

# **The Role of Artificial Intelligence in Enhancing Internal Auditing Processes on Audit Firms in The Kingdom of Saudi Arabia (KSA)**

(1) Eman Selem (2) Amera Yousry (3) Mahmoud Elkholy

(1),(2) Accounting department Faculty of commerce – Suez Canal University

(3) Accounting department Faculty of business administration – Benha University

(1),(2),(3), Accounting department faculty business administration, Taibah University, KSA

## **Abstract:**

**Study objective:** The study aimed to identify the impact of integrating artificial intelligence techniques into internal auditing processes in Saudi Arabian Audit Firms. It focuses on measuring the positive impact of these techniques on improving internal auditing efficiency and risk management. Also, the researchers tried to identify the most vital challenges facing Audit Firms in adopting artificial intelligence techniques and proposing mechanisms for overcoming challenges.

**Design and methodology:** The study relied on a questionnaire administered to various categories of employees in Saudi Arabian audit firms, including a group of auditors, financial advisors, and IT specialists. The sample included (84) valid responses for statistical analysis and was analyzed using the SPSS program to measure the relationship between integrating artificial intelligence techniques for improving internal auditing efficiency and risk management. The study also focused on analyzing the challenges facing the integration of artificial intelligence techniques and proposing mechanisms to overcome the challenges associated with adopting artificial intelligence in internal auditing processes.

**Results:** The results of the study revealed a statistically significant relationship between integrating artificial intelligence into internal auditing processes, improving internal auditing efficiency, and improving risk management. The results also showed that there are challenges related to adopting artificial intelligence, such as lack of skills, high cost, and resistance to change, which hinder the rapid adoption and implementation of AI Techniques in internal auditing processes. The results of the study also showed that adopting comprehensive strategies for training and evaluating tools can contribute to overcoming these challenges.

**Originality and addition:** This study is among the limited number of studies that focus on the impact of AI techniques on internal auditing processes in the Kingdom of Saudi Arabia and highlights the benefits that can be achieved by adopting AI Techniques in internal auditing processes. The study also provides some recommendations for auditing companies to enhance the integration of AI and how to overcome the challenges associated with AI adopting in internal auditing processes.

**Keywords:** Artificial Intelligence (AI), Internal auditing, Internal auditing Efficiency, Improving Risk Management.

## ملخص البحث:

**هدف الدراسة:** هدفت الدراسة إلى التعرف على أثر دمج تقنيات الذكاء الاصطناعي في وظائف التدقيق الداخلي في شركات التدقيق العاملة في المملكة العربية السعودية وركزت الدراسة على قياس الأثر الإيجابي لهذه التقنيات في تحسين الكفاءة التدقيق الداخلي وتحسين إدارة المخاطر، ولتحقيق هذا الهدف، حاول الباحثون الوقوف على أهم التحديات التي تواجه الشركات في تبني الذكاء الاصطناعي واقتراح عدداً من الآليات للتغلب على التحديات المرتبطة بتبني الذكاء الاصطناعي في عمليات المراجعة الداخلية.

**التصميم والمنهجية:** اعتمدت الدراسة على دراسة ميدانية شملت مجموعة من المراجعين والمستشارين الماليين وإحصائي تكنولوجيا المعلومات والعاملين في شركات التدقيق بالمملكة العربية السعودية، وشملت عينة الدراسة (84) استجابة صالحة للتحليل الإحصائي وتم تحليلها باستخدام برنامج SPSS لقياس العلاقة بين دمج الذكاء الاصطناعي وتحسين كفاءة التدقيق الداخلي وتحسين إدارة المخاطر، وكذلك اهتمت الدراسة بتحليل تأثير التحديات التي تواجه دمج تقنيات الذكاء الاصطناعي واقتراح عدد من الآليات للتغلب على التحديات المرتبطة بتبني الذكاء الاصطناعي في عمليات المراجعة الداخلية.

**النتائج:** كشفت نتائج الدراسة الميدانية عن وجود علاقة ذات دلالة إحصائية بين دمج الذكاء الاصطناعي في ممارسات التدقيق الداخلي وتحسين الكفاءة التدقيق الداخلي وتحسين إدارة المخاطر، كما أظهرت النتائج وجود تحديات متعلقة بتبني الذكاء الاصطناعي مثل قلة المهارات، والتكلفة العالية، ومقاومة التغيير تؤثر على سرعة وفعالية دمج هذه التقنيات، كما أظهرت نتائج الدراسة أن تبني استراتيجيات شاملة للتدريب وتقييم الأدوات يمكن أن يساهم في التغلب على هذه التحديات.

**الأصالة والإضافة:** تعتبر هذه الدراسة من الدراسات القليلة التي تركز على تأثير الذكاء الاصطناعي في ممارسات التدقيق الداخلي في المملكة العربية السعودية، وتسلط الضوء على الفوائد التي يمكن تحقيقها من خلال تبني هذه التقنيات في عمليات التدقيق، كما تقدم الدراسة عدداً من التوصيات لشركات المراجعة لتعزيز دمج الذكاء الاصطناعي والعمل على تجاوز التحديات المرتبطة بتبني الذكاء الاصطناعي في عمليات المراجعة الداخلية.

**الكلمات المفتاحية:** الذكاء الاصطناعي، التدقيق الداخلي، كفاءة التدقيق الداخلي، تحسين إدارة المخاطر.

## 1. Introduction

The internal auditing landscape is undergoing a significant transformation fueled by the Constructive potential of artificial intelligence. Accounting firms need to make critical choices to quickly adapt to new business landscapes. Using artificial intelligence (AI) in this decision-making process is vital for achieving maximum efficiency. AI is transforming how firms tackle problems and make decisions, mirroring the profound changes brought about by the Fourth Industrial Revolution. Audit firms are investing in cutting-edge technology, with leading firms like the "Big 4" pouring \$250 million annually into artificial intelligence development.(Musa & Lefkir, 2024) While subjective evidence suggests AI's transformative impact on audit efficiency, accuracy, and risk detection, (Cho et al., 2018) AI involves developing computer systems that can make informed decisions, understand their surroundings, and adapt to achieve objectives. These systems can analyze vast amounts of data to identify patterns and predict outcomes. Internal auditors can leverage AI to swiftly extract valuable insights from diverse data sources, aiding in evidence gathering. By fostering connections with stakeholders, internal auditors can gain a comprehensive understanding of the audit process's inputs.(Albawwat & Frijat, 2021), A dearth of empirical research, particularly in emerging economies like Saudi Arabia, hinders our understanding of its true effect. This research aims to bridge this gap by conducting an in-depth empirical study on the impact of AI on internal auditing processes within Saudi Arabian audit firms. The Kingdom of Saudi Arabia (KSA) presents a compelling research context. With Vision 2030 emphasizing diversification and technological advancement (Alotaibi & Alshehri, 2023), the acceptance of AI within Saudi Arabian businesses is expected to accelerate (Basri, 2020). This, coupled with the limited existing research on AI's impact on internal auditing processes in the region, necessitates a focused empirical investigation.

This study will leverage a multi-pronged approach, employing surveys and interviews with auditors, Financial Advisors, and IT specialists in KSA's leading auditing firms. By analyzing the data collected, we aim to:

- Quantify the level of AI adoption within the internal auditing processes of KSA audit firms.
- Identify the specific AI tools and techniques employed {e.g., Machine Learning (ML) and Natural Language Processing (NLP)}.
- Measure the perceived impact of AI on key audit objectives, such as efficiency, and improve risk management.
- Explore the challenges associated with AI adoption in internal auditing processes within the KSA context.

The findings of this research will contribute significantly to the academic literature on AI and internal auditing. By providing empirical evidence from an understudied region to the best of the researcher's knowledge, this study will inform both internal auditing professionals and regulators in KSA about the potential benefits and considerations when integrating AI into their audit processes. This research strives to enhance the effectiveness of internal auditing within Saudi Arabia, contributing to a more robust and efficient financial reporting ecosystem.

## 2. Literature review

(Wassie & Lakatos, 2024) This paper examines the burgeoning field of artificial intelligence applications in corporate internal auditing. The authors conducted a systematic literature review (SLR) to identify research gaps and propose a novel framework for effective AI integration. The review identified a scarcity of studies on AI in internal auditing, with a geographic concentration in specific regions. The prevalent use of the Technological-Organizational-Environmental (TOE) framework highlights the need for more comprehensive theoretical models. Empirical studies dominated, with case studies and surveys as primary data collection tools. The paper proposes a new comprehensive framework called CACS (Commitment, Access, Capability, and Skilling) for the effective use of AI in IAF. This framework addresses the key aspects necessary for successful AI implementation and utilization, including organizational commitment, access to data and systems, system capabilities, and the need for skill development among internal auditors. The paper emphasizes the need for further research in both theory and practice. It offers valuable insights for researchers and practitioners seeking to advance internal auditing processes in the face of evolving technology and regulations.

(Omoteso, 2012) This study explores the combination of artificial intelligence (AI), specifically expert systems (ES) and neural networks (NN), in auditing. It examines their development, advantages, and limitations, analyzing their influence on audit decisions and the profession's trajectory. The review highlights the potential of AI to improve audit efficiency and consistency. Where Expert Systems (ES) Improved decision-making, structured approach, Neural Networks (NN) help in Fraud prediction and pattern identification, However, challenges like over-reliance, ethical considerations, and the preservation of professional judgment remain.

(Carataş et al., 2018) This paper explores the multifaceted impact of artificial intelligence (AI) on the field of internal auditing. As AI technologies advance, auditors must adapt to leverage the opportunities and address the challenges presented by this evolving landscape. The paper emphasizes the importance for auditors to understand the fundamentals of AI to reshape their roles and prepare for the future of the profession. It categorizes AI into four distinct types (**Reactive Machines, Machines with Limited Memory, Machines with Theory of Mind, and Self-Aware Machines**) each with unique capabilities and applications relevant to internal auditing processes. These applications include automation, data scrutiny, and predictive modeling. The paper also explores the broader implications of AI adoption, including the potential for job automation and the need for educational systems to prepare future auditors. While the potential shift of auditors by AI is a concern, the paper argues that auditors who embrace AI and develop new skills can thrive in this new environment. The effective integration of AI in internal auditing promises to enhance the efficiency and effectiveness of audit processes. However, auditors must also be prepared to manage the associated risks, such as ethical dilemmas and cybersecurity threats.

(Ahmed Rizvan, 2022) This paper investigates the transformative impact of Artificial Intelligence on accounting and auditing. As disruptive technologies reshape industries in the age of the Fourth Industrial Revolution, the paper emphasizes the need for interdisciplinary research to guide the profession's future. Existing literature highlights the potential benefits of Artificial Intelligence in accounting and auditing, including increased efficiency, productivity, and accuracy. However, concerns regarding income inequality and job displacement are also addressed. Also, explores the historical development and cultural intrigue surrounding AI, tracing its evolution from early conceptions to contemporary advancements. It emphasizes AI's pervasive influence across diverse sectors, including agriculture, healthcare, automotive, and finance, highlighting its transformative potential for the accounting and auditing professions. This necessitates adaptation to the rapid pace of technological change, including the integration of AI, big data, and blockchain technologies. It Employs a semi-systematic review approach; the study analyzes relevant literature from 1992 to 2020. The focus is on understanding the current state and future implications of AI applications in accounting and auditing, along with the professional's readiness for these changes. Key findings identify several areas where AI is being applied, including expert systems, continuous auditing, decision support systems, neural networks, and machine learning. Additionally, the review explores the challenges and opportunities associated with these technologies, such as the need for regulatory frameworks, ethical considerations, and potential job market disruptions. Case studies of Big Four accounting firms implementing AI showcase strategic uses to enhance service offerings and operational efficiency. The paper concludes that while AI presents significant opportunities, a strategic and thoughtful approach to integration is vital. The profession must adapt by enhancing curricula, developing new skill sets, and embracing interdisciplinary collaboration. While AI automates tasks, the human element of professional judgment, creativity, and ethics remain crucial.

(Nicolau, 2023) This paper examines the transformative impact of Artificial Intelligence (AI) on internal auditing and accounting processes, The paper positions AI as a disruptive force, mirroring past revolutions (Industrial, Digital), with its unique ability to learn, adapt, and mimic human cognition. This sets the stage for AI's potential to reshape the financial landscape. It highlights the growing traction of AI in financial services, particularly audit and accounting, highlighting the shift from rule-based fraud detection systems to sophisticated machine learning algorithms capable of analyzing vast datasets. This integration empowers more detailed and accurate financial analyses, uncovering anomalies and predicting trends with greater precision. The study used simulated data and linear regression to assess the correlation between AI implementation and audit efficiency. The findings reveal a strong positive association, suggesting considerable time savings with higher AI integration. This underscores AI's potential to streamline audits while enhancing analysis accuracy and depth. Also, it emphasizes AI's potential to

automate routine tasks, freeing up professionals to focus on higher-value activities like strategic analysis and client interactions. However, the paper underscores the critical role of data quality, stressing the need for digitized financial records and data integrity for optimal AI functionality. AI promises to revolutionize traditional processes. However, realizing this potential requires a strategic approach that includes technology investment, continuous professional development, and upholding the core values of trust and integrity within the profession.

(Shapiro, 2020) This study investigates the growing pressures faced by internal auditing processes in large organizations. It identifies the expanding role of internal auditing, which now includes a broader range of assurance activities beyond just financial auditing. These activities encompass risk management, compliance, and governance. A key challenge highlighted by the study is the overwhelming volume of data and reports that internal auditors must process. This "data deluge" can result in a situation where auditors are "data rich, information poor", The abundance of data can obscure critical emerging risks. The study emphasizes the 2017 International Standards for the Professional Practice of Internal Auditing, which advocates technology's role in enhancing audit efficiency and effectiveness. The core of this research introduces AuditMap.ai, an AI-powered platform designed to improve the internal auditing process. This platform utilizes machine learning to analyze, classify, and read vast amounts of audit reports in various languages. This allows auditors to quickly identify and organize relevant information, accelerating audit planning and execution, leading to improved audit quality and faster response times. The study acknowledges the limitations and challenges associated with AI adoption in internal auditing. These include potential issues with machine learning model precision and recall, susceptibility to bias, and the possibility of missing critical information not captured in the audit data sets. However, the study argues that the benefits of AI integration outweigh these risks, especially when auditors are equipped with the knowledge to understand and mitigate these limitations. The study concludes by emphasizing that AI is not meant to take the place of auditors, but rather to augment their capabilities, similar to the impact of spreadsheets and word-processing tools. The future of internal auditing and risk management lies in AI's assistive role, enabling auditors to conduct more frequent and broader coverage audits, achieving the vision of continuous auditing.

(Mohammed Ali et al., 2022) The study investigated how Artificial Intelligence (AI) is transforming internal auditing in today's increasingly digital business world. Traditional auditing methods, designed for a bygone era, struggle to oversee the massive data volumes and real-time analysis needs of modern companies. This research explored how AI can revolutionize internal auditing, making it faster, more accurate, and offering deeper insights. The paper conducted a survey, sending questionnaires to a diverse group of professionals

including internal auditors, external auditors, accountants, academics, and financial managers. By analyzing the data statistically, they aimed to understand the impact of AI techniques on internal auditing activities. The findings were clear: a strong correlation existed between AI adoption and improved internal auditing. The vast majority of respondents agreed that AI technologies like machine learning and neural networks offered significant advantages. These tools could analyze vast amounts of data, assess risks more effectively, and even enable continuous monitoring. However, the study stressed a crucial point: for auditors to leverage these powerful tools effectively, proper training in AI is essential. The study paints a clear picture: AI has the potential to be a significant change in internal auditing. By providing tools for faster, more accurate, and more insightful audits, AI can transform the profession. The research emphasizes the need for the auditing profession to embrace AI and adapt to the evolving business landscape. It also recommends developing training programs for auditors on AI and establishing frameworks to ensure the responsible use of this powerful technology in the critical field of auditing.

(M. S. Rashwan & M. S. Alhelou, 2022) This study delved into the effectiveness of Artificial Intelligence (AI) within the internal auditing process of the Palestinian government sector. The focus was on how AI impacts three crucial areas: risk management, control systems, and governance. The study employed a descriptive-analytical approach, distributing questionnaires to internal auditors working across various Palestinian government ministries. By analyzing the data statistically, they aimed to understand the impact of AI on internal auditing. The study suggests that AI significantly improves the efficiency and effectiveness of audits, leading to better internal auditing services and reduced risks. But the benefits go beyond efficiency. For risk management and evaluation, AI is a significant change. Auditors equipped with AI tools were found to be more effective in identifying and mitigating risks. This translates to higher quality audits and less exposure to potential threats. Internal control systems also benefit from AI. AI tools facilitate a more thorough examination and evaluation, allowing auditors to detect weaknesses and implement timely solutions. This, in turn, strengthens the overall effectiveness of internal controls. The impact extends to governance procedures as well. The study suggests that AI integration promotes transparency, accountability, and efficient resource utilization. These factors contribute to more reliable management processes and financial reporting within the Palestinian government sector. The study paints a clear picture: AI holds significant potential for the internal auditing process in the Palestinian government sector. By enhancing risk management, control systems, and governance mechanisms, AI can lead to better results in terms of efficiency, quality, and risk mitigation. These findings highlight the importance of embracing AI technologies in government auditing processes.

(Schreyer et al., 2022) The study investigates the transformative potential of Artificial Intelligence (AI), particularly Deep Learning, in enhancing internal auditing processes. The ever-growing complexity of business processes and Enterprise Resource Planning (ERP) systems have introduced significant challenges for internal auditors. Traditional audit processes struggle to efficiently analyze the vast amount of complex data generated by modern organizations. The study aims to demonstrate how Deep Learning can revolutionize internal auditing by offering a more accurate, efficient, and objective approach to risk and irregularity identification. Through a practical case study from a major corporation (Nestlé S.A.), the research highlights the effectiveness of deep autoencoder neural networks in identifying anomalies in journal entries that evaded traditional audit methods. This finding underscores the transformative potential of Deep Learning to revolutionize internal auditing through (Enhanced Efficiency, Improved Accuracy, Continuous Monitoring, and Deeper Insights). However, the integration of AI in audit processes necessitates a balanced approach. Legal, ethical, and data privacy concerns remain crucial considerations. Continuous learning and adaptation by internal auditing professionals are paramount to ensure responsible and effective utilization of this powerful technology.

(Hamza et al., 2024). The study investigates the profound implications of AI on accounting processes within Saudi Arabia, it delves into how AI technologies are reshaping traditional accounting methodologies and propelling financial management in the Kingdom. It underscores the transformative potential of AI in processing vast amounts of data with exceptional speed and accuracy. This capability not only streamlines accounting processes but also facilitates improved financial analysis, risk assessment, and forecasting. By enabling more strategic business decisions, AI has the potential to enhance overall financial performance. The study employs a survey methodology, distributed amongst key stakeholders encompassing accounting professionals, technology specialists, and business leaders, The study's key findings illuminate the numerous benefits of AI integration, including cost-effectiveness, enhanced accuracy, and increased efficiency in accounting processes. AI's ability to automate repetitive tasks, such as data entry and reconciliation, frees up valuable human resources for more complex analytical roles. This not only boosts productivity but also diminishes the margin of error inherent in manual processes. Furthermore, AI-driven data analysis empowers real-time financial insights, facilitates proactive risk management, and improves the accuracy of financial forecasting. Also, the study acknowledges the challenges and ethical considerations associated with AI combination, including data security, privacy concerns, and the potential impact on job markets within the accounting job.



## **Summary of Literature Review**

The existing literature paints a compelling picture of Artificial Intelligence (AI) as a transformative force for internal auditing. This exciting technology promises to revolutionize the profession by boosting efficiency, enhancing accuracy, and uncovering deeper insights.

- **Efficiency gains** are anticipated through AI's ability to automate repetitive tasks like data analysis, freeing auditors to focus on higher-level strategic activities and client interaction (Shapiro, 2020; Mohammed Ali et al., 2022; Hamza et al., 2024).
- **Accuracy improvements** are expected due to AI's ability to analyze vast datasets, leading to more insightful audits. Machine learning algorithms can identify anomalies and patterns that might escape traditional methods (Schreyer et al., 2022; Nicolau, 2023; Mohammed Ali et al., 2022).
- **Deeper insights** are facilitated by AI's ability to conduct continuous monitoring and real-time risk assessment, allowing auditors to proactively recognize and mitigate potential threats before they escalate (M. S. Rashwan & M. S. Alhelou, 2022; Schreyer et al., 2022).

While existing research acknowledges the transformative potential of Artificial Intelligence (AI) for internal auditing, a critical gap remains in the context of the Kingdom of Saudi Arabia. Specifically, To the best of the researchers' knowledge, there is a complete absence of studies that explore the impact of AI on internal auditing processes within this unique region. This research aims to fill this crucial knowledge gap by investigating the practical application and potential benefits of AI for internal auditors operating in Saudi Arabia.

This lack of regional research presents a significant opportunity to contribute to the field. By studying the specific challenges and opportunities surrounding AI adoption in Saudi Arabia's internal auditing landscape, this research can offer valuable insights that may not be generalizable from studies conducted in other regions. The findings of this research will have significant implications for internal auditors, organizations, and policymakers seeking to harness the transformative power of AI for enhanced internal control and risk management.

## **3. Theoretical framework and development of hypotheses**

### **3.1. AI and internal auditing efficiency**

Internal auditing serves as a critical function within organizations, primarily focused on examining accounting processes, and financial transactions, and assessing internal control systems and risk management frameworks. Traditionally linked to upper management or audit committees (Al-Tae, S. H. H., & Flayyih, 2023), internal auditing has been defined as an independent, internal assurance and referring activity intended to add value and develop an organization's operations. It helps an organization achieve its

objectives by bringing a systematic, disciplined approach to appraise and improve the effectiveness of risk management, internal control, and processes of governance. (Hazaea, S. A., Al-Matari, E. M., Khatib, S. F., Albitar, 2023). The advent of technological advancements, particularly artificial intelligence (AI), has significantly transformed the landscape of internal auditing. AI technologies offer a range of tools and techniques that can enhance the efficiency and effectiveness of audit processes. Expert systems, for instance, leverage knowledge-based systems to mimic the reasoning of human experts, aiding auditors in identifying anomalies and suggesting corrective actions (Mohammed, Eman Jasem, 2022). Natural language processing (NLP) enables computers to understand and interpret human language, allowing auditors to analyze unstructured data such as textual documents and contracts more efficiently (Oyewole, A. T., et.al 2024) Machine learning algorithms have also become integral to internal auditing, enabling the automation of tasks such as data analysis, anomaly detection, and predictive modeling (Adelakun, B. O., Fatogun, D. T., Majekodunmi, T. G., & Adediran, 2024). By leveraging these technologies, internal auditors can enhance the quality and timeliness of their work, detect potential risks more effectively, and provide more value to their organizations. The integration of AI into internal auditing processes not only transforming the profession but also elevating the role of auditors as strategic business partners. These efficiency gains can ultimately contribute to a more effective and agile internal auditing function. Artificial intelligence (AI) represents the development of intelligent agents, systems capable of perceiving their environment, reasoning, learning, and taking actions to achieve specific goals. These systems process vast amounts of structured and unstructured data to generate insights and make decisions, similar to human cognitive processes. The economic impact of AI has been substantial, with projections indicating a market value of \$15 billion by 2030 (Palomares et al., 2021). AI's core functionality arises from the integration of software and hardware, simulating human brain processes to enable complex decision-making. By automating repetitive tasks, AI-powered solutions enhance accuracy and improve the quality of internal auditing processes (Yoon, 2020). The ultimate aspiration of AI is to replicate human intelligence in machines, allowing for cognitive processes such as understanding, reasoning, and learning (Lee & Tajudeen, 2020). The integration of artificial intelligence (AI) presents a significant opportunity to enhance the efficiency of internal auditing processes. By mechanizing regular and time-consuming duties, AI techniques can free up auditor resources to focus on higher-value activities. For instance, AI-powered tools can expedite data collection in an accurate manner, cleansing, and analysis, reducing The amount of time dedicated to these

preliminary stages of the audit process (Ucoglu, 2020). Additionally, machine learning algorithms can be employed to identify patterns and anomalies within large datasets, enabling auditors to pinpoint potential risks more accurately (Almufadda & Almezeini, 2022). Moreover, AI-driven automation of document review and analysis can streamline the audit process, allowing auditors to allocate more time to assessing complex risks and providing strategic insights. By increasing efficiency, the internal auditing function can become more dynamic and productive. These arguments lead to the following hypothesis:

**H1: There is a statistically significant relationship between AI techniques integration within internal auditing processes and the improvement of internal auditing efficiency.**

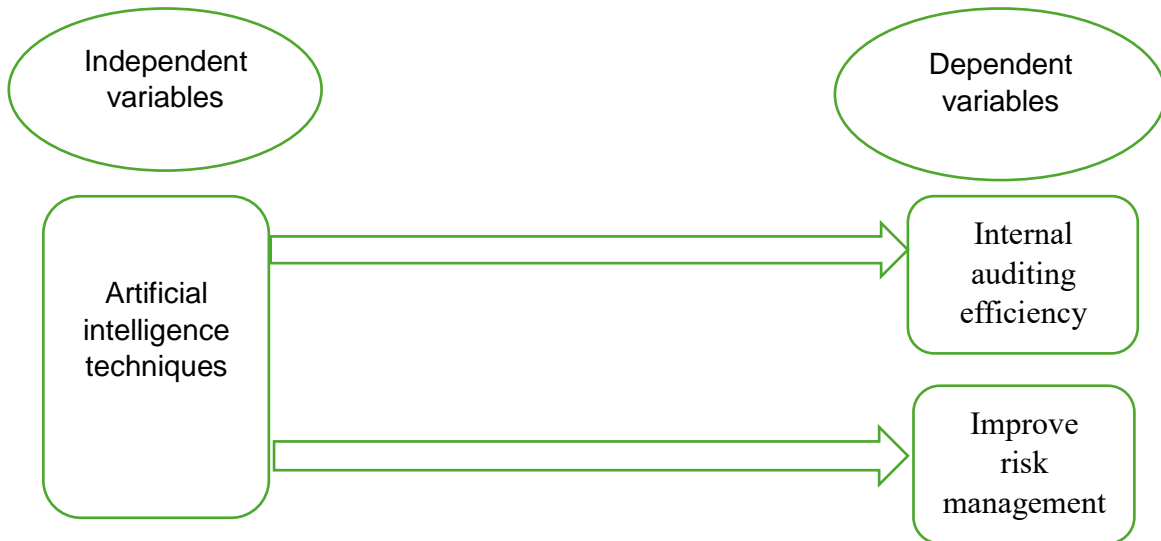
### 3.2. AI and Risk Management in Internal Auditing

Artificial Intelligence plays a crucial role in improving risk management within the function of internal auditing. By utilizing AI techniques such as Machine Learning algorithms, which in turn identify errors in cases of anomalies, manipulation, and fake and the creation of dynamic panels of digital devices and comparing them with indicators identified by the auditor, (Cockburn et al., 2018). through Natural Language Processing reading receipts and payments, financial records, adjustments, etc., and then matching pre-defined texts by auditors to prepare samples for items of relative importance.(Almufadda & Almezeini, 2022) Additionally, AI is utilized to extract data, detect anomalies or inconsistencies, analyze data patterns, generate specific alerts, and flag high-risk information related to evaluations, stock levels, and adjustments, (Demir & Demir, 2023), and Neural Network excels at processing vast quantities of data to identify underlying patterns. Their facility to learn from examples makes them ideal for tackling complex problems with limited or unclear solutions, provided sufficient training data is accessible. Internal auditing teams can enhance their risk assessment processes. (Mohammed Ali et al., 2022) AI's applications can analyze big amounts of data quickly and accurately, identifying patterns and anomalies that humans might overlook. This enables internal auditors to detect potential risks more effectively and efficiently. Moreover, AI can automate routine tasks like data collection and analysis, allowing auditors to focus on more strategic and improved risk management activities. (M. S. Rashwan & M. S. Alhelou, 2022) However, despite its benefits, the use of AI in risk management also poses challenges such as data privacy concerns, algorithm bias, and the need for auditors to understand and validate AI-generated insights. Therefore, internal auditing processes need to carefully integrate AI into their improved risk management processes while

ensuring proper oversight and validation mechanisms are in place. (Cho et al., 2018). These points suggest the following hypothesis:

**H2: There is a statistically significant relationship between AI techniques integration within internal auditing processes and improving risk management in internal auditing.**

**We can summarize the model of study as follows:**



Model Prepared by researchers

### 3.3. AI Challenges and Opportunities in Internal Auditing

The integration of artificial intelligence (AI) within the internal auditing function represents a transformative potential to elevate the profession. AI technologies, such as machine learning, natural language processing, and robotic process automation, offer a myriad of opportunities to enhance audit efficiency, effectiveness, and risk management. For instance, AI-driven data analytics can be employed to identify anomalies, trends, and patterns in vast datasets, enabling auditors to uncover hidden risks and potential fraud schemes more effectively (Li, O., & Wu, 2021). Additionally, AI-powered chatbots and virtual assistants can streamline communication and knowledge sharing within the audit team, facilitating collaboration and accelerating the audit process (Wassie & Lakatos, 2024). Moreover, the automation of routine tasks through robotic process automation (RPA) can free up auditor time for higher-value activities, such as risk assessment, fraud investigation, and consulting services.

However, the realization of AI's full potential in internal auditing is contingent upon overcoming a series of complex challenges. Data quality, integrity, and accessibility remain critical prerequisites for successful AI implementation. Insufficient or inaccurate data can lead to biased models and compromised audit results. Furthermore, the ethical implications of AI,

including issues of algorithmic bias, privacy, and transparency, require careful consideration to maintain public trust and confidence in the audit function (Argyres, N., Bertomeu, J., & Li, 2020). The development and deployment of AI-based audit tools necessitate substantial investments in technology, human capital, and organizational change management. Additionally, the potential displacement of human auditors due to automation raises concerns about job security and the need for upskilling and reskilling of the audit workforce. Driven decision-making, including issues of bias and accountability, demands careful consideration (Argyres, N., Bertomeu, J., & Li, 2020). These arguments lead to the following hypothesis:

**H3: There is a statistically significant relationship between the challenges facing audit firms and the adoption of AI techniques within internal auditing processes.**

#### 3.4. Mechanisms to Address the Challenges of AI Integration in Internal Auditing

- **There are challenges to AI integration in internal auditing such as:** (Alattas, 2023; M. S. Rashwan & M. S. Alhelou, 2022; Mohammed Ali et al., 2022; Zhang et al., 2020)

- The implementation of AI in internal auditing processes will be hindered by the lack of a skilled workforce capable of developing and managing AI-powered tools.
  - The high cost of acquiring and maintaining AI technologies will limit the adoption of AI in smaller organizations and developing countries.
  - Concerns over data privacy and security will pose significant challenges to the widespread use of AI in internal auditing processes.
  - The reliance on AI algorithms may lead to a reduction in human judgment and critical thinking within the internal auditing function.
  - The potential for bias in AI algorithms could lead to unfair or discriminatory audit outcomes.
  - The combination of AI into existing internal auditing processes and systems will require significant organizational change and resistance management.
  - The reliance on AI may reduce the development of auditors' analytical and problem-solving skills.
- **To overcome these challenges, propose the following mechanisms**
- Providing internal auditors with the expertise to leverage AI tools for risk identification, in-depth and expedited data analysis, and attracting and retaining top-tier professionals to bolster the team's technical prowess
  - developing a comprehensive strategy for integrating artificial intelligence into operational processes, starting with identifying core

- needs, then evaluating available tools and software options, and selecting the optimal solutions in terms of cost-benefit analysis.
- Developing and implementing a comprehensive security system to safeguard data from unauthorized breaches and guaranteeing adherence to privacy laws and regulations.
  - Conducting periodic assessments of auditing algorithms to ensure their alignment with technical and operational standards and to verify their freedom from any biases that could impact audit outcomes, thereby guaranteeing the fairness of the process
  - conducting regular human-in-the-loop reviews of AI-generated outputs to ensure accuracy, and objectivity, and to mitigate risks associated with over-reliance on intelligent models, thereby enhancing confidence in decisions based upon them
  - Developing A holistic change management framework for successful AI adoption, focusing on readiness assessment, goal setting, implementation planning, and performance evaluation
  - developing precise performance indicators to measure the effectiveness of AI tools in achieving desired objectives
  - providing a detailed and clear explanation of how AI tools function and how they impact audit outcomes, to increase transparency and trust in these tools and enhance internal auditors and management's understanding of their use.
  - Conducting regular evaluations of tools and techniques to assess their alignment with evolving needs and undertaking periodic updates to enhance their capabilities and improve the quality of their outputs

These arguments lead to the following hypothesis.

**H4: There is a statistically significant relationship between the adoption of specific mechanisms proposed by researchers and overcoming AI techniques adoption challenges in internal auditing processes.**

### 3.5. AI Techniques in Big 4 Firms

The Big Four accounting firms – Deloitte, EY, KPMG, and PwC – have long been at the forefront of the auditing industry. These firms have traditionally relied on human expertise and manual processes to conduct audits. However, the advent of artificial intelligence (AI) is rapidly transforming the auditing landscape. We can summarize the AI platforms used by Big-4 for internal auditing processes as follows:

#### 3.5.1. Deloitte and Artificial Intelligence for Internal Auditing

Among the most significant artificial intelligence techniques employed by the company in its internal auditing processes are IDO, Argus, and Grapa.

**IDO**, is an advanced technique that expands the scope of the internal auditor's work, analyzing large volumes of data and improving the speed and quality of decision-making while reducing costs. (Zhang et al., 2020).

**Argus**, a dedicated auditing application, leverages human interactions, advanced machine learning, and natural language processing to automatically identify and extract necessary accounting information from electronic documents. This innovation earned the company the International Accounting Journal's Best Innovation in Auditing Award in 2018 for its contribution to modernizing internal auditing processes. (Zemankova, 2019).

**Grapa**, a personal risk assessment assistant, aids internal auditors in comparing their strategies with other risk strategies and working with a vast dataset of over 1000 cases, each containing more than 50 risks. These AI techniques have enabled the company to broaden its audit scope and ensure the examination of massive amounts of data, resulting in high-quality findings. (Zemankova, 2019).

#### 3.5.2. Earnst & Young (EY) and Artificial Intelligence for Internal Auditing

Ernst & Young has invested significantly in artificial intelligence technologies to enhance the quality and efficiency of its internal auditing services and bolster client confidence. Key applications employed by EY in the internal auditing domain include EY Canvas and EY Helix.

**EY Canvas** is a pioneering end-to-end electronic platform for internal auditing. It facilitates seamless connections between internal auditors and clients, enabling consistent audits and allowing auditors to focus more on potential risks. Moreover, it streamlines the audit process, reducing the time spent on administrative tasks. (Akkaşa, H., Bouchriba, B., & Mohammed, 2024)

**EY Helix** is a powerful tool designed to analyze vast quantities of audit-related data. By providing clear insights into business operations and financial transactions, Helix plays a pivotal role in internal auditing processes. It aids in proactive risk assessment, identification, and handling of complex data and processes. (Akkaşa, H., Bouchriba, B., & Mohammed, 2024) Through the adoption of these AI-driven technologies, EY aims to minimize the time auditors spend on low-value tasks by leveraging analytical tools and intelligent automation to automate time-consuming activities. This strategic shift allows auditors to concentrate on more complex tasks such as risk assessment and identification. Furthermore, EY seeks to enhance transparency in its audit outcomes.

#### 3.5.3. KPMG and Artificial Intelligence for Internal Auditing

KPMG has positioned artificial intelligence as a comprehensive ecosystem underpinning all its operations (Siddiqui, 2024) The firm has invested over

\$5 billion in adopting innovative AI technologies, with a particular focus on data analytics for audit execution. This significant investment has solidified KPMG's position as the leading global auditing firm in technology-driven audit solutions (Srirejeki, K., & Liang, 2024). Key AI technologies employed by KPMG that have significantly impacted internal auditing include:

**KPMG Ignite** is a patented platform that combines machine learning, deep learning, document ingestion, and natural language processing. Applied to files, lists, and images, it enhances accuracy, accelerates decision-making, automates processes, and improves risk management. (KPMG Ignite).

**IBM Watson**, KPMG has integrated IBM's Watson cognitive computing technology into its audit processes. Watson enables auditors to understand digital data and extract critical information rapidly and accurately. It also reduces time-consuming tasks such as manual data collection and preparation (Mirchandani et al., 2020).

**KPMG Clara**, as a scalable cloud-based platform, KPMG Clara provides a structured approach for internal auditors and offers clients real-time visibility into audit status and potential risks. It represents a significant technological advancement in the audit domain (Siddiqui, 2024).

By utilizing the power of AI, KPMG is transforming the internal auditing function. These technologies enable auditors to work more efficiently, improve the quality of their work, and deliver more reliable results. Ultimately, KPMG's AI-driven approach empowers auditors to make more informed and data-driven decisions.

#### 3.5.4. Price Waterhouse Coopers (PwC) and Artificial Intelligence for Internal Auditing

PwC is a leading global professional services firm that has embraced artificial intelligence as a core component of its internal auditing practice. The firm has developed several innovative AI-driven solutions to enhance internal auditing efficiency and effectiveness. As follows:

**GL.ai**, This AI-powered robot leverages machine learning to mimic the knowledge and expertise of a highly experienced human auditor. By learning from historical data, GL.ai can automate decision-making processes, leading to significant efficiency gains. PwC was recognized for this innovation with the 2017 Best Innovation in Audit Award from International Accounting Publication (Zhang et al., 2020).

**Cash.ai**, This intelligent technology automates the audit of financial transactions, including bank reconciliations and foreign exchange. Cash.ai has been instrumental in PwC's success, earning the firm the Best Innovation in Audit Award in 2019 (Zemankova, 2019).



**Halo**, as an analytical platform, Halo directly collects data from clients' financial information systems and performs advanced analytics to improve risk management (Akkaşa, H., Bouchriba, B., & Mohammed, 2024).

Through these AI-driven initiatives, PwC aims to provide intelligent automation to support auditors in achieving accurate results. By automating routine tasks and enabling advanced analytics, PwC's AI solutions empower auditors to analyze complex data sets and make more informed decisions.

## **4. Research Methodology**

The study aims to test the study hypotheses, by identifying the opinions of the Study population on questions related to the impact of artificial intelligence in enhancing internal auditing processes in the Kingdom of Saudi Arabia. It includes the study tool, study sample, information collection, response rate, description of the study sample, study answer scales, verifying the validity and reliability of the survey, and testing the study hypotheses.

### **4.1 Sample Description and Data Collection**

#### **4.1.1 Study tool:**

To achieve the research objective, which is the impact of artificial intelligence in enhancing internal auditing processes in the Kingdom of Saudi Arabia, In the beginning, before preparing the survey list, the researchers conducted several personal interviews with some representatives of the sample, to benefit from their opinions on the research trend and type and to identify the questions most related to the research purpose. Then, after preparing the list, the researchers conducted several personal interviews and communicated via electronic means of communication, to answer some inquiries from the respondents, especially regarding some questions, to ensure the accuracy and integrity of the answers to these questions. The researchers prepared a survey list to collect data from sample members. The survey list was designed using a five-point Likert scale, when designing the questions, it is crucial to ensure their clarity, comprehensibility, and ability to validate or refute the hypotheses.

#### **4.1.2 Study sample, information collection, and response rate:**

The study relied on a questionnaire administered to various categories of employees in Saudi Arabian auditing firms, including a group of auditors, financial advisors, IT specialists, and others. Information was collected after sending the survey link via electronic communication means. The researchers received (84) correct responses as follows:

Table (1): The Number of Valid Responses for Each Category

Categories	Received responses	Rejected responses	Correct responses	
			Number	Percentage%
Auditor	43	-	43	51.2
Financial Advisor	17	1	16	19.0
IT Specialist	28	3	25	29.8
Total	88	4	84	100.0

#### **4.1.3 Description of the study sample:**

The following table shows the description of the study sample according to each job, and years of experience.

Table (2): The study sample according to each of the job, and years of experience.

Categories		Number	Percentage %
Job	Auditor	43	51.2
	Financial Advisor	16	19.0
	IT Specialist	25	29.8
	Total	84	100.0
Years of experience	More than 10	30	35.7
	From 5 to 10 years	38	45.2
	Less than 5 years	16	19.1
	Total	84	100.0

#### **4.2 Statistical analysis methodology and statistical methods used.**

##### **4.2.1 Study response scales:**

The following table shows the study response scales as follows:

Table (3): Study response scales

Response	Weighted average	General trend
Strongly disagree	from 1 to 1.8	Strongly disagree
Disagree	from 1.81 to 2.6	Disagree
Neutral	from 2.61 to 3.4	Neutral
Agree	from 3.41 to 4.2	Agree
Strongly agree	more than 4.2	Strongly agree

#### 4.2.2 Statistical methods used in data analysis:

The survey list consists of two parts:

- a. **The first part:** includes the personal data of the respondents in terms of job and number of years of experience.
- b. **The second part:** includes four two sections:
  - Section One: aims to identify some descriptive data on the extent to which auditing companies in the Kingdom of Saudi Arabia rely on artificial intelligence technologies and tools and techniques used in internal auditing operations and their opinions on the use of these technologies in the future.
  - Section Two: It includes four dimensions:
    - Dimension One (H1): This represents the aggregated variable for the average of the first hypothesis's (10) questions.
    - Dimension Two (H2): Represents the aggregated variable for the average of the second hypothesis's (5) questions.
    - Dimension Three (H3): This represents the aggregated variable for the average of the third hypothesis's (9) questions.
    - Dimension Four (H4): This represents the aggregated variable for the average of the fourth hypothesis's (9) questions.

To achieve the objectives of the study, the data were analyzed by using SPSS version 25 using the following statistical tools:

- Descriptive Statistics Measures: Extracting the mean and standard deviation.
- Ensuring the reliability of the survey items: Using Cronbach's Alpha coefficient.
- Ensuring construct validity and internal consistency: Calculating the Pearson Correlation coefficient.
- Testing the normality of data distribution: Using the Kolmogorov-Smirnov test.
- One Sample T-test indicates the statistical significance of statements that are less than (0.05), which indicates that there are significant differences in the opinions of those surveyed between (calculated Value) and the (critical value = 3), which represents a neutral choice.
- One-Way ANOVA test to examine the existence of statistically significant differences among the responses of the sample participants.

### 4.3 Description of the audit firms' adoption of AI techniques:

Table (4): Description of the audit firms' adoption of AI techniques

Question	The options available according each question Statement	Number	Percentage
Does your company use AI techniques in internal auditing?	Yes	60	71.4
	No	24	28.6
	Total	84	100.0
If yes, how long has your company started adopting AI in internal auditing?	From one to 5 years	46	54.8
	Less than a year	15	17.9
	More than 5 years	10	11.9
	Not applied	13	15.4
	Total	84	100.0
What is the level of use of AI in your company?	Fully Used	4	4.8
	In the trial phase	4	4.8
	Partially used	38	45.2
	Unused	20	23.8
	Very little used	18	21.4
	Total	84	100.0
What AI tools and techniques does your company use in internal auditing?	Natural Language Processing	5	6
	Analytical and Predictive Tools	6	7.1
	Big Data Analytics	5	6.0
	Expert Systems	25	29.8
	Machine Learning	5	6.0
	Neural Networks	10	11.9
	Other	5	6.0
	Smart Financial Analysis Tools	8	9.5
	Unused	15	17.9
	Total	84	100.0
Do you think audit firms in the Kingdom will promote the use of AI in internal audit in the coming years?	Yes, it will be used very heavily	27	32.1
	Yes, it can be used	57	67.9
	Total	84	100.0

From Table (4), the following can be observed:

- **Use of AI techniques in internal auditing:** The results indicate that 71.4% of auditing firms use AI techniques in their internal auditing processes, suggesting that the majority of companies have already begun adopting these technologies to enhance their efficiency.
- **Duration of AI adoption:** 54.8% of companies using AI techniques have adopted it within the past five years, since 17.9% have started using it within the last year, this reflects a strong trend towards adopting AI techniques, Additionally, 11.9% of companies have been using AI techniques for more than five years, indicating that some firms were early adopters of AI techniques.
- **Level of AI usage:** The results show that 45.2% of auditing firms use AI partially, indicating that many companies are still in the early stages of fully integrating this technology into their operations, The results also indicate that 23.8% of auditing firms do not use AI at all, and 21.4% use it very minimally, reflecting a wide variation in the level of AI utilization among companies.
- **AI tools and techniques used in internal auditing:** The results show that expert systems are the most commonly used, accounting for 29.8%, followed by neural networks at 11.9%, and smart financial analysis tools at 9.5%, The study also shows that small percentage of companies use other techniques, such as natural language processing, predictive analytics, and big data analytics, reflecting a diversity of tools being employed.
- **Future expectations for AI usage:** The results show that 32.1% believe AI will be used intensively in the coming years, while 67.9% of participants think AI could be used more extensively in internal auditing in the future, reflecting positive expectations for the future of these technologies. It is evident from the above that there is significant variation among auditing firms in terms of adopting and utilizing AI techniques in internal auditing. Most companies have started using these technologies in recent years, but

there is a wide disparity in both the level of usage and the types of tools employed. AI usage in internal auditing is expected to expand in the future, as most participants believe that these technologies will play a larger role in the years to come.

#### 4.4 Reliability and Validity of the Survey:

The reliability of the survey was verified using (Cronbach's Alpha) coefficient for all items and sections of the survey. Additionally, the construct validity and the consistency of the scores of the survey questions and statements with the overall score of the main section, representing the study's hypotheses, were assessed using Pearson's Correlation Coefficient. The results were as follows:

Table (5): Results of the Validity and Reliability Tests of the Study's Hypotheses

hypothesis	Number of statements	Reliability Coefficient (Cronbach's Alpha)	Validity Coefficient (Pearson Correlation)	p-value (sig.)
(H1)	10	0.803	0.867**	.000
(H2)	5	0.789	0.841**	.000
(H3)	9	0.799	0.839**	.000
(H4)	9	0.859	0.837**	.000

The previous table indicates the following:

- **Survey Reliability:** The reliability of the survey was verified using (Cronbach's Alpha) coefficient. The results showed that the reliability coefficients were high for each section of the survey, ranging between (0.789) and (0.859), with an overall reliability of (0.925) for all survey items. This indicates high reliability, which is statistically significant, making it suitable for analyzing results and testing the study's hypotheses.
- **Construct Validity:** The construction validity of the survey was assessed by calculating Pearson's Correlation Coefficient for all sections of the survey. The results showed that the correlation coefficients for all sections were statistically significant at the significance level ( $\alpha \leq 0.05$ ), with correlation values ranging between (0.837) and (0.867). Therefore, internal consistency validity was confirmed for all sections of the survey.

#### 4.5 Tests of Normality:

Table (6): Results of the Normality Test

Variable	Kolmogorov-Smirnov Statistic	Sig.
H1	0.096	0.055
H2	0.091	0.081
H3	0.098	0.073
H4	0.095	0.060

The Kolmogorov-Smirnov test was used to assess whether the data follows a normal distribution or not. The results were as follows:

From the previous table, the p-value (sig.) for all sections of the study is greater than the significance level (0.05). This indicates that the distribution of data for these sections follows a normal distribution; therefore, parametric statistical methods can be used to test the study's hypotheses.

#### 4.6 Results of Research Hypotheses Test:

##### 4.6.1 Results of The First Hypothesis Test:

**H1: There is a statistically significant relationship between AI techniques integration within internal auditing processes and the improvement of internal auditing efficiency.**

Table (7): Responses of the Study Sample to the Statements Measuring the First Hypothesis

VAR	Variable Description		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Standard Deviation	One-Sample Test		Ranking
										T	Sig.	
H11	High ability to process huge amounts of input data quickly and accurately.	N	44	38	2	0	0	4.5	0.549	25.05	.000	1
		%	52.4	45.2	2.4	0	0					
H12	Use machine learning techniques to detect unusual patterns, which helps detect errors and deviations.	N	31	49	4	0	0	4.32	0.563	21.51	.000	3
		%	36.9	58.3	4.8	0	0					
H13	Save auditors time to focus on the most complex tasks that require professional judgment.	N	34	41	9	0	0	4.30	0.655	18.17	.000	4
		%	40.5	48.8	10.7	0	0					
H14	Make more accurate recommendations due to continuous learning of AI. Easy and quick decision-making due to accurate and instant reports provided by AI.	N	31	49	4	0	0	4.32	0.563	21.51	.000	3
		%	36.9	58.3	4.8	0	0					
H15	Easy and quick decision-making due to accurate and instant reports provided by AI.	N	42	32	10	0	0	4.38	0.693	18.28	.000	2
		%	50	38.1	11.9	0	0					
H16	Improve compliance with laws, regulations, and standards through automatic and regular verification of compliance.	N	28	44	12	0	0	4.19	0.667	16.35	.000	6
		%	33.3	52.4	14.3	0	0					
H17	Provide smart interactive interfaces to help answer auditors' queries quickly and efficiently.	N	26	43	14	1	0	4.12	0.718	14.28	.000	8
		%	31	51.2	16.7	1.2	0					
H18	Enhance collaboration between internal auditing teams and other departments through data exchange and analysis.	N	27	39	18	0	0	4.11	0.728	13.93	.000	9
		%	32.1	46.4	21.4	0	0					
H19	Improve the quality of audit reports by performing deeper, complex data analytics.	N	29	40	15	0	0	4.17	0.709	15.09	.000	7
		%	34.5	47.6	17.9	0	0					
H110	Improves the ability of auditors to conduct predictive analysis and identify emerging risks	N	34	40	10	0	0	4.29	0.669	17.62	.000	5
		%	40.5	47.6	11.9	0	0					
Weighted Mean			4.2690									
Total Standard Deviation			.3930									

The following can be concluded from Table (7):



- Results of the analysis for the first dimension related to the first hypothesis: The analysis included 10 statements, with the mean scores ranging from 4.11 to 4.5. The statement "High ability to process huge amounts of input data quickly and accurately" received the highest mean score of 4.5, while the statement "Enhance collaboration between internal auditing teams and other departments through data exchange and analysis" received the lowest mean score of 4.11.
- Overall Mean for the First Hypothesis Statements: All the statements related to the first hypothesis had an overall mean score of 4.2690 with a standard deviation of 0.3930. According to the five-point Likert scale, this means falls within the "Strongly Agree" range, reflecting the consensus of the study sample on the positive relationship between AI integration and internal auditing efficiency.
- T-Test Results for One Sample: The results of the One-Sample T-Test show a statistically significant relationship between the level of AI integration and internal auditing efficiency, as (calculated Value) is greater than (Critical Value) for all statements of the first hypothesis. Additionally, the significance level (Sig = 0.00) for all statements in the first dimension is less than (0.05), indicating that all the mean scores are statistically significant. This demonstrates the strong impact of AI integration on internal auditing efficiency.
- A One-Way ANOVA test was conducted to verify the presence of statistically significant differences among the sample members. The test results showed that the significance value (Sig.) was 0.260, which is greater than the significance level of 0.05. This indicates that there are no differences between the responses of the sample members and that the study sample agrees on the existence of a statistically significant relationship between AI techniques integration within internal auditing processes and the improvement of internal auditing efficiency.

#### 4.6.2 Results of The Second Hypothesis Test:

**H2: There is a statistically significant relationship between AI techniques integration within internal auditing processes and improving risk management in internal auditing.**

Table (8): Responses of the Study Sample to the Statements Measuring the Second Hypothesis

VAR	Variable Description		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Standard Deviation	One-Sample Test		Ranking
										T	Sig.	
H21	Analyze huge amounts of data more deeply, and identify anomalous patterns that may indicate potential risks, helping internal auditors detect risks faster and more accurately	N	44	37	3	0	0	4.49	.570	23.92	.000	1
		%	52.4	44	3.6	0	0					
H22	Employ artificial intelligence techniques, such as machine learning, to predict future risks by analyzing historical data and trends, enabling the internal auditor to anticipate and mitigate risks or take preventive action	N	34	41	9	0	0	4.30	.655	18.17	.000	4
		%	40.5	48.8	10.7	0	0					
H23	Provide continuous real-time monitoring and analysis, enabling continuous risk assessment and regularly updated management strategies.	N	26	46	12	0	0	4.17	.656	16.31	.000	5
		%	31	54.8	14.3	0	0					
H24	Analyze unstructured documents and information such as emails and financial records, helping to detect unseen risks that may be unclear in traditional data.	N	38	40	4	2	0	4.36	.688	18.08	.000	3
		%	45.2	47.6	4.8	2.4	0					
H25	Apply complex algorithms to assess risk more objectively and accurately, helping auditors identify areas that require additional attention.	N	46	26	10	2	0	4.38	.790	16.02	.000	2
		%	54.8	31	11.9	2.4	0					
Weighted Mean			4.3175									
Total Standard Deviation			0.4349									

The following can be concluded from Table (8):

- The results of the analysis of the second dimension related to the second hypothesis consisted of (5) statements, with mean scores ranging from

(4.17) to (4.49). The statement that reads, "Analyze huge amounts of data more deeply, and identify anomalous patterns that may indicate potential risks, helping internal auditors detect risks faster and more accurately," received the highest mean score of (4.49), while the statement, "Provide continuous real-time monitoring and analysis, enabling continuous risk assessment and regularly updated management strategies," received the lowest mean score of (4.17).

- All statements in the second dimension related to the second hypothesis had an overall meaning of (4.3175) with a standard deviation of (0.4349). This means, according to the five-point Likert scale, falls within the range of "strongly agree," reflecting the consensus among the study sample regarding the positive relationship between the integration of artificial intelligence and the improvement of risk management.

- T-Test Results for One Sample: The results of the one-sample T-Test indicated a statistically significant relationship between the level of integration of artificial intelligence and the improvement of risk management. The calculated value was greater than the critical value for all statements of the second hypothesis. Additionally, the significance of the t-test, which is (Sig = 0.00), for all statements, is less than (0.05), indicating that all mean values are statistically significant, demonstrating a strong effect of the level of integration of artificial intelligence on the improvement of risk management.

- A One-Way ANOVA test was conducted to verify the presence of statistically significant differences among the sample members. The test results showed that the significance value (Sig.) was 0.326, which is greater than the significance level of 0.05. This indicates that there are no differences between the responses of the sample members and that the study sample agrees on the existence of a statistically significant relationship between AI techniques integration within internal auditing processes and improving risk management in internal auditing.

#### **4.6.3 Results of The Third Hypothesis Test:**

**H3: There is a statistically significant relationship between the challenges facing audit firms and the adoption of AI techniques within internal auditing processes.**

Table (9): Responses of the Study Sample to the Statements Measuring the Third Hypothesis:

VAR	Variable Description		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Standard Deviation	One-Sample Test		Ranking
										T	Sig.	
H31	Lack of experience and skills in the use, development, and management of AI tools, which requires specialized training.	N	20	48	16	0	0	4.05	.657	14.62	.000	4
		%	23.8	57.1	19	0	0					
H32	The high cost of acquiring and maintaining artificial intelligence technologies	N	33	40	11	0	0	4.26	.679	17.04	.000	2
		%	39.3	47.6	13.1	0	0					
H33	Data security and privacy concerns and protecting it from cyber threats.	N	25	45	12	2	0	4.11	.728	13.93	.000	3
		%	29.8	53.6	14.3	2.4	0					
H34	Reduce reliance on human judgment and critical thinking in the internal auditing function.	N	20	41	18	4	1	3.89	.865	9.47	.000	7
		%	23.8	48.8	21.4	4.8	1.2					
H35	The results may be inaccurate due to AI algorithm bias if they are not properly designed and trained, or if the data used is inaccurate or incomplete.	N	22	41	18	2	1	3.96	.828	10.68	.000	6
		%	26.2	48.8	21.4	2.4	1.2					
H36	Resistance to change where the use of resistance to change results from significant regulatory adjustments imposed by the use of artificial intelligence.	N	23	39	20	2	0	3.99	.784	11.55	.000	5
		%	27.4	46.4	23.8	2.4	0					
H37	The need for significant changes in internal auditing mechanisms requires additional effort to ensure alignment and control of processes.	N	22	33	26	2	1	3.87	.875	9.10	.000	8
		%	26.2	39.3	31	2.4	1.2					
H38	The possibility of a lack of ability for reviewers to analyze and solve problems as a result of their excessive reliance on artificial intelligence.	N	29	38	14	3	0	4.11	.807	12.58	.000	3
		%	34.5	45.2	16.7	3.6	0					
H39	Challenges related to AI and data protection laws and regulations, as compliance with these requirements, can be complex and require constant follow-up.	N	41	39	3	1	0	4.43	.626	20.90	.000	1
		%	48.8	46.4	3.6	1.2	0					
Weighted Mean			4.0741									
Total Standard Deviation			.4743									

The following can be concluded from Table (9):

- The results of the analysis of the third dimension related to the third hypothesis are represented in (9) statements, where the average scores ranged from (3.87) to (4.43). The statement "Challenges related to AI and data protection laws and regulations, as compliance with these requirements, can be complex and require constant follow-up " received the highest mean score of (4.43), while the statement " The need for significant changes in internal auditing mechanisms requires additional effort to ensure alignment and control of processes." received the lowest mean score of (3.87)
- All statements in the third dimension related to the third hypothesis had an overall meaning of (4.0741) with a standard deviation of (0.4743). This means, according to the five-point Likert scale, falls within the " Agree " range, reflecting the consensus of the study sample regarding the challenges related to the integration of artificial intelligence in internal auditing processes.
- T-Test Results for One Sample: The results of the one-sample T-Test showed a statistically significant relationship between the challenges and the integration of artificial intelligence in internal auditing processes, as the calculated value was greater than the critical value for all statements of the Third hypothesis. Furthermore, the significance of the T-Test, which is (Sig = 0.00), for all statements, is less than (0.05), indicating that all mean scores are statistically significant, thus demonstrating a relationship between the challenges related to the integration of artificial intelligence and the adoption of artificial intelligence within internal auditing processes.
- A One-Way ANOVA test was conducted to verify the presence of statistically significant differences among the sample members. The test results showed that the significance value (Sig.) was 0.208, which is greater than the significance level of 0.05. This indicates that there are no differences between the responses of the sample members and that the study sample agrees on the existence of a statistically significant relationship between the challenges facing audit firms and the adoption of AI techniques within internal auditing processes

#### 4.6.4 Results of the fourth Hypothesis Test:

**H4: There is a statistically significant relationship between the adoption of specific mechanisms proposed by researchers and overcoming AI techniques adoption challenges in internal auditing processes.**

Table (10): Responses of the Study Sample to the Statements Measuring the fourth Hypothesis

VAR	Variable Description		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Standard Deviation	One-Sample Test		Ranking
										T	Sig.	
H41	Provide internal auditors with the knowledge and skills to use AI tools in detecting risks, analyzing data deeper and faster, and attracting and employing highly experienced professionals to enhance the team's technical capabilities	N	31	47	6	0	0	4.30	0.597	19.93	.000	2
		%	36.9	56.0	7.1	0	0					
H42	Building a comprehensive strategy to integrate AI into operational processes, starting with identifying basic needs, then evaluating the available options of tools and programs, and selecting the optimal solutions in terms of cost and benefit.	N	36	39	8	1	0	4.31	0.694	17.30	.000	1
		%	42.9	46.4	9.5	1.2	0					
H43	Develop and implement a comprehensive security system to protect data from illegal breaches and ensure compliance with regulations and laws related to privacy protection.	N	29	51	4	0	0	4.30	0.555	21.43	.000	2
		%	34.5	60.7	4.8	0	0					
H44	Conduct periodic evaluations of the algorithms used in the audit to ensure that they comply with technical and operational standards and are free of any biases that may affect the results of the audit and ensure the fairness of the procedures.	N	30	41	12	1	0	4.19	0.719	15.17	.000	5
		%	35.7	48.8	14.3	1.2	0					
H45	Conduct regular human audits of AI results to ensure their accuracy and objectivity, reduce the risks associated with overreliance on smart models, and enhance confidence in decisions that rely on them.	N	26	44	13	0	1	4.12	0.751	13.66	.000	7
		%	31	52.4	15.5	0	1.2					
H46	Develop an integrated change management	N	27	48	9	0	0	4.21	0.622	17.88	.000	4
		%	32.1	57.1	10.7	0	0					

	framework to successfully adopt AI, with a focus on readiness assessment, goal setting, implementation planning, and performance evaluation.												
H47	Identify accurate performance indicators to measure the effectiveness of AI tools to achieve desired goals.	N	27	42	15	0	0	4.14	0.697	15.04	.000	6	
		%	32.1	50	17.9	0	0						
H48	Provide a detailed and clear explanation of how AI tools work and how they affect audit results, to increase transparency and trust in these tools and improve auditors' and management's understanding of how to use them.	N	29	45	10	0	0	4.23	0.647	17.38	.000	3	
		%	34.5	53.6	11.9	0	0						
H49	Evaluate tools and technologies regularly to see their compatibility and suitability to changing needs and conduct periodic updates to their tools to enhance their capabilities and improve the quality of the results they provide.	N	29	45	10	0	0	4.23	0.647	17.38	.000	3	
		%	34.5	53.6	11.9	0	0						
Weighted Mean		4.2249											
Total Standard Deviation		0.4534											

**The following can be concluded from Table (10):**

- The results of the analysis of the fourth dimension related to the fourth hypothesis are represented in (9) statements, with average scores ranging from (4.12) to (4.31). The statement "Building a comprehensive strategy to integrate AI into operational processes, starting with identifying basic needs, then evaluating the available options of tools and programs, and selecting the optimal solutions in terms of cost and benefit." received the highest mean score of (4.31), while the statement "Conduct regular human audits of AI results to ensure their accuracy and objectivity, reduce the risks associated with overreliance on smart models, and enhance confidence in decisions that rely on them." received the lowest mean score of (4.12).
- All statements in the fourth dimension related to the fourth hypothesis had an overall mean of (4.2249) with a standard deviation of (0.4534).

According to the five-point Likert scale, this means falls within the "Strongly Agree" range, reflecting the study sample's consensus on adopting the proposed mechanisms to overcome AI challenges in internal auditing processes.

- T-Test Results for One Sample: The results of the one-sample T-Test showed a statistically significant relationship between the adoption of the mechanisms proposed by the researchers and the ability to overcome AI challenges in internal auditing processes, as the calculated value was greater than the critical value for all statements of the fourth hypothesis. Furthermore, the significance of the t-test, which is (Sig = 0.00), for all statements, is less than (0.05), indicating that all mean scores are statistically significant, thus demonstrating a relationship between the adoption of the mechanisms proposed by the researchers and the ability to overcome AI challenges in internal auditing processes.
- A One-Way ANOVA test was conducted to verify the presence of statistically significant differences among the sample members. The test results showed that the significance value (Sig.) was 0.838, which is greater than the significance level of 0.05. This indicates that there are no differences between the responses of the sample members and that the study sample agrees on the existence of a statistically significant relationship between the adoption of specific mechanisms proposed by researchers and overcoming AI techniques adoption challenges in internal auditing processes.

## **5. Results and Recommendations:**

### **5.1 Results:**

#### **5.1.1 Study Results:**

- There is an agreement among the study sample members on the existence of a positive relationship between the integration of artificial intelligence (AI) techniques in internal auditing and the improvement of internal auditing processes' efficiency. The first hypothesis thus finds support in the views of most of the respondents in this study, as the integration of AI within internal auditing processes enhances efficiency in terms of data processing, detecting



anomalous patterns, saving time, enhancing the accuracy of recommendations, and enhancing compliance, this is consistent with more studies such as (Wassie & Lakatos, 2024)

- There is an agreement among the sample members among the study members on the existence of a positive relationship between the integration of AI techniques in internal auditing and the improvement of risk management. The integration of AI in internal auditing processes significantly enhances risk management by enabling deeper data analysis, predicting future risks, providing continuous monitoring, and analyzing unstructured documents. Most participants in the study support the second hypothesis, indicating the substantial benefits of applying AI techniques to improve risk management, thereby enhancing auditors' ability to take preventive actions. This is consistent with more studies such as (Kovanen, 2020; Schreyer et al., 2022)
- There is an agreement among the sample members on the existence of a negative relationship between the challenges facing audit firms and the adoption of AI techniques. The sample members are well aware of the challenges that may affect the rapid adoption of AI techniques. Among the main challenges are compliance issues, high costs, lack of skills, data security, and Resistance to change. These factors significantly impact the level of AI adoption, Consequently, audit firms must carefully consider these factors when adopting AI. This is consistent with more studies such as (Bharadiya, 2023; Hamza et al., 2024)
- There is an agreement among the study sample members on the existence of a positive relationship between the adoption of proposed mechanisms and the ability of audit firms to overcome the challenges of integrating AI into internal auditing processes. The results showed that building a comprehensive strategy is a critical factor for the success of AI integration processes. This requires audit firms to consider a clear and integrated plan, provide appropriate training, and regularly evaluate tools to ensure the effectiveness of AI integration. This is consistent with more studies such as (M. S. Rashwan & M. S. Alhelou, 2022)
- **General Results of the Study:**
  - The study results indicate that artificial intelligence will play a major role in the future of internal auditing. To achieve optimal benefit from its capabilities, companies must address current challenges through appropriate planning, training, and development of the AI infrastructure.
  - Combination artificial intelligence into internal auditing processes leads to a significant improvement in the efficiency of the audit process by automating repetitive tasks, reducing audit time, enhancing the accuracy of data analysis, and optimal utilization of resources.

- Artificial intelligence has a positive impact on improving risk management, as the study showed that artificial intelligence can improve risk management processes through continuous monitoring, predictive analytics, and early detection of potential problems.
- Audit firms face significant challenges when adopting artificial intelligence, the most important of which are high implementation costs, lack of experience in dealing with this technology, and issues related to data privacy and security.
- Artificial intelligence tools contribute to improving compliance with regulatory and legal requirements, which reduces the likelihood of violations or irregularities.
- The study indicated a lack of expertise and professional skills among internal auditors, and the study emphasized the importance of training auditors on the use of artificial intelligence tools.
- The study revealed the need for change management strategies to address resistance to change, especially due to concerns that artificial intelligence will replace human judgment and increase confidence in artificial intelligence systems among auditors.
- The use of AI enhances transparency in auditing processes by clarifying how decisions are made and providing a better view of the standards and processes used. The results also showed that the use of AI tools enhances auditors' ability to make data-driven decisions, which leads to improving the overall quality of auditing processes.
- The results proved that integrating AI into internal auditing processes enhances collaboration between teams, as auditors can collaborate more effectively with IT teams and other departments to improve the quality of results.
- The results highlight the need to develop auditing standards to be compatible with modern technologies, which contributes to improving the effectiveness and quality of internal auditing.
- The study indicated the importance of organizational culture in the success of integrating AI into auditing processes.

## **5.2 Recommendations:**

The study recommends investing in AI technologies to develop internal auditing processes, achieve higher efficiency, and enhance risk management in internal auditing processes, with a focus on continuous monitoring and analysis of unstructured data. To effectively integrate AI technologies into internal auditing processes, the researchers suggest the following:

- Improving cybersecurity by creating security mechanisms to avoid data breaches and respecting and adapting to privacy legislation.

This could be done by encrypting messages or securing databases. A comprehensive change management framework that includes considerations related to readiness assessments, setting goals, careful planning for implementation, and continuous monitoring of performance.

- Developing a comprehensive plan for adopting AI technologies: It is good for these plans to usually start by assessing our basic needs, but they should also reach the point of proposing a list of options with advantages and disadvantages so that we can choose the most appropriate solution.
- Providing the necessary training and technologies to address the challenges associated with integrating AI, so that educational programs are created for auditors on how to use AI tools. Training should also focus on increasing auditors' understanding of AI technologies and data analysis to better understand the work of the smart model and enhance audit results.
- Continuous monitoring of technologies: The regular assessment of the tools and technologies will make sure that they are still appropriate for the organization and further provide maximum efficiency. The performance of the whole company should periodically be assessed to see whether or not the set objectives of the firm are being met.
- Increased transparency into how AI tools work would engender confidence in their use and lead to successful adoptions.

## **6. Future Research:**

In light of the findings, the researchers suggest that more attention should be paid to future research.

- Studying the impact of artificial intelligence techniques on external auditing and studying the extent of differences in improving the quality of external auditing.
- Measuring the impact of using artificial intelligence techniques in detecting fraud and financial fraud.
- Studying the impact of using artificial intelligence on legal and regulatory aspects and protecting data security and privacy.
- Studying the impact of using artificial intelligence on the operational efficiency of internal auditing, by measuring the impact of using artificial intelligence methods on efficiency before adopting the use of artificial intelligence techniques and after using them.

- Measuring the effectiveness of artificial intelligence in internal auditing through a set of measures and indicators to improve the quality of internal auditing.
- Studying the use of artificial intelligence in internal auditing of the company's financial performance through cost-benefit analysis.

## 7. References

- Adelakun, B. O., Fatogun, D. T., Majekodunmi, T. G., & Adediran, G. A. (2024). Integrating machine learning algorithms into audit processes: Benefits and challenges. *Finance & Accounting Research Journal*, 6(6), 1000–1016.
- Ahmed Rizvan, H. (2022). Artificial Intelligence (AI) in Accounting & Auditing: A Literature Review. *Open Journal of Business and Management*, 10(1).
- Akkaşa, H., Bouchriba, B., & Mohammed, M. (2024). The impact of using artificial intelligence techniques on the internal auditing function: A case study of the Big Four auditing firms. *Journal of Studies in Economics and Business Administration.*, 7(1), 1–20.
- Al-Tae, S. H. H., & Flayyih, H. H. (2023). Impact of electronic internal auditing based on IT governance to reduce auditing risk. *Corporate Governance and Organizational Behavior Review*, 7(1), 94–100.
- Alattas, K. (2023). Saudi Arabia Corporate Firms are Hesitant to Embrace Artificial Intelligence as of 2020 Despite the Numerous Benefits. In *WSEAS Transactions on Systems and Control* (Vol. 18, pp. 38–46). <https://doi.org/10.37394/23203.2022.18.4>
- Albawwat, I., & Frijat, Y. Al. (2021). An analysis of auditors' perceptions towards artificial intelligence and its contribution to audit quality. *Accounting*, 7(4), 755–762. <https://doi.org/10.5267/j.ac.2021.2.009>
- Almufadda, G., & Almezeini, N. A. (2022). Artificial Intelligence Applications in the Auditing Profession: A Literature Review. *Journal of Emerging Technologies in Accounting*, 19(2), 29–42. <https://doi.org/10.2308/JETA-2020-083>
- Alotaibi, N. S., & Alshehri, A. H. (2023). Prospers and Obstacles in Using Artificial Intelligence in Saudi Arabia Higher Education Institutions—The Potential of AI-Based Learning Outcomes. *Sustainability (Switzerland)*, 15(13). <https://doi.org/10.3390/su151310723>
- Argyres, N., Bertomeu, J., & Li, Y. (2020). Artificial intelligence in auditing: Opportunities and challenges. *Journal of Accounting Research*, 58(3), 837–874.
- Basri, W. (2020). Examining the impact of artificial intelligence (AI)-assisted social media marketing on the performance of small and medium enterprises: Toward effective business management in the Saudi Arabian context. *International Journal of Computational Intelligence Systems*, 13(1), 142–152. <https://doi.org/10.2991/ijcis.d.200127.002>

- Bharadiya, J. P. (2023). The role of machine learning in transforming business intelligence. *International Journal of Computing and Artificial Intelligence*, 4(1), 16–24. <https://doi.org/10.33545/27076571.2023.v4.i1a.60>
- Carataş, M. ., Şpatariu, E. ., & Gheorghiu, G. (2018). Internal auditing Role in Artificial Intelligence. *Ovidius University Annals: Economic Sciences Series*, XVIII(1), 441–445.
- Cho, J., Ahn, S., & Jung, W. (2018). The Impact of Artificial Intelligence on the Audit Market. *Korean Accounting Journal*, 27(3), 289–330. <https://doi.org/10.24056/kaj.2018.06.001>
- Cockburn, I. M., Henderson, R., & Stern, S. (2018). The impact of artificial intelligence on innovation: An exploratory analysis. In *National Bureau of Economic Research* (Issue May).
- DEMİR, Ş. Ş., & DEMİR, M. (2023). Professionals’ perspectives on ChatGPT in the tourism industry: Does it inspire awe or concern? In *Journal of Tourism Theory and Research* (Vol. 9, Issue 2, pp. 61–77). <https://doi.org/10.24288/jttr.1313481>
- Hamza, R. A. E. M., Alnor, N. H. A., Al-Matari, E. M., Benzerrouk, Z. S., Mohamed, A. M. E., Bennaceur, M. Y., Elhefni, A. H. M., & Elshaabany, M. M. (2024). The Impact of Artificial Intelligence (AI) on the Accounting System of Saudi Companies. *WSEAS Transactions on Business and Economics*, 21, 499–511. <https://doi.org/10.37394/23207.2024.21.42>
- Hazaea, S. A., Al-Matari, E. M., Khatib, S. F., Albitar, K. (2023). Internal auditing in the Arab World: A Systematic Literature Review and Directions for Future Research. *Sage Open*, 13(4).
- Kovanen, A. (2020). *Risks of Intelligent Automation and Their Impact on Internal Auditing*. April, 1–84.
- *KPMG Ignite*. (n.d.).
- Lee, C. S., & Tajudeen, F. P. (2020). Usage and impact of artificial intelligence on accounting: Evidence from Malaysian organizations. *Asian Journal of Business and Accounting*, 13(1), 213–239. <https://doi.org/10.22452/ajba.vol13no1.8>
- Li, O., & Wu, D. (2021). Artificial intelligence in auditing: A research agenda. *Journal of Accounting and Public Policy*, 40(1), 106819.
- M. S. Rashwan, A. R., & M. S. Alhelou, E. (2022). The Effectiveness of the Use of Artificial Intelligence in The Internal Auditing Process and Its Impact On Risk Management, Control, and Governance in The Palestinian Government Sector. *International Journal of Accounting and Management Sciences*, 2(1). <https://doi.org/10.56830/rzba5370>
- Mirchandani, A., Gupta, N., & Ndiweni, E. (2020). Understanding the Fintech Wave: a Search for a Theoretical Explanation. *International Journal of Economics and Financial Issues*, 10(5), 331–343.

- <https://doi.org/10.32479/ijefi.10296>
- Mohammed, Eman Jasem, and S. H. A. (2022). The quality of audit work under an expert system. *Journal of Economics and Administrative Sciences*, 28(133), 187–199.
  - Mohammed Ali, M., Salah Abdullah, A., & Saad khattab, G. (2022). The Effect of Activating Artificial Intelligence Techniques on Enhancing Internal Auditing Activities " Field Study ". *Alexandria Journal of Accounting Research Third Issue*, 6, 1–40.
  - Musa, A. M. H., & Lefkir, H. (2024). The role of artificial intelligence in achieving auditing quality for small and medium enterprises in the Kingdom of Saudi Arabia. *International Journal of Data and Network Science*, 8(2), 835–844. <https://doi.org/10.5267/j.ijdns.2023.12.021>
  - NICOLAU, A. (2023). the Impact of AI on Internal Auditing and Accounting Practices. *Internal auditing & Risk Management*, 18, 38–56. <https://search.ebscohost.com/login.aspx?direct=true&db=bsh&AN=173426116&site=ehost-live>
  - Omoteso, K. (2012). The application of artificial intelligence in auditing: Looking back to the future. *Expert Systems with Applications*, 39(9), 8490–8495. <https://doi.org/10.1016/j.eswa.2012.01.098>
  - Oyewole, A. T., Adeoye, O. B., Addy, W. A., Okoye, C. C., Ofodile, O. C., & Ugochukwu, C. E. (2024). Automating financial reporting with natural language processing: A review and case analysis. *World Journal of Advanced Research and Reviews*, 21(3), 575–589.
  - Palomares, I., Martínez-Cámara, E., Montes, R., García-Moral, P., Chiachio, M., Chiachio, J., Alonso, S., Melero, F. J., Molina, D., Fernández, B., Moral, C., Marchena, R., de Vargas, J. P., & Herrera, F. (2021). A panoramic view and swot analysis of artificial intelligence for achieving sustainable development goals by 2030: progress and prospects. *Applied Intelligence*, 51(9), 6497–6527. <https://doi.org/10.1007/s10489-021-02264-y>
  - Schreyer, M., Baumgartner, M., Ruud, F., & Borth, D. (2022). Artificial Intelligence in Internal Auditing as a Contribution to Effective Governance. *Expert Focus, Special*, 45–50.
  - Shapiro, D. (2020). Artificial Intelligence for Internal Auditing and Risk Management. *Towards Data Science*. <https://towardsdatascience.com/artificial-intelligence-for-internal-audit-and-risk-management-94e509129d49>
  - Siddiqui, A. B. (2024). *Impact of Artificial Intelligence on Financial Reporting: Evidence from KPMG and S & P GLOBAL*.
  - Srirejeki, K., & Liang, J. (2024). Artificial Intelligence in Accounting: Implications for Practices and Education. SAR (Soedirman Accounting Review). *Journal of Accounting and Business*, 9(01), 99–110.

- Ucoglu, D. (2020). Current machine learning applications in accounting and auditing. *Pressacademia*, 12(1), 1–7. <https://doi.org/10.17261/pressacademia.2020.1337>
- Wassie, F. A., & Lakatos, L. P. (2024). Artificial intelligence and the future of the internal auditing function. *Humanities and Social Sciences Communications*, 11(1). <https://doi.org/10.1057/s41599-024-02905-w>
- Yoon, S. (2020). A study on the transformation of accounting based on new technologies: Evidence from Korea. *Sustainability (Switzerland)*, 12(20), 1–23. <https://doi.org/10.3390/su12208669>
- Zemankova, A. (2019). Artificial Intelligence and Blockchain in Audit and Accounting: Literature Review. *WSEAS Transactions on Business and Economics*, 16(1), 568–581. <https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=eoh&AN=2011664&site=ehost-live&scope=site&custid=s5599059%0Ahttp://wseas.org/wseas/cms.action?id=4016>
- Zhang, Y., Xiong, F., Xie, Y., Fan, X., & Gu, H. (2020). The Impact of Artificial Intelligence and Blockchain on the Accounting Profession. *IEEE Access*, 8, 110461–110477. <https://doi.org/10.1109/ACCESS.2020.3000505>