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2. Artificial Intelligence (AI) in Accounting and Auditing: The Conceptual Framework

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ABSTRACT:

This literature review explores the application of Artificial Intelligence (AI) in the fields of accounting and auditing. A semi-systematic or narrative review approach was employed to analyze relevant publications, including books and journals. In response to the disruptive technologies of Industry 4.0, the accounting and auditing professions must transform to adapt and evolve. Interdisciplinary collaboration is crucial for research in AI as it pertains to accounting and auditing. The wider adoption of AI in these fields promises increased efficiency, productivity, and accuracy but also poses challenges, such as income and wealth inequality, job displacement, and an unskilled workforce. Thus, educators, regulators, and professional bodies need to prepare for this paradigm shift by readying students, shaping policies, and training future professionals to navigate a world increasingly dominated by big data, blockchain, and AI. This shift will necessitate a reconceptualization of the accounting curriculum, revolutionary policy formulation, and the redesign of professional development programs. The emergence of professional hybrids is anticipated to lead the profession in the future. AI's development and implementation in accounting and auditing can be seen as a double-edged sword; while its ultimate impact remains uncertain, it is clear that the traditional accounting and auditing professions are poised for significant change.

KEYWORDS:

Artificial Intelligence, Accounting, Auditing, Disruptive Technologies, Industry.

Introduction:

Artificial Intelligence (AI) is a concept that has captivated both enthusiasts and experts for decades. The notion of machines or sentient beings capable of thinking, learning, and making autonomous decisions has been a source of fascination in popular culture and academic discourse alike. From Isaac Asimov and Arthur C. Clarke's science fiction to modern Hollywood films, human imagination has long envisioned the possibilities of AI. Buchanan (2005) highlighted that AI's history is intertwined with fantasies, possibilities,

demonstrations, and promises, drawing examples from historical and literary works, including Homer's mechanical tripods, Descartes' "mechanical man," and Asimov's futuristic narratives. While many early ideas were more philosophical than practical, the true development of AI technology began in the 1940s with the advent of modern computers post-World War II.

Today, AI has found applications across various industries. In agriculture, AI is used for greenhouse automation, predictive crop analysis, and soil monitoring. In healthcare, neural networks support clinical decision-making and patient evaluations. AI is also integrated into home and workplace security through speech and facial recognition technologies. Self-driving cars, aviation control systems, maritime navigation, marketing, e-commerce, trading, military operations, and many other sectors utilize AI to enhance efficiency and decision-making. The accounting and auditing professions are not immune to the widespread influence of AI, which is at a tipping point of innovation that could redefine how these professions are practiced globally. Understanding AI and staying informed about interdisciplinary advancements is essential in this rapidly changing landscape.

This study aims to explore how AI has impacted the accounting and auditing professions and how these fields might evolve in the future. The paper addresses whether these professions will remain unchanged, the nature of potential changes, how practices may shift, the preparedness of countries to embrace AI in accounting and auditing, the policy implications, and the ethical considerations of AI adoption. The study contributes to existing literature by reviewing AI-related research in accounting and auditing from 1992 to 2020, identifying current trends, and serving as a reference for future studies. Additionally, it introduces the AI phenomenon to professionals without delving into technical details and assesses global readiness for AI in accounting and auditing.

Following this introduction, the paper analyzes the concept and historical development of AI, examines its fit within accounting and auditing, outlines the benefits and risks associated with AI implementation, and provides examples of AI adoption in these fields worldwide. It then discusses how stakeholders can adapt to AI-driven changes and suggests areas for future research, concluding with a summary of key findings.

2. About Artificial Intelligence:

2.1. Definitional Analysis of Artificial Intelligence:

The definition of Artificial Intelligence is continuously evolving. Martinez (2019) argued that defining AI is challenging, suggesting that any definition must remain flexible to accommodate new developments in autonomous AI. He also emphasized the importance of a legal perspective in defining AI and critiqued existing definitions, including those found in legal dictionaries and state statutes. Methods for defining AI, such as describing ambiguity, using descriptive definitions, and providing prescriptive definitions, were outlined.

Grewal (2014) described AI as a mechanical system that gathers, processes, and disseminates knowledge and information to relevant parties. Haenlein and Kaplan (2019) defined AI as a system's ability to understand external data, learn from it, and apply the

learning to fulfill specific goals and tasks. Zhang et al. (2020) viewed AI as the outcome of leveraging big data and machine learning to comprehend the past and predict the future. Lee and Tajudeen (2020) described AI as enabling machines to learn from errors, adapt to new inputs, and perform human-like tasks. According to Elaine R. (2000, cited in Chukwudi et al., 2018), AI is the study of how to make computers perform tasks better than humans, involving systems that think and act rationally. Chukwudi et al. (2018) emphasized AI's ability to perform tasks typically requiring human intelligence, including knowledge acquisition, judgment, comprehension, and creativity.

Brown and O'Leary (1995) suggested multiple perspectives for defining AI, including intelligence, research, business, and programming perspectives. Crevier (1993) referred to AI as a multidisciplinary science, noting the lack of a unified language, values, or standards across its diverse fields. Huq (2014) defined AI as the science and engineering of creating intelligent machines and computer programs that simulate human intelligence. AI is a technology that evolves autonomously, learning and improving over time. Today, machines are even capable of teaching other machines and learning on the job, making AI a dynamic and self-sustaining field.

2.2. Evolution of Artificial Intelligence Technology:

The development of Artificial Intelligence (AI) can be divided into two main periods: ancient history and modern history. In ancient history, concepts of intelligent machines and mechanical devices with limited capacities were envisioned. Modern history, which began with the advent of modern computers in the post-World War II era, has seen the creation of complex computer programs aimed at solving challenging intellectual problems and creating tools for widespread applications.

In the 4th century BCE, Aristotle's "Prior Analytics" introduced syllogistic logic, the first formal deductive reasoning system (Jenkinson, 2009). Moving forward to the 19th century, Charles Babbage and Ada Byron designed the Analytical Engine in 1832, a programmable mechanical calculator. In 1854, George Boole developed binary algebra, representing the "laws of thought." In the early 20th century, Karel Čapek's play "R.U.R." (Rossum's Universal Robots) introduced the term "robot" into the English language. Alan Turing proposed the Turing Machine in 1936-37, laying the foundation for computer science (AAAI, 2017). In 1948-49, William Grey Walter created the first robots, Elmer and Elsie, capable of rudimentary autonomous behaviour (Inglis-Arkell, 2015). The early 1950s saw significant milestones with Isaac Asimov's three laws of robotics and Turing's paper "Computing Machinery and Intelligence."

The term "artificial intelligence" was coined in a 1955 proposal for the Dartmouth Conference by John McCarthy, Marvin Minsky, Nathaniel Rochester, and Claude E. Shannon (McCarthy et al., 2006). This conference in 1956 marked the birth of AI as a formal discipline. One of the earliest sustained AI projects in law was the "Taxman" system developed by L. Thorne McCarty in 1977 (O'Leary & Karlinsky, 1992). With the proliferation of computers and the internet, AI technology has expanded rapidly, impacting diverse sectors. AI has since evolved to compete with humans in intellectual tasks such as chess and is now integral to modern business solutions.

AI's development is marked by the establishment of foundational concepts in earlier periods, followed by their application and evolution in modern times. Currently, AI is advancing within the era of Industry 4.0, aiming for global democratization of AI technologies.

2.3. Cognitive and Non-Cognitive Technologies in the Modern Workplace:

Makridakis (2017) revisited predictions made in 1995 about the digital revolution's impact on 2015, noting that while some predictions were off, many came true. Technological tools are now widely used in various industries, with some having cognitive elements while others do not. Rezaee et al. (2002) discussed the use of Extensible Markup Language (XML) and eXtensible Business Reporting Language (XBRL) for financial reporting. The Internet of Things (IoT) integrates various technologies within organizations, while tools like Electronic Data Interchange (EDI) and Computer-assisted audit tools (CAATs) have transformed auditing processes.

Zhang et al. (2020) classified several major cognitive technologies currently in use: Natural Language Processing (e.g., Nuance, Cortana), Machine and Deep Learning (e.g., TensorFlow), Artificial General Intelligence (e.g., IBM Watson), and Computer Vision (e.g., Clarifai). Technologies such as Database Management Systems (DBMS), Cloud Computing, Enterprise Resource Planning (ERP), Big Data, Blockchain, and Machine Learning are becoming ubiquitous in modern enterprises. AI is expected to be integrated into organizations in one form or another.

3. The Role of AI in Accounting and Auditing:

Artificial Intelligence, also referred to as Cognitive Technology, covers a broad scope. Though not all aspects of AI are directly relevant to accounting, its influence on business practices cannot be ignored (Kokina & Davenport, 2017). AI is applied across various business functions, including production, sales, and accounting. Reddy et al. (2019) describe Accounting Information Systems (AIS) as an ontology of AI. To explore AI's potential in accounting and auditing, it is necessary to examine its applications in these areas.

3.1. Evidence from Literature:

Davenport & Ronanki (2018) suggest that businesses should focus on AI to enhance capabilities rather than technical skills, helping with process automation, data analysis, and communication. Chukwuani & Egiyi (2020) examined AI's impact on accounting automation, highlighting its influence on the profession. Historical studies, such as O'Leary (1995), identified areas like neural networks and expert systems as key focus areas in accounting-related AI research. Huang (2018) investigated AI applications in taxation, while Chukwudi et al. (2018) found AI positively impacts accounting functions. Luan et al. (2020) emphasized the importance of collaboration between academia, policymakers, and professionals to harness AI and big data advancements fully.

Kokina & Davenport (2017) categorized AI applications into four groups: analyzing numbers, digesting words and images, performing digital tasks, and performing physical

tasks. Baldwin et al. (2006) outlined audit tasks that could benefit from AI, including risk assessment and bankruptcy prediction. Makridakis (2017) explored AI's potential to revolutionize human life, including its transformative impact on accounting and auditing.

3.2. Focus Areas of AI Application in Accounting and Auditing:

Based on existing literature, key areas of AI application in accounting and auditing include:

Expert Systems (ES): Computer programs that simulate expert reasoning processes. They have applications in audit planning, evidence gathering, and financial statement preparation. However, their usage is limited due to issues like user neutrality (O'Leary, 2003).

Continuous Auditing: The systematic collection of electronic audit evidence to provide assurance on real-time accounting systems (Rezaee et al., 2002).

Decision Support Systems (DSS): Computer-based systems that assist in decision-making, particularly for unstructured accounting and audit tasks.

Neural Networks (NN): Systems that mimic the human brain's structure to improve task performance. They have applications in analytical review procedures and risk assessment.

Deep Learning & Machine Learning: Machine learning focuses on detecting data patterns and creating self-learning systems. These technologies can assist in transaction classification and fraud detection.

Natural Language Processing (NLP): AI models that understand and process human speech, with applications in document review and high-risk case identification.

Fuzzy Logic: A method of reasoning that handles degrees of truth, aiding in qualitative judgments like materiality decisions.

Genetic Algorithm: A search heuristic that simulates natural selection, with potential applications in account classification and fraud decision modeling.

Robotic Process Automation (RPA): Software that automates rule-based and repetitive tasks, enhancing efficiency in processes like data preparation and basic audit tests.

Hybrid Systems: Combining various AI technologies to address diverse audit tasks that involve both quantitative and qualitative analysis.

4. Benefits and Challenges of Implementing AI in Accounting and Auditing:

4.1. Benefits:

Studies have highlighted various benefits of AI implementation in accounting and auditing, such as increased efficiency, improved decision-making, and enhanced fraud detection (Omoteso, 2012; Chukwuani & Egiyi, 2020). AI enables accountants to focus on data-

driven decision-making and reduces costs (Mohammad et al., 2020). Furthermore, AI-driven automation facilitates the evaluation of documents and communications (Bizarro & Dorian, 2017). Those who widely adopt AI and embrace its potential stand to gain significant competitive advantages (Makridakis, 2017).

4.2 Risks and Limitations:

Numerous studies, as noted by Omoteso (2012), have identified various drawbacks of AI implementation in accounting and auditing. These include prolonged decision-making processes due to the need to explore more alternatives, significant costs for building, updating, and maintaining AI systems, and the inhibition of knowledge and skill development for novices. There is also a risk of these tools being acquired by competitors and the potential misuse of decision aids as evidence against auditors in court for over-reliance. Bizarro and Dorian (2017) highlighted that despite AI's potential to enhance efficiency in accounting and auditing tasks, it cannot replace the human abilities to reason, express emotions, exercise professional skepticism, and apply professional judgment. They also discussed the risk of "technological unemployment." Kumar Doshi et al. (2020) pointed out that AI acts as a "double-edged sword," creating both opportunities and threats, potentially complementing or entirely replacing the profession and casting doubt on its long-term viability.

Agnew (2016, cited in Kokina & Davenport, 2017) mentioned that according to a source from Ernst & Young (EY), AI could significantly reduce the number of new hires each year, altering the industry's employment model. Luo et al. (2018) outlined problems such as the initial lack of experience, slow returns on high investments, and a lack of necessary skills among professionals. Huang (2018) emphasized the challenge of keeping AI systems updated with frequent changes in laws and regulations, like tax laws. Zemánková (2019) argued that AI in accounting and auditing might contribute to income inequality, reduced labor demand, and compromised financial safety. There is also the risk of algorithms being exploitative, deceptive, or containing inherent human biases. Makridakis (2017) warned of possible negative outcomes such as increased unemployment, wealth inequality, the end of human dominance, and the approach of technological singularity. Mohammad et al. (2020) suggested that the main challenges in AI adoption include formulating effective strategic policies, mobilizing skilled manpower, and fostering commitment to AI at the leadership level.

1) Blockchain Technology:

Blockchain technology enables secure, real-time transmission of various forms of value, including data, assets, cash, and information (Zhang et al., 2020). Its features support a new generation of auditing based on continuous assurance. However, existing professional auditing standards are not equipped to integrate these changes into traditional audit processes (Zemánková, 2019). For blockchain to be truly transformative, widespread adoption and agreement on standards are necessary, which involves a significant learning curve. While blockchain can revolutionize corporate reporting, payment technologies, audit design, and transaction validation, concerns about cybersecurity and privacy need to be addressed. Integrating new technologies with existing infrastructure remains a challenge (Accounting Today, 2017).

2) Ethical Concerns and Fraud:

The use of AI in accounting and auditing raises numerous ethical and moral questions (Zemánková, 2019). There is a need to define what constitutes ethical practice in AI. As technology evolves, so do the methods of committing fraud, with new forms of white-collar crime emerging. Ucoglu (2020) emphasized the need for ethical and regulatory guidance and oversight in accounting and auditing firms.

3) Policy Formulation:

The growing use of AI, blockchain, and other disruptive technologies necessitates policy formulation in areas such as cybersecurity law, data protection law, and AI law. National and international policy development is needed to standardize the use of cognitive technologies.

4) Emergence of Big Data:

Big data, characterized by its volume, velocity, variety, and veracity (Zhang et al., 2020; Luan et al., 2020), is a double-edged sword. It can be beneficial to modern entities, but it can also pose a threat if organizations do not implement appropriate measures to manage the vast amounts of data.

5) Gig Economy and Professional Hybrids:

Griffin (2019) suggested that AI will lead to an increase in remote working and the emergence of the gig economy, transforming job dynamics. Many roles will become freelance, and there will be a higher demand for professional hybrids.

5. Examples of AI Implementation in Accounting and Auditing Globally:

Countries worldwide are increasingly engaging in AI research and applications, with a strong push for AI in academia (Luo et al., 2018). Accounting firms, particularly the Big Four, are leading AI implementation in accounting and auditing. These firms invest in AI and its integration into core business, considering it a critical factor for future success (Zhang et al., 2020). According to Griffin (2019), small businesses that fail to adapt risk being left behind, emphasizing the need for organizations to keep up with technological trends.

6. Future Research Avenues:

As AI in accounting and auditing is still a relatively new field, most current literature focuses on understanding concepts, identifying use cases, and assessing potential impacts. Few studies examine AI implementation in specific industries or countries. More research is needed to explore the determinants of AI implementation and its impact on firm performance and efficiency. Future research should also take an interdisciplinary approach, addressing issues such as AI's implications for accounting and auditing standards, various biases in AI, and documenting AI implementation successes and failures across industries.

8. Conclusion:

According to some analysts, anything that can be turned into data will eventually be managed by machines, leaving imagination and judgment as distinct human domains. AI is a tool that is valuable only if people know how to use it to streamline business processes. While AI can enhance efficiency in accounting, it cannot replace the human elements of creativity and judgment. Technological, regulatory, and economic changes will continue to test the profession, and the response to these changes will influence how audits are conducted. The profession will undergo a renaissance, with opportunities for innovation and progress. AI will not replace accountants but rather shift the focus, emphasizing the continued need for human professionals in the future (Greenman, 2017). Society must ensure that AI is used to prioritize value and efficiency.

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