaluating the organization from multiple perspectives and comprehending how elements in each perspective contribute to a company's strategic accomplishments. An example of this is the shown Balanced Scorecard (BSC) in Figure 1. Accountants have
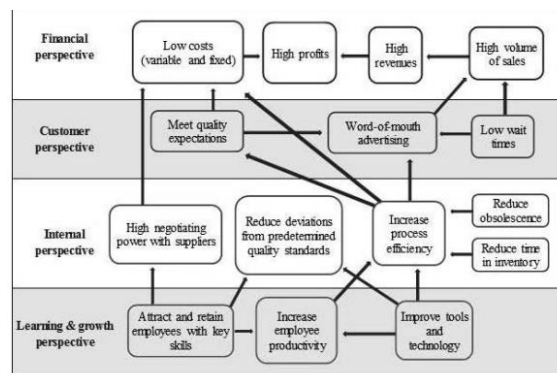
Figure 1. Sample Balance Scorecard
Source: Yoon et al. (2015)

always played a key role in creating BSC metrics and creating performance monitoring systems. Traditionally, BSC indicators have been based on structured data and have included things like sales revenue, rates of product defect, and customer satisfaction surveys (Phua et al., 2011; Ramli et al., 2015). With the use of Big Data analytics, accountants can improve their monitoring methods by adding unstructured data. Using this method makes it possible to find chances for growth and places where their financial analysis has to be improved (Salterio, 2015; Shust & Weiss, 2014; Wang et al., 2014). To create more sophisticated models, sentiment analysis, for example, can be combined with traditional accounting data by utilizing data from social media sites like Facebook. Best Buy serves as an example, as it was previously aware that consumers did not enjoy "restocking fees." However, a significant sentiment trend among their most valuable clients was discovered through the use of software to monitor social networks and the subsequent integration of this data with internal sales data (Yoon et al., 2015). Best Buy dramatically lowered all restocking costs as a result of this discovery (Laczniak & Murphy, 2019). This example shows how accountants might incorporate the examination of unstructured data into their problem-solving process. They can identify underlying causes, foresee possible outcomes, and develop mitigation techniques thanks to this wider viewpoint.

The Role of Big Data in Accelerating the Workflow of Management Accountants: Opportunities and Threats

The management accountant may have questions regarding his or her role in analyzing internal information that is useful to users. However, management accountants also need to be aware that this information will not always have the typical nature and scope of information, sometimes information will become very difficult to analyze and produce products based on that information (Sundaresan et al., 2019; Rybicka, 2018), when the information obtained is information explosion or aggregate in nature. It is important to remember that management accountants need to hone their skills related to Big Data technology. Several studies say that there is a link between Big Data information and the skills of a management accountant. Management accountants are required to have sufficient holistic understanding related to Big Data information so that this will be useful for improving their performance (Flood et al., 2016; Becker et al., 2016; Hung et al., 2015).

For a considerable amount of time, research in the field of performance

management has mostly concentrated on holistic models. Holistic techniques, such the pyramid model, balanced scorecard, and several business models, have been influential in the field of strategic management (Lee et al., 2014). Furthermore, it has been suggested that management accountants can meet real-world problems by interacting with professionals from a variety of backgrounds and broadening their perspectives beyond the confines of traditional accounting. Combining qualitative and quantitative methodologies is one example of this (Richins et al., 2017; Ramli et al., 2015). Analytically speaking, having a holistic approach entails gathering pertinent information and making well-informed decisions. This suggests that management accountants should take the initiative to come up with creative suggestions and ideas that, by providing insightful analysis and real-world business results, propel organizational transformation. The main goal is not to focus only on short-term problems but also on the "health" of the business as a whole. Therefore, in order to determine the impact of different domains—such as supply chain, customer interaction, human resources, and marketing—management accountants need to have stronger relationships with other operational departments (Pilipczuk, 2020). The norms, habits, beliefs, and results of decision-making are all synchronized in an analytical corporate culture to guarantee that analytical insights become real value instead of just possibilities.

Among the many issues that worry management accountants is the application of predictive and prescriptive data. In a recent Ernst & Young discussion, it was stressed that predictive and prescriptive information are related. This is a common subject in the analytical literature and is considered a major advancement in management accounting (Munir et al., 2022). While some experts say that

problems with traditional budgeting are related to the way budgets are used, others assert that there are fundamental flaws in the budgeting process itself (Peecher et al., 2007; Macintosh, 1994). However, there has been much discussion and criticism of traditional budgeting, with rolling budgets and activity-based budgeting becoming more popular alternatives (Laczniak & Murphy, 2019). Advanced predictive analytics, which use statistical modeling and data mining to identify risk events and assess new threats, is the direction that analytical accounting is taking.

Data structures must be in line with the factors that drive company value in order to choose and use the right Key Performance Indicators (KPIs) as dependent or independent variables in an analytical environment. Effective decision-making depends on this alignment (Jędrzejka, 2019; Hung et al., 2015; Brown-Liburd et al., 2015). By offering probability-based insights, analytical forecasting seeks to track anticipated business performance and facilitates prompt decision-making to close performance gaps and seize new possibilities (Laczniak & Murphy, 2019). A prediction, on the other hand, is a simple claim or an intuitive estimate about a future event that is frequently based on present conditions. For example, one can predict future automobile purchases and estimate net profits by using current sales numbers. Usually, a thorough modeling framework is used to conduct these activities and evaluate how they affect the net income of the organization as a whole. A thorough understanding of numerous advanced statistical approaches, as well as an awareness of their assumptions and limits, are required for integrating forecasts and predictions into conventional budgeting and planning processes within a Business Analytics (BA) framework.

On the other hand, Big Data is essential to improving management accountants' performance over the course of their careers. It

provides them with the precise knowledge they need to make decisions that are in line with the strategic goals of the organization (Balakrishnan et al., 2021; Balakrishnan et al., 2004; Anderson & Zéghal, 1994). The amalgamation of Big Data exhibits potential in providing pertinent perspectives and expediting the achievement of objectives. Although several studies highlight the importance of big data for the accounting industry, further research is needed to determine how big data actually affects accountants in the real world. This essay adopts a theoretical stance to investigate how information technology affects accountants' daily activities and how professionals throughout the globe are adjusting to these revolutionary shifts.

Big Data Point of view on the Developing of the Management Accountant Profession and Artificial Intelligence Investment

The field of management accounting is currently dealing with a lot of very changing difficulties. They must generate excellent organizational performance ratings, but they also need to possess competence that increases when artificial intelligence has an impact. For years, accountants have embraced automation as a means of improving the productivity and efficacy of their work. However, as of right now, technology cannot take the place of expert knowledge and sound judgment. After all, prior iterations of 'intelligent' systems have typically shown the limitations of machines and the enduring power of human knowledge.

Since the 1950s, computer scientists have been interested in artificial intelligence (AI), which has made significant strides in recent years. Artificial intelligence (AI) applications are gradually permeating many facets of our lives and have become an essential component of our online interactions (Arnaboldi et al., 2017). It's important to remember that modern machine learning algorithms don't try to replicate human

intellect in its entirety. As a matter of fact, several specialists argue against referring to these systems as "AI" (Brown-Liburd et al., 2015). However, these algorithms frequently surpass humans in terms of accuracy and consistency when assessed on a task-specific basis. Accounting professionals can benefit greatly from AI in the short to medium term by increasing their productivity, offering better insights, and adding more value to firms (Cukier & Mayer-Schoenberger, 2013). In the future, as AI-powered systems progressively take on decision-making tasks that have historically been performed by humans, it may lead to more significant changes. This study presents a paradigm, centered around three key questions, for using the potential afforded by increasingly complex systems.

What is the future hold for AI integration in the accounting field? It's critical to think about the ways in which intelligent systems might improve business decision-making while taking accountants' contributions to this shift into account (Balakrishnan et al., 2004; Anderson & Zéghal, 1994). It's critical to comprehend how artificial intelligence and human expertise work together. We need to investigate the new facets of this technology, as well as how it might enhance human potential and what limits it has. In addition, we ought to explore real-world examples of how accountants use AI. We can develop a long-term vision by using real-world examples that highlight the benefits and limitations of AI systems in accounting (Becker et al., 2016; Brown-Liburd et al., 2015).

We expect more human decision-making to be delegated to intelligent systems in the upcoming decades. Although technology has long been used by accountants to improve their services to companies, this offers a chance to fundamentally improve the quality of business and investment decisions, which is a major goal of the field (Flood et al., 2016; Gupta et al.,

2015). In order to fully realize this potential, the accounting profession should focus on the fundamental business issues it seeks to resolve while also considering how new technology can alter the way it approaches problem.

By giving wise counsel and assisting with decision-making, accountants seek to improve both organizational and financial efficiency. Accounting is a means to an end; its main goals are to guarantee decision accountability and enable prudent resource allocation (Jędrzejka, 2019; Laczniak & Murphy, 2019). It is fundamental to investment, growth, and building trust across different entities and economies. Novel systems present a variety of methods for mplishing these broad goals and tackling the core business issues that the accounting industry strives to overcome.

Companies and governments work to preserve correct tax compliance, while investors look for reassurance and faith in a company's financial results. Furthermore, management has to decide how to allocate resources and take accountability for such decisions (Lee et al., 2014; Munir et al., 2022). The main goal of the accounting profession is to find solutions to these fundamental problems, which are necessary for economies and enterprises to prosper.

Furthermore, new problems may arise that can be solved with improved systems and updated data. One widely acknowledged vision for humanity's ambitions in the upcoming decades, for example, is represented by the UN Global Goals (Ramli et al., 2015; Rezaee et al., 2018). Whatever the situation, significant work is needed to achieve these goals. In order to enable informed resource allocation for goal achievement, we must, at the very least, develop effective measures (Rybicka, 2018; Wang et al., 2016; Munoko et al., 2020). We also need to set up accountability systems for these choices. As a result, the first stage in developing a long-term

vision is to focus on the profession's ultimate goal, which is to improve decision-making, and identify the primary business issues that better decision-making will resolve Rather than settling for incremental improvements or status quo maintenance, the accounting profession needs to embrace real change in order to advance (Moll & Yigitbasioglu, 2019). Artificial intelligence (AI) has the potential to improve our ability to extract meaningful insights from data, which could improve human specialists' ability to make decisions and serve as advisors. Studies reveal that when humans and computers work together, as in chess and medicine, the results are frequently better than when one or the other is used alone (Vasarhelyi et al., 2015; Gepp et al., 2018). However, as AI systems become more robust, they are intruding into increasingly complex decision domains, with the potential to replace specific human tasks in a variety of scenarios and enable whole new services, solutions, and paradigms (Richins et al., 2017) As such, as the industry looks to the future, it needs to think beyond small adjustments to current procedures. It's also important to consider the unique abilities and qualities that accountants bring to companies. These are characteristics that go beyond technical proficiency and include things like professional skepticism, the capacity to extract and utilize insights from numerical data, and the conviction that numerical data is reliable It also means taking an active part in debates that are helpful, such as thinking about the importance of human decision-making in complex business areas. Certain characteristics that are unique to humans—like empathy, creativity, and leadership—might be difficult for robots to imitate. We should never undervalue how adaptive and creative humans can be. However, "human decision-making" frequently acts as a temporary fix for incomplete data. Powerful computers with access to new data sources

have the ability to make most human decision-making obsolete. In an attempt to preserve the status quo and long-standing procedures, efforts to minimize the likelihood that computers would do better than humans in many areas are unlikely to succeed.

METHOD

The conceptual framework technique (Jaakkola, 2020) is used in this study to investigate the connection between management accounting and big data. To find precise and pertinent data for our research topic, we carried out a thorough keyword search (Susanto, Rudyanto, and Rahayuningsih 2022). Our approach entails first mapping research themes in the context of Big Data and management accounting, and then carefully interpreting the mapping outcomes. In addition, we reviewed prior research in a number of areas regarding big data's effects on the accounting industry, including management accounting, in order to perform a comparative analysis. Providing qualitative insights into the changing relationship between accountants and big data is our aim, particularly in this era of deep data analytics. In addition, we hope to offer projections regarding the near-term future of accounting. We have studied pertinent literature to guide our debate and provide evidence for our conclusions.

RESULTS
Artificial Intelligence and Management Accountant Profession

In a company's operations, the management accountant plays a crucial role. The competitive edge of a corporation is mostly determined by this profession. Furthermore, it is closely related to evaluating the merits and demerits of internal management, which can either increase earnings or reduce possible losses. It is difficult to predict how much human decision-making will be replaced by computers in the coming decades. This forecast is dependent on a more comprehensive framework that includes political, social, and economic elements. Uncertainty is further increased by the rapidly changing technological world. For this reason, it is essential to keep an open mind when thinking about the future. Professional organizations, companies, and educators, including the ICAEW, have been engaged in a robust debate regarding the skills and educational needs for future accounting professionals.

It's common known that the accounting industry is changing and that accountants will need a wider range of skills going forward, including data analysis and technological know-how. Soft skills like flexibility and critical thinking are also becoming more and more important. The significance of lifelong learning is also growing. Diverse perspectives exist regarding the future of accounting, nevertheless, from highly skilled hybrid professionals to less skilled individuals who use technology to obtain specialized expertise. The profession adapts when stakeholders come to a consensus and business needs change. Professional associations modify their credentials in reaction to changing market needs. All parties involved in the accounting profession will find it more and more important that accounting firms, whether in business or practice, are continuously innovating to give more value.

Although machine learning and other artificial intelligence techniques have been around for a while, their use in the accounting and business domains is still in its infancy. To see a bright future, one must develop a deep understanding of how artificial intelligence (AI) might help with accounting and company operations problems. This entails dealing with real-world obstacles and the skills accountants need to develop in order to work well with intelligent technologies.

Accountants use their technical knowledge of finance and accounting to help stakeholders and organizations make better decisions. They rely on top-notch data and analysis, both financial and non-financial, to offer direction in a range of business responsibilities. Technology has long been an important tool for accountants, helping them with three major challenges: (1) providing data that is affordable for decision support; (2) using data analysis to extract new insights; and (3) freeing up time for more important tasks like problem-solving, strategy development, relationship management, and leadership. Machine learning techniques provide significant improvements in all areas of accounting, giving accountants new skills and automating a lot of choices and work.

Therefore, it is imperative to identify accounting and business scenarios in which machine learning can be applied and reap significant benefits, while also identifying contexts in which it may not be the most appropriate use. This strategy makes sure that actual business needs, not just technological limitations, drive the incorporation of machine learning. Although there hasn't been much practical application of machine learning in accounting up to this point, some initial research and pilot projects have included: Using machine learning to automate accounting entry coding, which will improve the accuracy of rule-based approaches and allow for more effective process automation. Improving fraud detection with cutting-edge machine learning algorithms that can recognize unusual behavior and offer better predictions for fraudulent activity. estimating revenue using predictive models based on machine learning. applying deep learning models to improve accessibility and analysis of unstructured data, such emails and contracts.

Big Data, Artificial Intelligence, and the Management Accountant Profession: Practical and Theoretical Impacts

Both the volume and quality of data are critical to the performance of AI systems. In the absence of high-quality data, models find it difficult to learn. Because it is high-quality and well-structured, transactional accounting data offers a promising starting point for model building. However, data problems still plague organizations, particularly those with complex, non-integrated legacy systems. Certain challenges might not have enough data for strong model support, and smaller businesses might not have the volume of data required for reliable results.

Strong machine learning algorithms could require external data sources, which aren't always easily accessible or reasonably priced. Moreover, the prior predictability of machine learning success is still difficult to achieve. As a result, developing models using a variety of datasets and taking lessons from both successful and unsuccessful situations can offer insightful advice for adoption in the future. Another major barrier is privacy and ethics, especially when AI systems use personal data. Think about the example of fraud detection, wherein, subject to ethical and regulatory constraints, employee email correspondence may be analyzed.

Business and economic factors also play a major role in the adoption of AI technologies. This adoption illustrates two different organizational strategies. First of all, just as we use machine learning in our internet search and purchasing activities, machine learning is becoming a crucial component of business and accounting software, becoming omnipresent in accountants' daily workflows and frequently going unnoticed. This is how AI tools are typically adopted by smaller firms in particular. Second, intentional adoption of AI skills to tackle particular accounting or business difficulties frequently requires large financial outlays.

Even though there is a ton of free and open-source software available in this field, there are situations where choosing a reputable software supplier is required because of legal or regulatory requirements. Whether on-premises

or in the cloud, handling large data volumes may require a significant amount of computing power and infrastructure. As a result, it is anticipated that investments in AI will be made with a focus on areas that have great potential for financial gain—particularly projects aimed at cutting costs—or that are essential for improving customer service and competitive positioning. On the other hand, certain domains may not have a strong business case even though they have the potential to be profitable. In a similar vein, the market potential necessary to warrant software developers' investment may not always coincide with the innovative use of machine learning in specialized accounting.

Companies will need to have access to a wider range of skills more and more. Although technical expertise in machine learning is still important, it needs to be balanced with a deep understanding of the business context and data-related insights, similar to how data analytics has evolved accounting. Accountants are in a good position to take advantage of data analytics because of their high numerical ability and business acumen. This change will be accelerated by the development of AI, with certain positions still favoring technical accounting knowledge and human judgment in challenging situations.

Increasing the number of professional jobs in an organization can greatly improve departmental communication and partnerships, which will help them derive more insightful information from data and models. Moreover, this change will unavoidably result in new work opportunities. Consider accountants, who may be involved in several facets of algorithm audits, testing, or model training. They might also help formulate problem statements and incorporate solutions into well-established company processes. Even more practical duties like addressing exceptions, organizing data inputs and outputs, or data preparation may fall under the purview of certain accountants. There is no denying that this change will affect the skill set that employers require of accountants.

A thorough understanding of machine learning techniques may be required for certain occupations, such as those that involve model training. On the other hand, accountants may be able to foster relevant discussions with experts and other business units in some domains by having only a basic understanding of machine learning. Critical thinking and good communication are becoming increasingly important. Furthermore, in order to optimize the use of machine learning techniques, accountants might need to adopt new attitudes and practices. For example, dedicating more time to proactive and predictive activities, such providing context for projections or quickly adjusting to changing conditions, will require a different strategy.

Accounting's use of AI functions inside a larger institutional framework. Regulatory agencies and standards organizations must improve their understanding of AI applications and take proactive measures to mitigate any related dangers. In order to bring about change in crucial areas like financial reporting and audits, this institutional support is essential. Therefore, it is crucial that standard setters and regulators take an active role in this area. For example, auditing standard setters look into how auditors use various methods to obtain data and evaluate its accuracy. In keeping with these talks, these firms are currently discussing how data analytics capabilities affect auditing requirements, giving machine learning some proper thought.

There are significant difficulties in the context of model transparency, especially when working with extremely complicated models such as deep learning models. Understanding how these models produce their results can be challenging because their inner workings can appear to be a mysterious black box. The increasing reliance of auditing businesses and organizations on black box models makes it necessary to investigate methods for guaranteeing their optimal performance. In order to encourage and promote the use of

transparent models that support their goals, regulators might take the initiative. Notably, financial services firms who are trying to enhance regulatory compliance in response to increasing demand from regulatory bodies are frequently the source of significant investments in this field.

Big Data and Artificial Intelligence on the Management Accountant Profession: Several Critical Perspectives

As is typical in many small and medium-sized businesses, there is frequently little division within the accounting department in a traditional accounting job. This lack of compartmentalization can cause chaos, which may open the door for financial malfeasance by those looking to benefit themselves. Artificial intelligence, on the other hand, has the potential to completely transform the industry by automating a wide range of accounting-related jobs. Accounting experts now mostly input instructions and supervise the process. The system will automatically provide a trial balance and reconcile bills at the end of the accounting month.

Every accounting staff member has different passwords, individual accounts, and special access privileges in the accounting system, such as fingerprint and retina scanners. The possibility of financial fraud is significantly reduced by this obvious division of duties. The accounting system is a useful tool, but it's crucial to remember that human monitoring is still required, therefore financial fraud risk cannot be completely eliminated by it. However, this is a positive step forward, especially since digital footprints can now be tracked and monitored thanks to artificial intelligence (Jędrzejka, 2019). The position of management accountants is changing more than ever before due to the rapid growth of technology. Decision-making and cost management are going to be greatly impacted by this technology change (Rybicka, 2018). Using data analytics methods on large datasets may eventually replace some regular accounting jobs. This does not, however, mean that accountants will become obsolete. Rather, the automation of repetitive processes brought about by the Big Data revolution will free up accountants to focus on finding ways to bring value to their firms (Richins et al., 2017). They will become more interested in evaluating, analyzing, and interpreting data than in gathering and organizing it.

While data analysts are skilled in performing in-depth analyses, finding correlations, and using different algorithms, management accountants offer a different set of abilities. Their ability to comprehend business jargon allows them to identify and analyze relevant information, which in turn helps organizations develop their best plans. In order to manage emerging technologies and take advantage of opportunities while avoiding dangers, management accountants need to have high-level cognitive capabilities, such as data science and analytical ability.

With the ongoing advancement of technology, these abilities will become more and more crucial in the years to come. Cognitive managerial accounting is a new trend that is emerging as a result of this change. The Institute of Management Accountants (IMA) has updated the IMA's Management to reflect the evolving competencies that management accountants will need to secure their future careers. The IMA did this in order to keep up with the rapidly evolving business landscape and the rapid advancement of technology.

In six major domains—Strategy and Planning, Performance Evaluation, Reporting and Oversight, Technology and Analytics Integration, Business Insight and Operations, Leadership, and Professional Ethics and Values—the Accounting Competency Framework describes essential competencies required of contemporary management accountants. It outlines the specific skills and knowledge needed to use technology and analyze data for better organizational outcomes in each of these domains. For management

accountants, this framework is an invaluable tool that helps them stay relevant in the ever-changing business environment (IMA, 2019).

According to Pilipczuk's 2020 study, management accountants need a wide range of skills, including technical competence, cognitive ability, and social and behavioral aptitudes. Future management accountants, in the opinion of Pilipczuk (2020), must not only possess exceptional technical skills but also have great cognitive abilities in order to support strategic decision-making in the context of growing datasets. According to Richins et al. (2017), these experts are better equipped to evaluate and communicate the insights found in data narratives when they combine their technological skills with strategic acumen.

Management accounting's function has changed dramatically over the years, moving from being primarily concerned with budgeting, cost analysis, and other conventional financial duties to taking a more strategic approach. These days, it entails creating and putting into action plans that improve overall business performance while skillfully handling risk. With advancements in cost control and decision-making processes, this integration of developing technology is expected to bring about significant changes, one of which will be the transformation of accounting practices. Additionally, it will result in a decrease in data distortions and errors, improving operational effectiveness. As a result, this change is probably going to change the way that accounting career pathways are offered. Businesses that can successfully integrate cutting-edge technologies with their knowledge of management accounting will succeed.

CONCLUSION

In the current digital era, we are seeing an increasing amount of intelligent technologies being used to improve many jobs. In order to better understand how management accounting and intelligent systems work together, this research study will look at how the two can be used in tandem. In the field of management accounting, structured procedures and repetitive operations are prime candidates for intelligent system optimization. After a thorough evaluation of the literature and an analysis of the research issues, this study offers insights that motivate more investigation into this area. According to surveys and interviews, intelligent systems have the potential to have a big impact on management accounting by providing professionals with extra value for a variety of daily tasks.

Although information system (IS) professionals and accountants agree about the potential benefits of the Internet of Things (IoT), especially when it comes to using real-time data (Brous et al., 2020; S. Li et al., 2015), different viewpoints are revealed by the thorough analysis and discussion of the findings with reference to the original research question. Fifty percent of IS professionals are unsure if these benefits would have an impact on their line of work, and seventeen percent believe that management, not management accounting, will be the primary beneficiary. On the other hand, 90.8% of accountants believe that IoT will immediately improve their day-to-day work. As such, these findings do not prove beyond a reasonable doubt that IoT will have a big influence on management accounting.

It is clear from examining the results of the second research question that IS professionals and accountants agree on the potential benefits of Big Data and AI for improving the management accounting process. Bhimani (2020), Rybicka (2018), and Richin et al. (2017) state that both parties agree that these technologies have the potential to be valuable additions. When analyzing the biggest gains, accountants point out the benefits of time and cost optimization, while IS specialists stress the efficiency and productivity gains brought about by automation. It's important to remember that these two factors operate best together because higher workplace productivity and efficiency eventually result in improved time management and long-term cost optimization.

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