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The Use of Artificial Intelligence in Accounting and Auditing*

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Abstract

This study examines the application of artificial intelligence (AI) in accounting and auditing, emphasizing its role in enhancing the efficiency and accuracy of accounting processes. Through a comprehensive analysis of existing literature, the study evaluates the impact of AI technologies, including machine learning and natural language processing, on key areas such as continuous auditing, financial forecasting, and regulatory compliance. The findings indicate that AI enhances the quality of financial reporting, facilitates early fraud detection, and reduces human error, thereby improving the reliability of financial statements. However, the practical adoption of these technologies is challenged by factors such as high implementation costs and the need to comply with regulatory requirements. To address these challenges, the study highlights the necessity of developing appropriate regulatory frameworks to support and promote the integration of AI in accounting and auditing.

Keywords: Artificial Intelligence, Continuous Auditing, Financial Forecasting, Fraud Detection

Jel Codes: M41, M42, C63, L86

Muhasebe ve Denetim Alanında Yapay Zekâ Kullanımı

Öz

Bu çalışma, yapay zekanın (YZ) muhasebe ve denetim alanındaki uygulamalarını inceleyerek, muhasebe süreçlerinin verimliliğini ve doğruluğunu artırmadaki rolüne odaklanmaktadır. Mevcut literatürün kapsamlı bir analizi doğrultusunda, makine öğrenimi ve doğal dil işleme gibi YZ teknolojilerinin sürekli denetim, finansal tahmin ve düzenleyici uyumluluk üzerindeki etkileri değerlendirilmektedir. Çalışmada yapılan tespitler, YZ'nin finansal raporlama kalitesini artırdığını, dolandırıcılığın erken tespit edilmesini sağladığını ve insan hatalarını azaltarak finansal tabloların güvenilirliğini güçlendirdiğini ortaya koymaktadır. Ancak, bu teknolojilerin uygulamaya geçirilmesi, yüksek maliyetler ve düzenleyici gerekliliklere uyum gibi çeşitli zorluklarla karşı karşıyadır. Bu bağlamda çalışma, YZ'nin muhasebe ve denetim süreçlerine entegrasyonunu desteklemek ve yaygınlaştırmak amacıyla uygun düzenleyici çerçevelerin geliştirilmesinin önemini vurgulamaktadır.

Anahtar Kelimeler: Yapay Zekâ, Sürekli Denetim, Finansal Tahmin, Dolandırıcılık Tespiti

Jel Kodları: M41, M42, C63, L86

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INTRODUCTION

In recent years, technological advancements, especially in Artificial Intelligence (AI), have led to significant changes across various fields. AI, which replicates human cognitive abilities like learning, data analysis, and problem-solving, enables complex tasks to be performed without human intervention using techniques such as machine learning, deep learning, natural language processing, and neural networks.

AI technology, a key result of the ongoing technological revolution, is transforming individuals, society, and organizations. It is evolving from a tool into a system capable of shaping its own agenda. By simulating human intelligence and processing data in real time, AI helps organizations adapt quickly, improve efficiency, and navigate the changing business environment, strengthening their ability to compete and innovate (Abbas, 2024: 633).

Artificial intelligence significantly contributes to various sectors, including healthcare, education, transportation, agriculture, and industry. By enhancing process efficiency, AI reduces both labor and time costs, enabling businesses to improve their performance and adapt more effectively to rapid market changes. In recent years, accounting and auditing have increasingly benefited from AI applications. These technologies transform traditional accounting processes, facilitating more accurate and efficient transactions, reducing labor and time requirements, and enhancing the reliability of financial reports by minimizing the risk of errors.

Accounting and auditing are essential business functions that provide critical information on financial status and performance, supporting managerial decision-making. Traditional methods primarily rely on manual processes and paper-based documentation, which not only consume time but also increase the likelihood of errors. Furthermore, these conventional approaches limit the ability to conduct comprehensive analyses using large datasets. However, advancements in technology and artificial intelligence have led to a fundamental transformation in accounting and auditing practices. Automated systems now improve efficiency and accuracy in processes such as bookkeeping, financial reporting, internal control systems, and risk assessment. This transformation enhances organizational performance while reducing the risk of errors.

Advanced AI tools support strategic decision-making by enabling rapid and precise analysis of large volumes of financial data, contributing significantly to detecting anomalies and predicting future risks. AI enhances audit quality by facilitating continuous auditing and reducing dependence on traditional methods. Additionally, it serves as an effective tool for detecting financial fraud, increasing transparency, and improving reliability. Consequently, accounting firms are increasingly adopting AI technologies to automate routine tasks, allowing auditors to focus on complex analyses and strategic decision-making. For instance, machine learning techniques enhance accuracy by automatically analyzing extensive financial datasets and identifying irregular patterns, thereby significantly reducing the risk of human error (Odeyemi et al., 2023: 360). Furthermore, Robotic Process Automation (RPA), an AI-driven business process, accelerates accounting and auditing by automating repetitive tasks, enabling faster execution of operations such as invoice processing and financial transaction audits.

This study examines the impact of AI on efficiency and accuracy in accounting and auditing, exploring its applications and the challenges of implementation. The research seeks to answer the following question: What are the different applications of artificial intelligence in accounting and auditing, and how can these applications increase the efficiency and accuracy of accounting and auditing processes? Furthermore, they relate to the long-term effects of AI adoption in accounting and auditing. How will this technology affect traditional job roles? Will the widespread use of artificial intelligence reduce the employment opportunities of accountants, or will it instead lighten their workload and enable them to perform in-depth analysis of more complex tasks? Examining these issues will help the research provide valuable insights into the opportunities and challenges presented by artificial intelligence in accounting and auditing, thereby identifying ways to adapt to these transformations.

The research will consist of three main sections. The first section will provide a general introduction to the research. The second section will present a comprehensive definition of artificial intelligence, discuss AI technologies, and analyze the challenges and opportunities associated with their use. The third section will examine AI applications in accounting and auditing, including commonly used technologies such as machine learning. Through this structure, the study aims to offer a thorough understanding of the role of AI in transforming accounting and auditing practices.

ARTIFICIAL INTELLIGENCE

Definition and explanation of artificial intelligence

Artificial intelligence (AI) is a field dedicated to replicating the cognitive functions of the human mind through computer systems. The term "artificial intelligence" originates from the combination of "artificial" and "intelligence." The field was formally established in 1956 when John McCarthy first introduced the term. However, the concept of machines emulating human intelligence dates to 1945. Since the mid-20th century, AI has evolved from rule-based systems to advanced techniques capable of learning from data and making informed decisions (Smith et al., 2006:4).

AI refers to the capacity of machines to simulate cognitive processes such as learning, reasoning, problem-solving, and perception (Liu et al., 2021:3154). According to George F. Luger, AI is a branch of computer science grounded in both theoretical and practical foundations (Luger, 2009 :1-2). Merriam-Webster defines AI as the ability of machines to imitate behaviors characteristic of human intelligence. Similarly, the Oxford Dictionary describes AI as the ability of computers and digital systems to perform tasks that traditionally require human intelligence (Oxford, 2010 :88-89).

Development of AI is closely linked to computer science and mathematics. The Dartmouth Project (1956) initiated AI research (Goonatilleke & Hettige, 2022:723). The 1960s saw advancements in robotics (Boudah, 2006/2007:15-16), the 1970s expanded AI into specialized fields (Abdel Nour, 2005:24), and the 1980s introduced expert systems. In the 1990s, AI applications spread to military and commercial sectors.

Key milestones include IBM's Deep Blue defeating Garry Kasparov in 1997 and Google's AlphaGo winning against a human champion in 2016, showcasing AI's growing capabilities (Elias & Rabie, 2022:13-15). AI continues to evolve but faces challenges in ethics and data privacy.

Sub-components of artificial intelligence

Machine learning

Machine learning, a subfield of AI, enables computers to learn from data and make predictions. It includes supervised, unsupervised, semi-supervised, and reinforcement learning (Shaveta, 2023:282). Machine learning is applied in various fields, including healthcare, agriculture, and big data analytics, supporting decision-making (Sheng et al., 2022:2). In accounting and auditing, it automates tasks, improves data analysis, and enhances client services (Tandiono, 2023:1). A key application is fraud detection, where machine learning identifies anomalies in large datasets (Supriadi, 2024:55). AI-driven auditing aligns with International Standards on Auditing (ISA) for digital records examination (Schreyer et al., 2022:105). Integrating AI into accounting education is essential for developing technical skills and ensuring ethical oversight (Tandiono, 2023:3).

Deep learning

Deep learning, an AI technique based on deep neural networks, analyzes complex patterns in large datasets and has revolutionized financial data analysis, particularly in detecting errors and fraud in accounting and auditing (Jerome et al., 2023:14). Techniques like CNN and RNN are effective in image and time-series analysis (Abada et al., 2022:3) and are widely used in medical diagnosis. In accounting and auditing, deep learning outperforms traditional methods by offering higher accuracy in anomaly detection and financial statement analysis (Schultz & Tropmann-Frick, 2020:5421), improving audit quality through comprehensive data analysis (Wang, 2023:2). Unlike machine learning, it autonomously extracts features, enabling more accurate decision-making (Asher et al., 2021:8). Thus, deep learning enhances efficiency and reliability in accounting and auditing.

Natural language processing

Natural Language Processing (NLP) enables computers to understand and generate human language, supporting tasks like named entity recognition, machine translation, and sentiment analysis (Jerome et al., 2023:16). In internal auditing, NLP processes unstructured data, identifying key audit points and enhancing risk assessment. It aids fraud detection in forensic accounting by analyzing large datasets to uncover suspicious transactions and financial inconsistencies (Xu, 2024:800; Odeyemi et al., 2024:205). Text analysis automates information extraction, improving accounting decisions and revealing financial insights (Bochkay et al., 2022:766). Additionally, sentiment and text analysis contribute to a deeper financial understanding by revealing hidden insights within accounting data (Cabedo and Huguet, 2021:169).

Expert systems

Expert systems replicate human decision-making processes using components like knowledge bases and inference engines, with applications in fields like medicine, agriculture, and accounting (Sayed, 2021: 1396, 1398). In accounting, they help manage complex financial data. However, challenges include the complexity of knowledge bases, the need for regular updates, and high costs. Maintaining current knowledge bases is difficult and costly (Duan et al., 2005: 1), while the installation and maintenance costs can be a significant barrier for organizations (Sinha and Zhao, 2011: 9).

Intelligent robots

Intelligent robots are AI-driven systems that perceive their environment, learn from it, and make autonomous decisions. They use machine learning to adapt to changes and perform tasks efficiently (Fontanelli, 2022:4). Key features include sensory capabilities, adaptability, and operational efficiency, with sensors enabling precise task execution and energy optimization (Xu, 2019:1; Licardo et al., 2024:1). These robots enhance efficiency in industries like healthcare, agriculture, and education (Raharjo et al., 2024:640), and in finance, Robotic Process Automation (RPA) automates repetitive tasks, accelerating digital transformation (Rui et al., 2023:9).

Fuzzy logic

Fuzzy logic, introduced by L. Zadeh in 1965, is an AI technique that integrates learning and decision-making with Artificial Neural Networks (ANN) (Staub et al., 2015:1478). Unlike binary logic, which uses discrete truth values, fuzzy logic operates on a continuum from 0 to 1, making it effective for handling uncertain or incomplete data (Nica et al., 2024:1-2). Its ability to manage uncertain data allows for accurate decision-making in noisy environments, such as disease detection systems (Agarwal, 2023: 4991). Fuzzy logic is particularly useful in fields like accounting and auditing, where uncertainty is common (Imeni, 2020: 71).

Challenges and opportunities in applications of artificial intelligence

Artificial intelligence (AI) can improve efficiency and decision-making in sectors like healthcare, agriculture, finance, accounting, and education, but it also presents challenges related to ethics, data privacy, and workforce dynamics. In healthcare, AI aids in medical imaging and mental health, though concerns about clinical benefits and data privacy remain (Shen, 2021:2; Strohm et al., 2020:5528). In agriculture, its efficiency potential is limited by a lack of expertise (Sakapaji and Puthenkalam, 2023:1149). In finance, AI enhances operations, but ethical and legal challenges persist (Golić, 2020:68). In accounting and auditing, AI reduces errors and improves accuracy, but data security and regulatory compliance are critical concerns (Odeyemi et al., 2023:360). In education, while AI can improve learning, it may exacerbate inequalities.

USE OF ARTIFICIAL INTELLIGENCE IN ACCOUNTING AND AUDITING

Technological development of accounting and auditing over time

Accounting has evolved from early systems in Mesopotamia (Carmona & Ezzamel, 2007:7) to Luca Pacioli's double-entry system (Faccia & Mosteanu, 2019:108), and now AI, blockchain, and data analytics are transforming the field. These advancements enhance analytical capabilities and decision-making (Peng et al., 2023:3), shifting accountants' roles from data recording to strategic decision-making (Carvalho & Almeida, 2022:1). AI and machine learning optimize resources (Zhang et al., 2020:462), while blockchain ensures transparency and reduces fraud (Rhee et al., 2022:2). In auditing, AI and data analytics improve audit quality, and big data analytics streamline data processing (Alotaibi & Alnesafi, 2023:97; Chu & Yong, 2021:43). Blockchain and AI introduce smart contracts and automated verification, enhancing reliability (Rozario & Vasarhelyi, 2018:1).

Artificial intelligence in accounting

Artificial intelligence enhances data processing speed in accounting, reducing errors and allowing accountants to focus on strategic tasks. Large firms invest in AI to improve efficiency (Tandiono, 2023:1). AI supports forecasting, data analysis, and automation, emphasizing the need for AI skills in accounting education (Odonkor et al., 2024:68; Cai, 2022:1). Robotic process automation (RPA) streamlines tasks like data entry, transaction processing, and reporting (Adnan et al., 2024:80, 83). Machine learning (ML) aids financial forecasting, predictive analysis, and anomaly detection, though challenges such as model drift and transparency issues persist (Chen et al., 2022:4). Optical character recognition (OCR) reduces manual data entry by digitizing documents, enhancing efficiency (Özyiğit, 2022:641). Integrating OCR with ML improves

data analysis and reporting, minimizing errors and improving reliability.

AI enhances financial reporting by automating manual processes, increasing accuracy, and enabling real-time data analysis for better decision-making (Antwi et al., 2024:213). It aids risk management by predicting financial trends and detecting fraud (El Hajj and Hammoud, 2023:15). AI-driven financial reporting improves efficiency and reliability while reducing human error, allowing professionals to focus on strategic decisions (Peng et al., 2023:6). However, challenges such as ethical concerns, regulatory compliance, and data quality issues affect its effectiveness (Truby, 2020:946).

Big data analytics, characterized by volume, velocity, and variety, transforms financial reporting and risk management (Younas, 2019:105). Big data analytics enables accountants to generate reports more quickly, enhance risk management, and gain insights into market trends (Abdelrazeik, 2022:269).AI processes large datasets, identifies patterns, and enhances fraud detection, forecasting, and risk assessment (Megeid, 2022:261, 207; Nurdiani et al., 2023:64). While AI enables automation and efficiency (Ahmadi, 2024:68), it also faces challenges such as the need for extensive training data, the "black box" issue, and the risk of overfitting (Zaripova et al., 2023:4, 5).

AI strengthens risk management by improving fraud detection and financial accuracy through ML and predictive analysis (Askary et al., 2018:323). It enables organizations to identify risks promptly, ensuring regulatory compliance and reducing operational risks (Bonsu et al., 2023:129; Majumder, 2024:67). AI enhances risk analysis by identifying financial threats and supporting early warning systems for better resource allocation (Chen et al., 2022:1; Gao, 2024:315). However, challenges such as complexity and privacy remain, requiring ethical and regulatory compliance (Odonkor et al., 2024:177; Adelakun et al., 2024:1042). Deep learning further improves risk prediction but must align with regulatory standards (Chen, 2023:672; Zeng et al., 2022:1).

Artificial intelligence in auditing

AI applications in auditing improve efficiency and accuracy by supporting anomaly detection, fraud prevention, risk assessment, and financial data analysis (Ivakhnenkov, 2023:54). However, a gap exists between firms that adopt AI and those that do not (Ríkharðsson et al., 2022:323). AI enables effective analysis of large datasets, aiding strategic decision-making (Odeyemi et al., 2023:359), but adoption is slow due to challenges and resistance to new technology (Mpofu, 2023:496). Ethical concerns about accountability also arise (Shani and Al-Tameemi, 2021:9).

Continuous auditing, supported by AI, enhances risk management, fraud detection, and early error prevention through real-time monitoring (Minkkinen et al., 2022:1; Lidiana, 2024:214). It also strengthens collaboration between management and auditors. AI tools improve audit quality by analyzing full datasets (Odeyemi et al., 2023:363).

AI enhances financial forecasting through predictive analysis using historical data and algorithms, offering better accuracy than traditional models (Anwar and Ali, 2018:1; Chopra and Sharma, 2021:20). It aids in management decisions, resource allocation, and risk management (Kureljusic and Karger, 2023:88; Adelakun, 2023:333), especially in stock market strategies (Zakaria et al., 2023:420).

AI ensures compliance by analyzing regulatory changes with NLP, automating compliance monitoring, and improving efficiency (Martin, 2021:1; Mavi et al., 2023:178). It enhances fraud detection through big data analytics and improves transparency with Explainable AI (Ssetimba et al., 2024:697; Chen and Storchan, 2021:1).

Robotic Process Automation (RPA) boosts efficiency by automating repetitive tasks and improving audit processes with AI integration (Liu, 2022:25). RPA identifies discrepancies and reduces auditors' workload, enabling focus on strategic decision-making (Kend and Nguyen, 2020:1). Automation is increasingly sought after in auditing, with up to 45% of business processes estimated to be automated (Liu, 2022:25).

Artificial intelligence tools and techniques in accounting and auditing

Machine learning

Machine learning in accounting

Machine learning enhances accounting processes by improving efficiency and decision-making. It automates transaction classification, detects fraudulent activities by analyzing historical data, and supports predictive analysis for forecasting financial trends and risks. Additionally, it aids in expense management, reduces costs by categorizing expenditures, and enhances data processing for accurate reporting. Machine learning systems continuously adapt to new data, ensuring accounting processes stay current and effective (Li et al., 2023: 1, 4, 6).

Machine learning in auditing

Clustering algorithms, like K-means, are highly effective in detecting financial fraud by processing large volumes of financial data quickly and efficiently. These algorithms identify irregular patterns associated with fraudulent transactions, enabling anomaly detection. They are adaptable, adjusting rapidly to new fraud techniques and evolving financial risks. By monitoring high-risk transactions, clustering algorithms contribute to proactive fraud prevention. Additionally, they enhance the understanding of financial relationships by clustering similar transactions, providing deeper insights into financial data (Huang et al., 2024: 33).

Machine learning is a powerful tool in detecting tax evasion and ensuring compliance by identifying anomalies and potential tax non-compliance. It uses pattern recognition to detect fraudulent transactions by analyzing large financial datasets. Machine learning also enhances tax compliance through real-time monitoring, enabling continuous audit processes. Additionally, it improves audit efficiency by reducing the manual workload of auditors, thus accelerating the tax audit process (Rathor, 2024: 117, 118, 119, 120, 124).

Natural language processing

Text analysis: analysis of contracts and financial documents

FinBERT is an effective NLP model specifically designed for financial text mining tasks. It has been pre-trained on extensive datasets to address the challenge of limited labeled data within the financial sector. The model demonstrates high accuracy through multi-task learning, fine-tuning with minimal data, and comprehensive pre-training strategies (Liu et al., 2020: 4513, 4514, 4518).

FinBERT contributes significantly to the financial sector by enhancing sentiment analysis in financial reports and management communications, providing valuable insights into market behavior (Huang et al., 2023:809). Trained in large financial datasets, it is proficient in understanding industry-specific terminology, making it highly effective in financial text analysis (Huang et al., 2023:809, 830). Additionally, FinBERT improves transparency and accountability by detecting inconsistencies in management statements, thereby enhancing the quality of financial reporting (Huang et al., 2023:810, 829-830).

Conversational intelligence applications: chatbots for customer service

NLP-powered chatbots are increasingly used in customer service. These bots are designed to respond to frequently asked questions and offer personalized financial advice. AI-driven customer service systems efficiently handle low-complexity tasks, allowing human agents to focus on more intricate issues (Xu et al., 2020: 3).

The effectiveness of AI in customer service depends on the following factors (Xu et al., 2020: 1, 3, 5, 6):

- Task Complexity and Problem-Solving Ability: While AI systems excel at handling simple tasks, human agents prefer complex issues.
- Cognitive Load: High-complexity tasks can create challenges for users interacting with AI systems.
- Regulated Mediation: User preferences for AI systems vary depending on the complexity of the task.

The integration of chatbots in the accounting sector accelerates operational processes and enhances customer satisfaction.

Deep learning

Using LSTM in financial forecasts

Long Short-Term Memory (LSTM) networks are essential for financial forecasting, as they effectively analyze complex time-series data and predict future trends (Zaheer et al., 2023: 1). LSTMs outperform traditional methods by capturing long-term dependencies and nonlinear relationships in historical data. Their integration with Convolutional Neural Networks (CNNs) further enhances forecasting accuracy (Zaheer et al., 2023: 4).

Anomaly detection using deep learning

Deep learning is a powerful tool for detecting anomalies in financial data. Schreyer et al. demonstrated that adversarial autoencoding neural networks could effectively identify irregularities in financial data, making them highly valuable for fraud detection (Schreyer et al., 2019: 1). Additionally, multilayer neural networks serve as an essential tool in evaluating the quality of accounting information (Wang, 2023: 609).

Deep learning techniques are also utilized in forecasting financial crises. Chen and Zhang proposed that artificial neural network models, based on accounting data, provide effective early warnings for financial crises (Chen and Zhang, 2022: 1).

Federated learning in auditing

Federated learning enables secure data collaboration in auditing by allowing participants to train models on local data and share only model updates with a central server, ensuring privacy protection (Sultan et al., 2024: 603). This technology allows auditors to develop deep learning models using data from multiple clients while maintaining data security (Schreyer et al., 2022: 105).

Expert systems

Expert system tools and techniques in accounting and auditing

Changchit and Holsapple highlight key tools of expert systems in accounting and auditing. One such tool is the GURU integrated artificial intelligence environment. GURU offers tools for rule management, program management, and database management, all which aid in managing decision-making processes. This system enhances internal control assessments by systematically organizing auditors' decisions (Changchit & Holsapple, 2004: 106).

Expert systems also assist managers in identifying weaknesses in internal control and facilitate training processes. This is crucial for organizations, as it leads to more reliable financial reporting and improved internal control practices (Changchit & Holsapple, 2004: 103).

Examples of expert systems in accounting include the System Information System, Survey and TRACOR Systems, and the Finexpro System. These systems are designed to enhance accounting efficiency and play significant roles in decision-making, transaction monitoring, and improving overall operational efficiency (Elias & Rabie, 2022: 70-71).

Robotic process automation software robots

Software robots automation in auditing

RPA technologies expedite financial auditing procedures and enhance accuracy (Tofan and Airinei, 2024: 498, 503, 504, 507):

- Automatic Evidence Collection: Data is systematically gathered, eliminating the need for manual intervention by auditors.
- Advanced Data Accuracy: Ensures the reliability of collected data by minimizing human errors.
- Effective Data Classification: Data is swiftly categorized according to predefined rules.
- Advanced Data Interpretation: RPA facilitates deeper analysis by auditors.
- Real-Time Data Processing: Processes data instantly, ensuring auditors access up-to-date information.
- Standardization of Processes: Enhances the reliability of audits through consistent workflows.
- Scalability and Flexibility: RPA efficiently manages audit workloads without requiring additional resources.
- Advanced Analysis: Detects trends and anomalies through sophisticated analysis tools.
- Continuous Monitoring and Feedback: Promotes ongoing improvement of audit processes through continuous monitoring.

Automation of software robots in accounting

RPA significantly improves efficiency in accounting processes (Lui and Shum, 2022: 156):

- Invoice Matching: Automates the matching of invoices, reducing errors.
- Payment Processing: Speeds up payment processing and enhances compliance.
- Account Reconciliation: Automatically matches data across different systems.

RPA also facilitates data migration, ensuring consistency across systems (Yao, 2024: 1-2-7-9). By integrating RPA with advanced analytics and visualization tools, financial management is optimized, errors are minimized, and audit quality is improved, thus allowing professionals to allocate more time to strategic decision-making.

Companies' applications of artificial intelligence in accounting and auditing

KPMG:

KPMG uses AI-powered cognitive automation to improve tax compliance and auditing processes, leveraging big data analytics to identify risks and provide real-time insights. The firm employs machine learning to process large data sets and enhance the quality of financial insights. KPMG Clara, an AI and machine learning-supported cloud-based auditing platform, analyzes data to detect risks and facilitate collaboration (KPMG, Clara). Additionally, KPMG has developed automated audit processes, such as cash audits, using machine learning (Üçoğlu, 2020: 4).

PricewaterhouseCoopers (PwC):

PwC has enhanced its fraud detection systems in financial audits by integrating machine learning algorithms,

increasing data analysis precision and financial reporting (Üçoğlu, 2020: 3, 4). The firm uses several AI-powered tools to improve its auditing processes: PwC Aura, a cloud-based ERP platform for risk assessments and digital collaboration (PwC, Aura); GL.ai, an AI bot that analyzes data to detect fraud and errors (PwC, Harnessing the power of AI to transform the detection of fraud and error); Cash.ai, which automates cash audits and enhances efficiency (PwC, Harnessing AI to pioneer new approaches to the audit); and PwC Halo, which improves risk assessment by analyzing data, detecting inaccuracies, and providing data-driven insights for audits (PwC, Halo).

Ernst & Young (EY):

Ernst & Young (EY) has integrated Natural Language Processing (NLP) into its financial statement analysis to enhance efficiency. EY Canvas, an online platform, connects audit professionals with clients on a unified network, enabling efficient audit management through real-time data updates (EY, EY Canvas). EY Helix, an AI-powered analytics platform, enhances audit quality by offering detailed insights and conducting risk assessments via advanced data analysis, allowing auditors to obtain more precise results (EY, EY Helix). The EY Blockchain Analyzer audits blockchain transactions and provides real-time business applications to improve transparency, making it particularly useful for financial reporting and tax calculations (EY Blockchain Analyzer: Explorer & Visualizer). Additionally, EY uses machine learning to analyze unstructured data, helping assess fraud risks and improve accuracy (Üçoğlu, 2020: 3).

Deloitte:

Deloitte ensures integrity in supply chain auditing through blockchain technology and leverages machine learning to automate data analysis and risk assessments. Argus, combining machine learning and NLP, analyzes financial documents to detect inconsistencies, improving audit accuracy (Kokina & Davenport, 2017:6). Cortex, an AI platform incorporating intelligent automation and machine learning, facilitates decision-making and improves efficiency across various areas (Deloitte, CortexAI). Tools like CognitiveSpend and CognitivePersonnel analyze spending and workforce data, while MissionGraph and CogniSteward strengthen data analytics and management. BrainSpace, a machine learning tool, analyzes unstructured data to support auditors in their work. Sonar, another AI tool, is designed to verify the accuracy of manually entered data (Deloitte, 16 Artificial Intelligence Projects from Deloitte – Practical Cases of Applied AI, 2018: 15,38). Omnia DNAV integrates digital technologies to improve audit quality, and Deloitte employs predictive analytics to identify financial risks (Üçoğlu, 2020:4).

Challenges of applying artificial intelligence in accounting and auditing

Technical challenges of applying artificial intelligence in accounting and auditing

The implementation of AI in auditing presents several technical challenges, including data complexity, integration with existing systems, consistency, scalability, and the need for skilled auditors (Peng et al., 2023: 4-10). Deep learning algorithms may produce results difficult for human auditors to interpret, requiring a balance between AI's power and professional judgment (Grissa and Abaoub, 2024: 1, 3). The rapid evolution of AI demands continuous learning and adaptation from auditors (Iwuanyanwu et al., 2023: 63), while small businesses face challenges such as investment costs and skill development (Ríkharðsson et al., 2022: 323, 333, 334). Data security is also a major concern, requiring robust security measures to prevent data breaches (Fedyk et al., 2022: 939).

Economic challenges of implementing artificial intelligence in accounting and auditing

The economic challenges of AI in accounting and auditing include high costs, significant investments, and difficulties in measuring ROI, as benefits are often operational rather than immediate financial gains (Veselovsky et al., 2021: 294). AI's impact on the workforce may lead to job displacement, especially for low-skilled workers, requiring retraining and upskilling to mitigate economic consequences (Fedyk et al., 2022: 941).

Ethical and legal challenges of applying artificial intelligence in accounting and auditing

The use of AI in accounting and auditing raises ethical and legal concerns, including accountability, trust, and transparency, especially regarding errors in audit results (Seethamraju and Hecimovic, 2022: 783, 792, 795). AI's potential to replace professional judgment in audits risks compromising audit quality, and existing auditing standards may need updating. Current laws may be insufficient to address AI's rapid evolution, highlighting the need for new regulations. Data security and privacy concerns also arise, with the potential for legal liabilities due to breaches of sensitive customer information (Akula and

Garibay, 2021: 2). Addressing these issues requires prioritizing transparency, fairness, and reliability in AI systems.

Comprehensive solutions to the challenges of artificial intelligence in accounting and auditing

The integration of artificial intelligence (AI) in accounting and auditing faces a variety of challenges, including algorithmic bias, resistance to change, and ethical concerns. Overcoming these challenges requires a combination of technological, organizational, and regulatory solutions.

Algorithmic bias and auditing methods

To mitigate algorithmic bias, strict audit procedures are essential, including legal, ethical, and technical audits, which are necessary to identify and eliminate biases in AI algorithms. Legal audits ensure that AI systems comply with relevant legal regulations, while ethical audits examine algorithms for their adherence to ethical principles. Technical audits focus on thoroughly analyzing the performance and security of algorithms. A combination of these audit methods allows for a more comprehensive and effective audit process. Additionally, proactive risk management through regular audits helps detect vulnerabilities early, enabling timely interventions (Mökander, 2023: 12, 16, 17, 19).

Education and interdisciplinary approach

Continuous education is vital for accountants to effectively adopt AI technologies. (Owonifari et al.,2023: 9) argue that ongoing education can enhance the quality of auditing practices and financial reporting. Additionally, an interdisciplinary approach is necessary to fully understand the complexities associated with AI (Hasan, 2022: 440).

Ethical AI solutions

AI solutions should be developed from a multidisciplinary perspective to ensure their ethical use. Several fundamental approaches for ethical AI development include collaboration between disciplines such as computer science, law, and ethics. A risk assessment methodology should be applied to identify and assess AI-related risks while considering their ethical implications. Involving various stakeholders, including experts and the public, in the development process is also essential. Additionally, clear guidelines and frameworks for AI management, in line with ethical principles, should be established. Finally, the continuous monitoring and adaptation of AI systems are necessary to address societal concerns as they emerge (Felländer et al., 2022: 1, 2, 3, 4).

Blockchain technology and AI integration

Blockchain technology can transform accounting processes and enhance trust in financial reporting. (Tan and Low ,2019: 312) state that the integration of blockchain with AI enables real-time audits, further improving the efficiency and reliability of the auditing process.

In conclusion, a comprehensive strategy that incorporates audit frameworks, continuous training, interdisciplinary collaboration, and ethical management is necessary to address the challenges of AI applications in accounting and auditing. By implementing these solutions, organizations can responsibly harness the potential of AI technologies.

Future development of artificial intelligence in accounting and auditing

The advancement of artificial intelligence (AI) in accounting and auditing is expected to enhance process automation, enabling professionals to focus on more complex analytical tasks. AI will minimize manual operations, allowing auditors to provide deeper insights and contribute to more efficient auditing practices. However, the evolution of AI in this field necessitates updates to auditing standards and careful consideration of ethical concerns (Kend and Nguyen, 2020: 269, 274, 279, 280).

Key trends in the future of artificial intelligence in accounting and auditing

The adoption of AI in accounting and auditing is growing rapidly, driven by several key trends shaping the future of AI applications in this field. AI technologies are expected to be widely used for tasks such as data entry, reconciliation, financial analysis, and risk assessment. This will lead to a transformation in auditing practices, particularly through continuous auditing and real-time analysis, which will change traditional methodologies. AI-driven insights will enhance decision-making in financial reporting and risk management. Additionally, ethical considerations related to transparency, accountability, and bias reduction will become more prominent. New regulatory developments will be necessary to govern AI applications in accounting and auditing. As AI technologies evolve, professionals in the field will need to develop new skills to effectively use these tools. Furthermore, AI will be integrated with blockchain and the Internet of Things (IoT), increasing the reliability of financial processes. Organizations that successfully implement AI will gain a

competitive advantage in the market (Onwubuariri et al., 2024: 1072, 1073, 1081, 1082).

Interaction between artificial intelligence and human expertise

The collaboration between AI and human expertise will become increasingly significant, with AI supporting auditors in data analysis and process management. However, human judgment will remain essential for ethical decision-making, contextual interpretation, and ensuring the integrity of audit procedures. AI-driven systems, with their ability to continuously learn, will enhance big data analysis and risk management processes. Nevertheless, the growing reliance on digital technologies will necessitate the reinforcement of cybersecurity measures (Lehner and Knoll, 2022: 2).

CONCLUSION

To show a clearer picture of the findings of the study, the primary findings related to the pros, cons, and professional requirements associated with using artificial intelligence in auditing and accounting are outlined below.

Key benefits of artificial intelligence in the field of accounting

- Enhances accounting process accuracy and integrity.
- Enables error detection and correction, and outlier identification.
- Enhances overall financial reporting quality.
- Enables more reliable financial forecasting through data analysis.
- Enables management decision-making using data-driven information.
- Contributes to improved financial performance and more effective risk management.

Key benefits of artificial intelligence in the field of auditing

- Facilitates real-time data analysis through continuous auditing processes.
- Reduces reliance on traditional periodic audits.
- Enhances the accuracy, consistency, and reliability of audit outcomes.
- Enables earlier detection of fraudulent activities and financial misstatements.
- Increases the efficiency and responsiveness of audit procedures.

Opportunities and challenges of artificial intelligence in accounting and auditing

Opportunities

- Improved operational efficiency across financial functions.
- Faster and more accurate decision-making using real-time information.
- Removal of manual errors and process inefficiencies.
- Improved compliance with evolving financial regulations and standards.

Challenges

- High cost of investments for adopting and maintaining AI technologies.
- Lack of proper existing technical infrastructure, particularly for small organizations.
- Ongoing need for skilled workers who can work effectively with AI tools.
- Higher threats to data security, privacy, and ethical use of automated systems.

Essential competencies required for accounting and auditing professionals in the age of artificial intelligence

- Analytical skill in interpreting complex data and applying AI-powered tools.
- Familiarity with AI technologies and how they can be applied in financial accounting and auditing.
- Practice of handling big data processing and the ability to extract financial information from big data.
- Information technology awareness of the digital platforms used in financial and auditing activities.
- Ability to collaborate with cross-functional teams, including software developers and data analysts.
- Adaptability to respond to evolving technological landscapes and readiness to continually update knowledge.
- Understanding of cybersecurity guidelines for the protection of financial data in AI systems.
- Strong ethical values and knowledge of relevant legal and regulatory standards.
- Sound professional judgment and critical thinking in AI-supported decision-making.

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