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The Impact of Information Technology on Auditing

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Appreciation

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List of Abbreviations

Abbreviation	Full Form
AC	Audit Committee
AI	Artificial Intelligence
BoD	Board of Directors
CBAI	Cloud-Based Artificial Intelligence
GCC	Gulf Cooperation Council
HTMT	Heterotrait-Monotrait Ratio
IAASB	International Auditing and Assurance Standards Board
IFRS	International Financial Reporting Standards
ISA	International Standard on Auditing
IT	Information Technology
JCPAA	Jordanian Certified Public Accountants Association
KAM	Key Audit Matters
KSE	Kuwait Stock Exchange
PCAOB	Public Company Accounting Oversight Board
PLS	Partial Least Squares
SEM	Structural Equation Modeling
SOCPA	Saudi Organization for Certified Public Accountants
VIF	Variance Inflation Factor
VOSviewer	Visualization of Similarities Viewer (software)
WoS	Web of Science

Abstract

This doctoral thesis investigates the transformative impact of information technology (IT) on the auditing profession, with a specific focus on Jordan and the Gulf Cooperation Council (GCC) region. As the global business landscape undergoes rapid digital transformation, driven by the proliferation of technologies such as artificial intelligence (AI), blockchain, and cloud computing, the audit profession is compelled to evolve to maintain relevance, credibility, and effectiveness. This study seeks to explore how these emerging technologies are reshaping audit methodologies, influencing financial reporting practices, and redefining the responsibilities of auditors in an increasingly digitized environment.

The research is motivated by the growing recognition that IT not only enhances audit quality, efficiency, and transparency but also introduces a complex set of challenges including cybersecurity risks, regulatory uncertainty, and a widening skill gap among audit professionals. While developed economies have made substantial progress in integrating IT into auditing, emerging markets like Jordan and the GCC face distinct constraints and opportunities shaped by infrastructural, institutional, and regulatory dynamics. Therefore, this study offers a contextualized analysis of IT adoption in the audit profession within a Middle Eastern context, addressing a significant gap in existing literature.

Guided by a robust theoretical framework combining the Technology Acceptance Model (TAM), Diffusion of Innovations Theory, and Agency Theory, the thesis adopts a mixed-methods research design across three complementary studies. These include a bibliometric analysis of global research trends, a quantitative examination of the role of cloud-based AI in auditing practices, and an econometric assessment of Key Audit Matter (KAM) disclosures in the banking sector.

The first study presents a state-of-the-art bibliometric review of scholarly contributions on IT in auditing, analyzing 328 peer-reviewed articles published between 2017 and 2022. Using the VOSviewer software, the study maps the intellectual structure of the field,

identifies dominant themes, and highlights influential authors, institutions, and publication outlets. The findings reveal a steep upward trajectory in research output, signaling intensified scholarly interest in the role of AI and blockchain in enhancing audit quality, fraud detection, and real-time assurance.

The second study employs a structured survey of 322 external auditors in Jordan to investigate the impact of cloud-based AI on audit effectiveness, with particular attention to the mediating role of the auditor. Data was analyzed using structural equation modeling (SEM) via SmartPLS. The results demonstrate that cloud-based AI significantly improves audit accuracy, decision-making, and risk assessment, while the auditor's role remains pivotal in interpreting AI-generated insights, ensuring regulatory compliance, and mitigating algorithmic bias. The findings also underline the importance of continuous professional training and ethical governance to ensure responsible use of AI in auditing.

The third empirical study focuses on the disclosure of KAMs within the banking sector of Jordan and the GCC, using a longitudinal dataset of 79 banks over a seven-year period (2016–2022). Employing random-effects Poisson and logistic regression models, this study examines the influence of IT integration on KAM transparency and identifies key determinants including auditor tenure, audit committee effectiveness, and board attributes. The analysis reveals that IT-enhanced audit environments are associated with more detailed and timely KAM disclosures, thereby improving financial reporting transparency and stakeholder trust, especially in high-risk industries such as banking.

Across all three studies, the thesis identifies both significant opportunities and critical challenges associated with IT adoption in auditing. Key benefits include enhanced audit efficiency, real-time monitoring, reduced operational costs, improved risk assessments, and heightened stakeholder confidence. However, challenges such as cybersecurity vulnerabilities, inconsistent regulatory frameworks, lack of skilled IT auditors, and ethical concerns related to AI decision-making persist. These findings underscore the urgent need for structured frameworks that guide IT adoption while safeguarding audit quality, data integrity, and public trust.

This thesis contributes to academic literature by offering an empirical account of IT's multifaceted impact on auditing within a developing region. It also presents practical implications for auditors, regulators, and policymakers, including recommendations for curriculum reform, the development of AI governance guidelines, and the establishment of harmonized auditing standards that accommodate technological innovation. Furthermore, the study highlights the potential of hybrid audit models that combine machine learning capabilities with human judgment, thus ensuring that technological advancement does not compromise the professional skepticism and ethical accountability that define the audit profession.

Ultimately, this research advances our understanding of how digital transformation is reshaping audit practice and regulation. By bridging theoretical perspectives with empirical insights, it provides a comprehensive foundation for future studies on digital auditing in emerging economies and offers actionable guidance for stakeholders navigating the complexities of IT-driven assurance in the 21st century.

Resumen

Esta Tesis Doctoral investiga el impacto transformador de la tecnología de la información (TI) en la profesión de auditoría, con un enfoque específico en Jordania y la región del Consejo de Cooperación del Golfo (GCC). A medida que el panorama empresarial global experimenta una rápida transformación digital, impulsada por la proliferación de tecnologías como la inteligencia artificial (IA), la blockchain y la computación en la nube, la profesión de auditoría se ve obligada a evolucionar para mantener su relevancia, credibilidad y efectividad. Este estudio busca explorar cómo estas tecnologías emergentes están remodelando las metodologías de auditoría, influyendo en las prácticas del informe financiero y redefiniendo las responsabilidades de los auditores en un entorno cada vez más digitalizado.

La investigación está motivada por el creciente reconocimiento de que la TI no solo mejora la calidad, eficiencia y transparencia de las auditorías, sino que también introduce un conjunto complejo de desafíos, incluido riesgos de ciberseguridad, incertidumbre regulatoria y una creciente brecha de habilidades entre los profesionales de la auditoría. Aunque las economías desarrolladas han logrado avances significativos en la integración de la TI en la auditoría, los mercados emergentes como Jordania y el GCC enfrentan restricciones y oportunidades distintas, moldeadas por dinámicas infraestructurales, institucionales y regulatorias. Por lo tanto, este estudio ofrece un análisis contextualizado de la adopción de TI en la profesión de auditoría dentro de un contexto del Medio Oriente, abordando una importante laguna en la literatura existente.

Guiado por un marco teórico robusto que combina el Modelo de Aceptación de la Tecnología (TAM), la Teoría de la Difusión de Innovaciones y la Teoría de Agencia, la Tesis adopta un diseño de investigación mixto a través de tres estudios complementarios. Estos incluyen un análisis bibliométrico de las tendencias globales de investigación, un examen cuantitativo del papel de la cloud-based AI en las prácticas de auditoría y una evaluación econométrica de las divulgaciones de los Asuntos Clave de Auditoría (KAM) en el sector bancario.

El primer estudio presenta una revisión bibliométrica de las contribuciones académicas sobre TI en la auditoría, analizando 328 artículos publicados entre 2017 y 2022. Utilizando el software VOSviewer, el estudio mapea la estructura intelectual del campo, identifica temas dominantes y destaca autores, instituciones y revistas influyentes. Los hallazgos revelan una trayectoria ascendente en la producción de investigación, señalando un interés académico intensificado el papel de la IA y la blockchain para mejorar la calidad de la auditoría y la detección de fraudes en tiempo real.

El segundo estudio emplea una encuesta estructurada a 322 auditores externos en Jordania para investigar el impacto de la cloud-based AI en la efectividad de la auditoría, prestando especial atención al papel mediador del auditor. Los datos se analizaron utilizando un modelo de ecuaciones estructurales (SEM) mediante SmartPLS. Los resultados demuestran que la cloud-based AI mejora significativamente la precisión de la auditoría, la toma de decisiones y la evaluación de riesgos, mientras que el papel del auditor sigue siendo crucial para interpretar los conocimientos generados por la IA, asegurar el cumplimiento normativo y mitigar el sesgo algorítmico. Los hallazgos también subrayan la importancia de la formación profesional continua y la ética para garantizar el uso responsable de la IA en la auditoría.

El tercer estudio empírico se centra en la divulgación de KAM dentro del sector bancario de Jordania y el GCC, utilizando un conjunto de datos longitudinales de 79 bancos durante un período de siete años (2016–2022). Empleando modelos de regresión de Poisson y logística con efectos aleatorios, este estudio examina la influencia de la integración de TI en la transparencia de los KAM e identifica determinantes clave, incluida la antigüedad del auditor, la efectividad del comité de auditoría y las características del consejo de administración. El análisis revela que los entornos de auditoría con la utilización de las TIs están asociados con divulgaciones de KAM más detalladas y oportunas, mejorando así la transparencia del reporte financiero y la confianza de los stakeholders, especialmente en industrias de alto riesgo como la banca.

A lo largo de los tres estudios, la Tesis identifica tanto oportunidades significativas como

desafíos críticos asociados con la adopción de TI en la auditoría. Entre los principales beneficios se incluyen una mayor eficiencia en la auditoría, control en tiempo real, reducción de costes operativos, mejores evaluaciones de riesgos y una mayor confianza de los stakeholders. Sin embargo, persisten desafíos como vulnerabilidades de ciberseguridad, marcos regulatorios inconsistentes, falta de auditores de TI capacitados y preocupaciones éticas relacionadas con la toma de decisiones basada en la IA. Estos hallazgos subrayan la necesidad urgente de marcos estructurados que guíen la adopción de TI mientras se salvaguarda la calidad de la auditoría, la integridad de los datos y la confianza pública.

Esta Tesis contribuye a la literatura académica al ofrecer un relato empírico del impacto multifacético de la TI en la auditoría dentro de una región en desarrollo. También presenta implicaciones prácticas para auditores y reguladores, incluyendo recomendaciones para la reforma del currículo, el desarrollo de directrices de la IA y el establecimiento de estándares de auditoría armonizados que permitan la innovación tecnológica. Asimismo, el estudio destaca el potencial de modelos de auditoría híbridos que combinan capacidades de aprendizaje automático con el juicio humano, asegurando que el avance tecnológico no comprometa el escepticismo profesional y la responsabilidad ética que definen la profesión de auditoría.

En última instancia, esta investigación contribuye significativamente al entendimiento de cómo la transformación digital está reconfigurando tanto la práctica como la regulación de la auditoría. Al integrar enfoques teóricos con evidencia empírica, ofrece una base sólida y comprensiva para futuras investigaciones en el ámbito de la auditoría digital en economías emergentes, al tiempo que proporciona orientación práctica a los stakeholders que enfrentan desafíos y complejidades impulsadas por la TI en el siglo XXI.

Resum

Aquesta tesi doctoral investiga l'impacte transformador de la tecnologia de la informació (TI) en la professió d'auditoria, amb un enfocament específic en Jordània i la regió del Consell de Cooperació del Golf (GCC). A mesura que el panorama empresarial global experimenta una ràpida transformació digital, impulsada per la proliferació de tecnologies com la intel·ligència artificial (IA), la cadena de blocs i el núvol computacional, la professió d'auditoria es veu obligada a evolucionar per mantenir la seua rellevància, credibilitat i efectivitat. Aquest estudi busca explorar com aquestes tecnologies emergents estan remodelant les metodologies d'auditoria, influint en les pràctiques de report financer i redefinint les responsabilitats dels auditors en un entorn cada vegada més digitalitzat.

La recerca està motivada pel creixent reconeixement que la TI no només millora la qualitat, eficiència i transparència de les auditories, sinó que també introdueix un conjunt complex de reptes, inclosos riscos de ciberseguretat, incertesa regulatòria i una creixent bretxa de competències entre els professionals de l'auditoria. Tot i que les economies desenvolupades han aconseguit avanços significatius en la integració de la TI en l'auditoria, els mercats emergents com Jordània i el GCC enfronten restriccions i oportunitats distintes, modelades per dinàmiques infraestructurals, institucionals i regulatòries. Per tant, aquest estudi ofereix un anàlisi contextualitzat de l'adopció de TI en la professió d'auditoria dins d'un context del Mig Orient, abordant una important bretxa en la literatura existent.

Guiat per un marc teòric robust que combina el Model d'Acceptació de la Tecnologia (TAM), la Teoria de la Difusió d'Innovacions i la Teoria d'Agència, la tesi adopta un disseny de recerca mixt a través de tres estudis complementaris. Aquests inclouen un anàlisi bibliomètric de les tendències globals de recerca, un examen quantitatiu del paper de la IA basada en el núvol en les pràctiques d'auditoria i una avaluació econòmica de les divulgacions d'Assumptes Clau d'Auditoria (KAM) en el sector bancari.

El primer estudi presenta una revisió bibliomètrica d'avantguarda de les contribucions acadèmiques sobre TI en l'auditoria, analitzant 328 articles revisats per experts publicats

entre 2017 i 2022. Utilitzant el programari VOSviewer, l'estudi mapeja l'estructura intel·lectual del camp, identifica temes dominants i destaca autors, institucions i revistes influents. Els resultats revelen una trajectòria ascendent pronunciada en la producció de recerca, assenyalant un interès acadèmic intensificat en el paper de la IA i la cadena de blocs per millorar la qualitat de l'auditoria, la detecció de frau i la garantia en temps real.

El segon estudi empra una enquesta estructurada a 322 auditors externs a Jordània per investigar l'impacte de la IA basada en el núvol en l'efectivitat de l'auditoria, prestant especial atenció al paper mediador de l'auditor. Les dades s'han analitzat utilitzant modelatge d'equacions estructurals (SEM) mitjançant SmartPLS. Els resultats demostren que la IA basada en el núvol millora significativament la precisió de l'auditoria, la presa de decisions i l'avaluació de riscos, mentre que el paper de l'auditor continua essent crucial per interpretar els coneixements generats per la IA, assegurar el compliment normatiu i mitigar el biaix algorítmic. Els resultats també subratllen la importància de la formació professional contínua i la governança ètica per garantir l'ús responsable de la IA en l'auditoria.

El tercer estudi empíric se centra en la divulgació de KAM dins del sector bancari de Jordània i el GCC, utilitzant un conjunt de dades longitudinals de 79 bancs durant un període de set anys (2016–2022). Emprant models de regressió de Poisson i logística amb efectes aleatoris, aquest estudi examina la influència de la integració de TI en la transparència dels KAM i identifica determinants clau, incloent-hi l'antiguitat de l'auditor, l'efectivitat del comitè d'auditoria i els atributs del consell. L'anàlisi revela que els entorns d'auditoria millorats amb TI estan associats amb divulgacions de KAM més detallades i oportunes, millorant així la transparència del report financer i la confiança dels stakeholders, especialment en indústries d'alt risc com la banca.

Al llarg dels tres estudis, la tesi identifica tant oportunitats significatives com reptes crítics associats amb l'adopció de TI en l'auditoria. Entre els principals beneficis s'inclouen una major eficiència en l'auditoria, monitoratge en temps real, reducció de costos operatius, millors avaluacions de riscos i una major confiança dels stakeholders. No obstant això, persisteixen reptes com vulnerabilitats de ciberseguretat, marcs regulatoris inconsistents,

falta d'auditors de TI capacitats i preocupacions ètiques relacionades amb la presa de decisions basada en IA. Aquests resultats subratllen la necessitat urgent de marcs estructurats que guien l'adopció de TI mentre es salvaguarda la qualitat de l'auditoria, la integritat de les dades i la confiança pública.

Aquesta tesi contribueix a la literatura acadèmica oferint un relat empíric de l'impacte multifacètic de la TI en l'auditoria dins d'una regió en desenvolupament. També presenta implicacions pràctiques per a auditors, reguladors i formuladors de polítiques, incloses recomanacions per a la reforma del currículum, el desenvolupament de directrius de governança de la IA i l'establiment d'estàndards d'auditoria harmonitzats que permeten la innovació tecnològica. A més, l'estudi destaca el potencial de models d'auditoria híbrids que combinen capacitats d'aprenentatge automàtic amb el judici humà, assegurant que l'avanç tecnològic no compromet l'escepticisme professional i la responsabilitat ètica que defineixen la professió d'auditoria.

Finalment, aquesta recerca amplia la nostra comprensió de com la transformació digital està remodelant la pràctica i regulació de l'auditoria. En vincular perspectives teòriques amb coneixements empírics, proporciona una base integral per a futurs estudis sobre auditoria digital en economies emergents i ofereix orientació pràctica per als stakeholders que naveguen les complexitats de la garantia impulsada per TI en el segle XXI.

CHAPTER ONE: INTRODUCTION

CHAPTER ONE

1.1 Background

The rapid advancement of information technology (IT) has profoundly reshaped the auditing profession, necessitating continuous adaptation by auditors to remain effective in a dynamic digital environment (Azizi et al., 2024). Technological innovations such as artificial intelligence (AI), blockchain, and cloud computing have redefined traditional audit methodologies, enhancing audit quality, efficiency, and transparency (Al-Omush et al., 2025). The adoption of these technologies in auditing is particularly significant in Jordan and the Gulf Cooperation Council (GCC) countries, where regulatory frameworks, financial reporting structures, and governance practices are evolving in response to digital transformation (Falah Alroud et al., 2025).

Auditing is a critical component of financial accountability, ensuring the accuracy and reliability of financial statements. IT has significantly transformed auditing processes by introducing automation, reducing human error, and improving fraud detection capabilities (Roszkowska, 2021). Historically, auditors relied on physical records, manual calculations, and subjective judgment, which posed challenges related to efficiency, accuracy, and fraud detection (Samiolo et al., 2024). The advent of IT solutions, such as AI-powered analytics, cloud computing, and blockchain technology, has addressed these challenges by automating data analysis, enabling real-time audit trails, and enhancing fraud prevention mechanisms. These advancements have also increased the transparency and accountability of financial reporting, which is essential for regulatory compliance and investor confidence (Roszkowska, 2021).

The integration of IT into auditing practices has led to fundamental changes in how financial data is processed, analyzed, and verified (Gepp et al., 2018). The role of auditors has expanded beyond traditional functions, requiring them to develop competencies in IT systems, data analytics, and cybersecurity (Rahman et al., 2021). AI, for instance, has significantly enhanced auditors' ability to detect anomalies, assess risks, and provide data-driven insights that improve the overall audit process (Sutisna, 2025). Machine learning algorithms can quickly analyze large datasets and identify patterns that may indicate fraudulent activities, reducing the reliance on manual audit procedures (Gepp et al., 2018).

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Similarly, blockchain technology provides a decentralized and immutable ledger that ensures the integrity of financial transactions, reducing the risk of data manipulation and errors (Bonsón & Bednárová, 2019). Furthermore, cloud computing has facilitated remote auditing and real-time data access, significantly reduced operational inefficiencies, and enhanced collaboration between auditors and clients (Sewpersadh, 2025).

The global landscape of financial auditing has undergone considerable transformation due to the widespread adoption of IT (Manita et al., 2020). Countries with advanced regulatory frameworks have established guidelines for integrating digital technologies into auditing practices, emphasizing the importance of IT-driven audit procedures. The increasing digitization of business operations has necessitated an evolution in audit methodologies to keep pace with modern financial reporting complexities (Vitali & Giuliani, 2024). Large multinational firms are investing heavily in AI and blockchain-based audit tools to streamline compliance processes and enhance financial statement verification.

Moreover, the application of cloud-based AI has revolutionized risk assessment in auditing by facilitating real-time data analysis and predictive modeling (Abu Huson et al., 2025). Regulatory authorities in developed economies have recognized the importance of technology-driven audits, prompting the creation of policies to govern the use of AI and other digital tools in financial auditing (Sewpersadh, 2025). These global trends underscore the necessity for Jordan and the GCC countries to modernize their auditing practices to align with international standards. Despite the growing adoption of IT in auditing globally, limited research exists on its implementation in emerging economies.

Jordan, as a developing economy, has recognized the necessity of modernizing its auditing sector to align with international standards (Alharasis, 2025). Regulatory bodies such as the Jordanian Certified Public Accountants Association (JCPAA) and the International Financial Reporting Standards (IFRS) have encouraged the adoption of IT solutions in auditing to enhance compliance and reporting accuracy. The auditing landscape in Jordan and the GCC countries is influenced by factors such as government policies, technological infrastructure, and corporate governance mechanisms, all of which play a vital role in

determining the effectiveness of IT adoption in auditing practices (Abu Huson et al., 2025). The regulatory framework for key audit matters in Jordan and the GCC countries is shaped by a combination of international accounting standards, Islamic finance principles, and local legal requirements (Mah'd & Mardini, 2022). These nations adopt the IFRS for financial reporting purposes, with auditors being responsible for ensuring adherence to both national laws and specific regulatory guidelines. Each country within the region has its own designated bodies responsible for monitoring and enforcing auditing and accounting standards (Griffith, 2020).

The banking sector has witnessed significant IT-driven transformations in auditing. Financial institutions in Jordan and the GCC countries have increasingly relied on automated audit processes, AI-driven risk assessment, and blockchain-powered transaction verification to enhance financial transparency. The integration of IT in auditing has been instrumental in mitigating fraud risks, improving regulatory compliance, and ensuring more accurate financial disclosures (Morshed & Khrais, 2025).

Despite these advancements, challenges persist in implementing IT solutions within the auditing industry in Jordan and the GCC countries. Issues such as data security concerns, resistance to technological change, and the high costs associated with deploying sophisticated IT systems pose significant barriers to widespread adoption (Falah Alroud, 2025). However, given the increasing reliance on technology in financial reporting, overcoming these challenges is imperative for auditors to remain competitive in the evolving global market.

1.2 Motivations

The increasing reliance on IT in auditing has introduced a paradigm shift in the profession, offering enhanced efficiency, accuracy, and real-time data processing (Al-Omush et al., 2025). However, despite these advancements, numerous challenges remain that hinder the seamless adoption and integration of IT-driven audit methodologies. The primary issue lies in balancing technological innovation with data security, regulatory compliance,

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ethical considerations, and the continuous skill development required for auditors to adapt to emerging technologies (Aljawarneh et al., 2023).

The auditing profession has traditionally been characterized by structured methodologies, standardized processes, and manual verification techniques. The introduction of AI, blockchain, cloud computing, and data analytics has disrupted conventional practices, presenting both opportunities and challenges (Abu Huson et al., 2024). While these technologies improve audit accuracy, fraud detection, and efficiency, they also raise significant concerns regarding data security, privacy, and ethical accountability. The potential for algorithmic biases, data breaches, and the opacity of AI-driven decision-making processes poses significant risks to the integrity of financial audits (Al-Omush et al., 2025).

A key issue in IT-driven auditing is the regulatory and compliance landscape, which struggles to keep pace with technological advancements. In developing countries such as Jordan, where regulatory frameworks are still evolving, auditors face difficulties in navigating compliance requirements when using AI-based tools and blockchain for financial verification (Falah Alroud et al., 2025). The absence of well-defined standards for auditing AI-generated insights further exacerbates the problem, leading to inconsistencies in audit practices and financial reporting (Munoko et al., 2020).

Another major challenge stems from the varying levels of digital infrastructure and technological readiness across organizations. Many firms in Jordan and the GCC region lack the necessary IT infrastructure to support large-scale AI and blockchain implementation in auditing. This technological divide places auditors in a difficult position, as they must rely on outdated systems while attempting to comply with emerging global standards. The disparity in IT adoption levels creates inconsistencies in financial reporting, making it harder for auditors to maintain uniform assurance procedures across different industries (Sewpersadh, 2025; Roszkowska, 2021).

One of the most pressing challenges auditor faces is ensuring data security and privacy in

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a digitalized audit environment. The increased volume of electronic transactions and data storage raises the risk of cyberattacks, unauthorized access, and fraudulent financial reporting (Sutisna, 2025). Despite the adoption of cybersecurity measures, financial institutions and audit firms remain vulnerable to sophisticated hacking techniques and data breaches (Uddin et al., 2020). This issue is particularly critical in Jordan and the GCC region, where cybersecurity infrastructures may not be as robust as those in developed nations.

Cybersecurity threats in the auditing field include unauthorized access to sensitive financial information, data breaches exposing confidential corporate records, and ransomware attacks that can disrupt financial reporting processes. The consequences of such incidents extend beyond financial loss, as compromised audit reports can lead to reputational damage, legal liabilities, and regulatory penalties (Hasan et al., 2024). Therefore, auditing firms must prioritize robust cybersecurity strategies, including encryption, multi-factor authentication, and regular security audits, to safeguard the integrity of digital financial records (Nurwanah, 2024; Uddin et al., 2020; Sutisna, 2025).

Another significant concern is the skill gap among auditors in utilizing advanced IT solutions. Traditional auditors may lack the necessary expertise to operate AI-powered audit systems, analyze large datasets, and assess blockchain-verified financial transactions (Sewpersadh, 2025). Without adequate training and professional development, auditors may struggle to interpret AI-driven risk assessments, leading to inaccurate conclusions and reduced audit quality (Al-Omush et al., 2025). Bridging this skill gap is essential to ensure that auditing professionals remain competent and adaptable in the face of rapid technological advancements.

The transformation of auditing roles due to IT adoption necessitates a shift in professional training and education. Universities and professional accounting bodies must revise their curricula to incorporate courses on data analytics, cybersecurity, AI applications, and blockchain auditing. Additionally, firms must invest in continuous learning programs to equip their auditors with the technical skills needed to manage IT-driven audit

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environments effectively. Without structured educational reforms, the auditing profession risks lagging technological advancements, reducing the credibility and reliability of financial assurance services.

Additionally, regulatory and ethical dilemmas continue to pose challenges in IT-based auditing. Many AI models operate as ‘black-box’ systems, making it difficult for auditors to explain how decisions were reached based on machine-generated data. This lack of transparency can undermine stakeholder trust in AI-assisted audits and create legal challenges in the event of financial disputes (Schweitzer, 2024). Furthermore, regulators struggle to establish universally accepted frameworks that govern AI-driven auditing practices, resulting in inconsistencies across different markets and industries (Sewpersadh, 2025).

The ethical considerations surrounding AI-driven audits extend beyond transparency issues (Al-Omush et al., 2025). Auditors must ensure that AI models used in financial reporting are free from biases that could lead to discriminatory or misleading conclusions (Murikah et al., 2024). The algorithms trained on historical financial data may inherit biases from previous reporting patterns, potentially distorting audit outcomes. Establishing ethical AI governance frameworks is crucial to ensure that AI-driven audits uphold fairness, accuracy, and accountability in financial reporting (Schweitzer, 2024).

Given these challenges, there is a growing need for a structured approach to integrating IT into the auditing profession. This thesis aims to explore the impact of IT on audit methodologies in Jordan and the GCC region, examining how AI, blockchain, and cloud-based technologies influence financial reporting, risk assessment, and regulatory compliance. By identifying best practices and potential solutions, this research will provide insights into optimizing IT adoption in auditing while ensuring security, transparency, and compliance.

A key objective of this research is to investigate how auditors in Jordan and the GCC region navigate IT-related challenges in their auditing processes. By analyzing real-world

case studies, regulatory developments, and technological advancements, this thesis seeks to offer practical recommendations for enhancing IT adoption in the auditing sector.

Moreover, this study will examine the role of international auditing standards in shaping IT integration strategies. Comparing the regulatory approaches of developed economies with those of Jordan and the GCC will help identify gaps and provide recommendations for aligning local auditing practices with global best practices. The research will also explore whether hybrid audit models—combining AI-powered analytics with traditional human judgment—can provide a balanced solution to ensuring financial accuracy while maintaining auditor oversight.

Ultimately, this study aims to contribute to the broader discussion on digital transformation in auditing, providing policymakers, regulators, and audit practitioners with actionable insights into mitigating the risks associated with IT-driven audits while maximizing their benefits. Addressing the challenges of cybersecurity, skill development, regulatory compliance, and ethical AI governance will be critical in ensuring that auditing in Jordan and the GCC region keeps pace with the rapidly evolving global financial landscape.

By proposing a comprehensive framework for IT adoption in auditing, this thesis will help bridge the gap between technological advancements and practical implementation, ensuring that IT-driven audits maintain the highest levels of accuracy, security, and accountability.

1.3 General Aim and Objectives

The primary objective of this thesis is to examine the impact of IT on auditing in Jordan and the GCC region. The rapid advancement of IT, including AI, blockchain, and cloud-based systems, has fundamentally transformed auditing processes, introducing both opportunities and challenges. This study seeks to evaluate how these technological innovations influence audit quality, regulatory compliance, financial reporting transparency, and auditor responsibilities within the region.

To achieve this primary objective, the following specific research objectives have been formulated:

RO1: State-of-the-Art Analysis of IT in Auditing

This objective aims to identify and analyze the existing body of knowledge on the role of IT in auditing. By conducting a bibliometric analysis, this study will systematically map the evolution of IT applications in auditing, highlight key research trends, and identify emerging themes. This objective will provide a foundation for understanding how technologies such as AI, blockchain, and big data analytics have influenced audit methodologies.

RO2: Examining Cloud-Based AI and Its Impact on Audit Reports

This objective is to investigate the relationship between cloud-based AI and audit reports, with a specific focus on the mediating role of auditors. The increasing reliance on AI-driven tools in auditing has raised questions regarding human oversight, decision-making processes, and the reliability of AI-generated insights. Through a quantitative approach, this research will assess the extent to which AI enhances audit efficiency and accuracy while evaluating potential limitations, such as bias in AI models and challenges related to auditor judgment. The findings will offer insights into how auditors in Jordan can effectively integrate AI technologies while maintaining audit integrity and regulatory compliance.

RO3: Investigating the Disclosure of Key Audit Matters in the Banking Sector

This objective focuses on understanding how IT influences the disclosure of Key Audit Matters (KAMs) in the banking sector of Jordan and GCC countries. Specifically, this study will examine how auditor characteristics, banking sector dynamics, board of directors' attributes, and audit committee governance affect KAM disclosures. Utilizing random-effects Poisson and logistic regression models, this research will explore patterns and variations in KAM disclosures, shedding light on the role IT plays in shaping transparency and accountability in financial reporting. Given the banking sector's heavy

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reliance on digital transactions and regulatory oversight, this objective will provide critical insights into the intersection of IT and audit reporting within a high-risk financial environment.

By addressing these objectives, this thesis aims to contribute to the academic literature on IT in auditing while offering practical implications for auditors, regulators, and policymakers. The findings will help stakeholders understand the opportunities and challenges associated with IT adoption in auditing, particularly in emerging economies such as Jordan and the GCC countries. Moreover, the study will provide recommendations for enhancing IT integration in audit practices while ensuring ethical considerations, regulatory compliance, and the professional judgment of auditors remain central to audit processes.

This thesis also seeks to bridge the knowledge gap in understanding the adoption of emerging technologies in the auditing landscape in Jordan and the GCC countries. Given the limited empirical research on this topic within the Middle Eastern context, this study will provide new insights into how auditors perceive and integrate IT in their professional practices.

1.4 Theoretical Framework

The integration of IT into auditing has brought about a fundamental transformation in the profession, reshaping traditional audit methodologies, enhancing the transparency of financial reporting, and introducing a range of regulatory, strategic, and ethical dimensions (Abu Huson et al., 2024). As emerging technologies such as AI, blockchain, and cloud computing become increasingly embedded in audit practices, it is essential to situate these developments within an appropriate theoretical foundation. This study employs a multi-theoretical framework that incorporates the Technology Acceptance Model (TAM), Diffusion of Innovations Theory, and Agency Theory to explore the drivers, processes, and implications associated with the adoption of IT in auditing, particularly within the context of Jordan and the GCC region.

The TAM, initially proposed by Davis (1989), offers critical insights into the psychological and behavioral factors that influence individuals' acceptance and use of technological innovations. TAM posits that two core constructs—perceived usefulness and perceived ease of use—are primary determinants of an individual's intention to adopt a new technology. In the domain of auditing, TAM provides a valuable lens through which to evaluate how auditors in Jordan and the GCC perceive the incorporation of AI, blockchain, and cloud-based systems into their professional workflows. Auditors are more likely to embrace these technologies when they perceive them as enhancing audit efficiency, reducing manual workload, and supporting adherence to regulatory standards. Conversely, the presence of perceived complexity, insufficient familiarity, or inadequate institutional support may hinder adoption. By emphasizing the cognitive and behavioral aspects of technology use, TAM underscores the importance of targeted training initiatives, user-centered system design, and supportive organizational environments in promoting successful IT implementation, particularly in developing economies.

Complementing TAM, Rogers' Diffusion of Innovations Theory (2003) provides a broader socio-organizational perspective on the spread and uptake of technological innovations. The theory conceptualizes diffusion as a process whereby an innovation spreads over time through specific communication channels within a social system. It categorizes adopters into five groups—innovators, early adopters, early majority, late majority, and laggards—based on their readiness to embrace new technologies. Applied to the current research, this theory aids in understanding the variation in IT adoption across audit firms in Jordan. While some organizations quickly integrate AI and blockchain due to their potential benefits in fraud detection, operational efficiency, and compliance, others exhibit reluctance stemming from high implementation costs, unclear regulatory guidance, or limited technical expertise. By identifying patterns of adoption and resistance, Diffusion of Innovations Theory contributes to the development of targeted policy measures and strategic interventions aimed at fostering more widespread and equitable technology integration across the auditing sector.

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Furthermore, Agency Theory enriches the analytical framework by addressing the principal-agent relationship central to the auditing function. Grounded in the concept of information asymmetry, Agency Theory examines the role of auditors as independent agents entrusted with verifying the fairness and accuracy of financial statements prepared by company management for the benefit of shareholders. The increasing application of IT in auditing introduces new complexities to this dynamic, particularly concerning auditor independence, decision-making autonomy, and accountability. For instance, the use of automated risk assessment tools and AI-driven anomaly detection systems modifies the nature of audit evidence and alters the extent of human involvement in assurance processes. Similarly, blockchain technology offers the promise of tamper-proof transaction records, which may mitigate fraud risks but also raises concerns regarding overreliance on technology versus professional skepticism. Moreover, cloud computing affects data access, storage, and confidentiality, thereby influencing the reliability of audit assurance and the level of trust stakeholders place in financial reporting.

By synthesizing TAM, Diffusion of Innovations Theory, and Agency Theory, this study establishes a comprehensive theoretical foundation that integrates individual, organizational, and institutional perspectives on IT adoption in auditing. TAM elucidates the psychological and behavioral factors underlying technology acceptance; Diffusion Theory contextualizes the varying rates and patterns of adoption across different levels of technological maturity; and Agency Theory enables a critical analysis of the evolving expectations placed upon auditors, the delegation of tasks to automated systems, and the broader implications for audit quality and professional integrity.

Together, these theoretical lenses provide a robust analytical basis for investigating how IT is reshaping auditing practices in Jordan and the wider GCC region. They facilitate a nuanced understanding of not only the operational and technical advantages offered by emerging technologies but also the institutional, ethical, and human elements that influence their effective deployment. This thesis aims to identify both the transformative opportunities and the persistent challenges faced by auditors and regulatory authorities in advancing the accuracy, security, and credibility of financial reporting in the digital era.

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The following sections build upon this theoretical scaffolding to critically assess the benefits, limitations, and future trajectories of IT-enabled auditing practices.

1.4.1 The Evolving Role of IT in Auditing

The growing reliance on IT in auditing has transformed how financial records are assessed and verified. The digitalization of financial transactions and the proliferation of automated accounting systems necessitate a shift in auditing methodologies to ensure accuracy and compliance (Sheela et al., 2023). Traditional audit procedures, which relied on manual data verification and sampling methods, have been increasingly supplemented or replaced by data-driven approaches that leverage AI and machine learning for anomaly detection and predictive risk assessment (Appelbaum et al., 2017).

The regulatory landscape governing IT adoption in auditing varies considerably from one country to another. Developed economies have implemented comprehensive guidelines for IT integration, while emerging economies like Jordan face challenges in aligning regulatory standards with global best practices. The role of regulatory bodies such as the JCPAA and the IFRS has been instrumental in guiding IT adoption in auditing. However, there remains a need for clearer frameworks and standardized guidelines to facilitate a seamless transition toward digital auditing in Jordan.

The banking sector serves as an ideal case study for examining IT's impact on auditing due to its heavy reliance on digital transactions and regulatory oversight. The disclosure of KAMs has emerged as a critical component of audit reports, providing stakeholders with valuable insights into financial statement risks and auditor judgments (Rahaman et al., 2023). IT solutions, such as blockchain-powered transaction verification and AI-driven risk modeling, have significantly enhanced the transparency and reliability of KAM disclosures, ensuring that financial reports reflect an accurate representation of an institution's financial health (Abu Huson et al., 2024).

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1.4.2 Benefits of AI and IT in Auditing

1.4.2.1 Enhanced Efficiency and Accuracy

AI-driven tools have revolutionized the auditing landscape by minimizing manual effort, reducing errors, and enabling auditors to focus on higher-value tasks such as risk assessment and strategic analysis. Traditional auditing required extensive manual efforts in data collection, transaction verification, and compliance assessments, often making the process time-consuming and susceptible to human errors. The application of AI-driven tools has streamlined these operations, ensured improved precision and efficiency, while also empowered auditors to deliver deeper insights and more proactive recommendations (Anomah et al., 2024).

AI-powered automation enables auditors to analyze vast amounts of structured and unstructured financial data within seconds. Machine learning algorithms and natural language processing tools extract relevant information from financial statements, contracts, and invoices, categorizing transactions and flagging potential anomalies (Chowdhury, 2021). This automation minimizes the likelihood of oversight, as AI systems can identify deviations and inconsistencies that might be missed through manual reviews (Sewpersadh, 2025).

One of AI's major contributions to auditing is eliminating repetitive tasks (Fedyk et al., 2022). Auditors traditionally spend extensive hours reviewing financial records and reconciling accounts, but with robotic process automation (RPA), these tasks are now performed quickly and precisely. RPA bots can handle data entry, generate audit trails, and facilitate compliance checks, freeing auditors to focus on high-value activities such as fraud detection, strategic advisory, and risk assessment (Perdana et al., 2023).

Furthermore, AI facilitates real-time auditing, a departure from conventional retrospective audits. Continuous transaction monitoring allows auditors to detect irregularities as they occur rather than at the end of an audit cycle (Al-Omush et al., 2025). This proactive approach enables companies to address financial discrepancies immediately, reducing the risk of fraud and non-compliance. Additionally, real-time auditing enhances corporate

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governance by fostering greater transparency and accountability in financial reporting (Ilori et al., 2024).

The use of AI also enhances accuracy by reducing human biases. While manual auditing methods are prone to errors due to fatigue, judgmental biases, and inconsistent sampling, AI systems maintain objectivity in data analysis. AI-based predictive models detect patterns, assess financial risks, and generate insights with a higher level of precision than traditional methods (Tiron-Tudor & Deliu, 2022). Blockchain technology further strengthens audit accuracy by providing immutable transaction records, ensuring data integrity and audit reliability (Chen et al., 2021).

However, it is essential to recognize that AI does not replace human auditors but rather augments their capabilities (Munoko et al., 2020). Human expertise remains vital in interpreting AI-generated insights, exercising professional skepticism, and making informed decisions. By leveraging AI, auditors can increase their efficiency, improve the accuracy of financial reporting, and deliver high-quality audit services (Tiron-Tudor & Deliu, 2022).

1.4.2.2 Improved Risk Assessment

Risk assessment is a critical aspect of auditing, and AI has significantly enhanced its effectiveness (Munoko et al., 2020). Traditional risk assessment methods relied on historical data, subjective judgment, and sample-based testing, which could overlook hidden risks or emerging financial irregularities. In contrast, AI-driven techniques adopt a more data-focused and forward-thinking approach (Boinapalli, 2023).

AI-powered predictive analytics enables auditors to analyze vast datasets and detect early warning signals of financial risks (Al-Omush et al., 2025). By assessing historical financial data, AI models identify anomalies, fraud indicators, and deviations from normal transaction patterns. These insights allow auditors to prioritize high-risk areas, allocate resources efficiently, and conduct more targeted risk assessments (Bello & Olufemi, 2024; Boinapalli, 2023).

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Machine learning algorithms play a pivotal role in enhancing risk assessment accuracy. These algorithms continuously learn from audit outcomes, adapting to evolving financial risks and improving their predictive capabilities (Ilori et al., 2024). For example, AI can identify unusual spending behaviors, duplicate transactions, or round-dollar payments, all of which may indicate fraudulent activity. This allows auditors to conduct more comprehensive investigations and strengthen their fraud detection mechanisms (Roszkowska, 2021; Bello & Olufemi, 2024).

AI also supports risk-based auditing, where auditors focus on high-risk transactions rather than applying uniform audit procedures across all financial records (Sewpersadh, 2025). Risk-based auditing improves efficiency by reducing unnecessary manual reviews and directing auditors' attention to the most critical financial areas. This approach is particularly valuable in high-risk industries such as banking, insurance, and multinational corporations, where complex transactions require rigorous scrutiny (Le et al., 2022).

Regulatory compliance is another crucial area where AI enhances risk assessment. Financial regulations are constantly evolving, and organizations must ensure compliance with national and international auditing standards (Adeniran et al., 2024; Munoko et al., 2020). AI-powered compliance monitoring tools analyze financial records against regulatory requirements, flagging potential compliance violations and reducing the likelihood of legal penalties. These tools provide real-time updates on regulatory changes, allowing auditors to adapt their practices accordingly (Panchapakesan et al., 2025).

Overall, AI's capabilities in predictive analytics, anomaly detection, and risk prioritization significantly improve the effectiveness of audit risk assessments. By leveraging AI-driven insights, auditors can detect potential risks earlier, mitigate financial fraud, and enhance the credibility of financial reporting.

1.4.2.3 Real-Time Monitoring and Reporting

The ability to perform real-time monitoring and reporting represents one of the most

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transformative impacts of AI and IT in auditing (Abdullah & Almaqtari, 2024). Traditional auditing methods relied on periodic assessments, often conducted at the end of financial cycles. This approach delayed the detection of financial misstatements and fraudulent activities. AI-powered real-time auditing, however, offers a more dynamic and proactive approach (Ghafar et al., 2024).

Real-time monitoring is made possible through automated data collection and analysis. AI algorithms continuously scan financial transactions, bank statements, and company ledgers, identifying irregularities as they occur (Bello & Olufemi, 2024). Blockchain technology further enhances this process by providing an immutable ledger where transactions are securely recorded and verified in real-time. This ensures the authenticity of financial records and reduces the likelihood of fraudulent reporting (Roszkowska, 2021).

Cloud-based AI platforms play a vital role in enabling remote real-time audits. These platforms allow auditors to access financial data securely from different locations, facilitating seamless collaboration between audit teams and their clients (Sewpersadh, 2025). Cloud technology also ensures data consistency by synchronizing records across different departments, eliminating discrepancies and improving the reliability of audit reports (Abu Huson et al., 2025).

Automated reporting tools streamline the process of generating audit reports. AI-powered dashboards provide real-time visualizations of financial health indicators, enabling auditors to communicate findings more effectively to stakeholders. These dashboards display key financial metrics, highlight risk factors, and suggest corrective actions, enhancing decision-making for both auditors and company executives (Panchapakesan et al., 2025).

By implementing real-time monitoring, organizations benefit from improved internal controls and financial governance. Continuous auditing enables companies to address financial discrepancies promptly, reducing financial risks and increasing operational

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efficiency. AI-driven alerts notify auditors of suspicious transactions, ensuring timely intervention and fraud prevention (Ilori et al., 2024).

1.4.2.4 Cost Reduction

The integration of AI and IT in auditing has resulted in significant cost reductions for audit firms and their clients (Fedyk et al., 2022). Traditional auditing involved labor-intensive processes, extensive documentation, and manual verification, all of which contributed to high operational costs. AI-driven automation has streamlined these tasks, reducing the reliance on manual labor and lowering overall audit expenses (Al-Omush et al., 2025).

One of the primary cost-saving benefits of AI is the reduction in audit cycle times. Automated data processing accelerates financial statement verification, allowing auditors to complete audits in a fraction of the time required using conventional methods (Panchapakesan et al., 2025). This efficiency translates into lower billable hours for clients, making auditing services more cost-effective.

Additionally, AI-driven fraud detection minimizes financial losses due to fraud and mismanagement. By identifying fraudulent activities early, organizations can take corrective measures before significant financial damage occurs. This proactive fraud prevention reduces litigation costs, regulatory fines, and reputational risks associated with financial misstatements (Sharma et al., 2024).

Cloud computing further enhances cost efficiency by reducing infrastructure expenses. Audit firms no longer need to maintain extensive physical storage for financial records, as cloud platforms provide secure, scalable data storage solutions (Appelbaum, 2016). Cloud-based audits also enable remote work, reducing travel expenses and increasing flexibility for audit teams (Lorentzon et al., 2024).

By leveraging AI and IT, organizations can optimize audit processes, reduce operational costs, and allocate financial resources more strategically (Almaqtari, 2024). The cost

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efficiency achieved through digital transformation strengthens the sustainability of auditing practices while maintaining high standards of financial transparency and regulatory compliance (Manita et al., 2020).

1.4.3 Challenges and Considerations

1.4.3.1 Data Security and Privacy

The increased reliance on digital systems in auditing has raised significant concerns regarding data security and privacy. As financial transactions, corporate records, and audit reports become increasingly digitized, the risk of cyber threats and unauthorized access has escalated. Auditors must ensure that robust cybersecurity measures are in place to protect sensitive financial information from potential breaches (Hasan et al., 2024).

One of the primary concerns surrounding data security in auditing is the vulnerability of financial information to cyberattacks. Cybercriminals often target organizations with weak security measures, seeking to exploit financial data for fraudulent activities (Uddin et al., 2020). Common threats include phishing attacks, malware infiltration, and ransomware attacks, all of which can compromise confidential client information. Auditing firms must invest in advanced cybersecurity technologies such as encryption, multi-factor authentication, and secure cloud storage to mitigate these risks (Nurwanah, 2024).

Blockchain technology has emerged as a promising solution for enhancing data security in auditing. By creating an immutable and decentralized ledger of transactions, blockchain ensures that financial records cannot be altered or tampered with retroactively. This provides auditors with a reliable and transparent system for verifying financial data integrity (Qadir & Mahmood, 2024). However, the adoption of blockchain technology in auditing also presents challenges, including the need for regulatory frameworks that align with blockchain-based record-keeping (Sheela et al., 2023).

Another key aspect of data security is the implementation of stringent access controls. Unauthorized access to financial data poses a significant risk, particularly in organizations

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that handle large volumes of sensitive information (Gade, 2020). Auditors must ensure that only authorized personnel have access to critical financial records, utilizing role-based access controls and stringent authentication mechanisms (Omotunde & Ahmed, 2023).

Privacy regulations also play a crucial role in shaping data security practices in auditing. The General Data Protection Regulation (GDPR) and similar data protection laws require organizations to implement strict measures to safeguard personal and financial information (Fakeyede et al., 2023). Compliance with these regulations is essential for audit firms operating in jurisdictions with stringent data protection laws. Failure to comply with privacy regulations can result in legal penalties, reputational damage, and financial losses (Bello et al., 2024).

To address data security and privacy concerns effectively, auditors must adopt a proactive approach that includes regular security audits, vulnerability assessments, and employee training on cybersecurity best practices (Fakeyede et al., 2023). By prioritizing data security, audit firms can safeguard sensitive financial information, maintain compliance with regulatory requirements, and enhance stakeholder trust (Sutisna, 2025).

1.4.3.2 Skill Development

The successful integration of AI and IT in auditing requires auditors to develop new skills and competencies. As traditional audit methodologies evolve, professionals must acquire expertise in data analytics, machine learning, cybersecurity, and blockchain technology to remain effective in their roles (Abu Huson et al., 2024).

One of the key challenges in skill development is the need for continuous professional education. Many auditors were trained in traditional auditing methods and may lack familiarity with emerging technologies (Feliciano & Quick, 2022). To bridge this knowledge gap, auditing firms and professional organizations must invest in comprehensive training programs that equip auditors with the technical skills required for AI-driven auditing (Al-Omush et al., 2025).

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Data literacy is becoming an essential skill for auditors in the digital era. AI-powered audit tools rely on complex algorithms to process financial data, detect anomalies, and generate risk assessments (Sutisna, 2025). Auditors must be proficient in interpreting AI-generated insights, validating machine-learning models, and applying data-driven decision-making principles. Understanding statistical models and data visualization techniques is also crucial for effectively analyzing audit findings (Abu Huson et al., 2025).

Cybersecurity awareness is another critical component of skill development. As auditors increasingly rely on cloud-based platforms and AI-driven audit software, they must be knowledgeable about cybersecurity risks and best practices. Training programs should focus on secure data handling, threat detection, and incident response strategies to mitigate cyber threats (Hasan et al., 2024).

Regulatory knowledge must also be continuously updated to keep pace with evolving compliance requirements. AI and IT innovations in auditing often introduce new legal and ethical considerations, requiring auditors to stay informed about regulatory changes affecting financial reporting and data privacy (Munoko et al., 2020). Professional certification programs, such as the Certified Information Systems Auditor and AI-specific auditing certifications, can help auditors enhance their technical competencies (Sabty & Al-Taie, 2024).

To foster skill development, auditing firms should encourage a culture of continuous learning and collaboration between traditional auditors and IT professionals. Cross-disciplinary training programs can facilitate knowledge-sharing and enhance auditors' ability to navigate the complexities of AI and IT integration (Munoko et al., 2020).

1.4.3.3 Regulatory Compliance

As regulatory frameworks evolve, auditors must navigate complex compliance requirements to ensure the integrity and credibility of the auditing profession (Sheela et al., 2023). The integration of AI and IT in auditing has introduced new regulatory challenges, particularly concerning data security, financial reporting standards, and the use

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of AI-driven decision-making models (Sreseli, 2023).

One of the primary regulatory concerns is the need for standardized guidelines governing AI-driven auditing practices. Regulatory bodies such as the International Auditing and Assurance Standards Board (IAASB) and the Public Company Accounting Oversight Board (PCAOB) are working to develop frameworks that address AI's role in financial audits (Sewpersadh, 2025). However, the lack of universally accepted AI auditing standards presents challenges for auditors operating across multiple jurisdictions (Munoko et al., 2020).

AI-driven auditing also raises concerns about the transparency and explainability of AI-generated audit findings (Sreseli, 2023). Regulators require auditors to provide justification for their conclusions, yet many AI algorithms function as “black boxes,” making it difficult to trace how certain audit decisions were reached. To address this challenge, auditing firms must adopt explainable AI techniques that enhance the interpretability of machine learning models (Al-Omush et al., 2025).

Another key aspect of regulatory compliance is data protection. Privacy laws such as GDPR, the California Consumer Privacy Act, and other regional regulations impose strict requirements on how financial data is collected, processed, and stored (Alexander, 2019). Auditors must ensure compliance with these regulations while conducting AI-assisted audits, implementing measures such as financial data anonymization and encryption to protect client information (Hasan et al., 2024).

The increasing use of blockchain in financial reporting also raises regulatory concerns. While blockchain enhances transparency and security, regulators must establish guidelines for auditing blockchain-based financial transactions. Audit firms must collaborate with regulatory authorities to develop best practices for verifying blockchain records and ensuring compliance with financial reporting standards (Almadadha, 2024).

To navigate the evolving regulatory landscape, auditing firms must engage in proactive

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compliance monitoring, regulatory risk assessments, and collaboration with standard-setting bodies (Owusu-Afriyie et al., 2024). By staying informed about regulatory changes and adopting best practices, auditors can maintain compliance while leveraging AI and IT innovations to enhance audit quality (Sewpersadh, 2025).

1.4.3.4 Ethical Considerations

The use of AI in auditing raises ethical concerns regarding transparency, accountability, and bias. As AI-driven audit tools play an increasingly prominent role in financial reporting, auditors must ensure that AI systems are used responsibly and that their outputs are subject to human oversight and verification (Munoko et al., 2020).

One of the primary ethical concerns is algorithmic bias. AI models are trained in historical financial data, which may contain biases that influence audit outcomes. If not carefully managed, AI algorithms may reinforce existing biases in financial reporting, leading to unfair or misleading audit conclusions. Auditors must implement fairness checks and bias mitigation strategies to ensure that AI-generated findings are objective and equitable (Murikah et al., 2024).

Another ethical challenge is the potential over-reliance on AI in auditing. While AI enhances efficiency and accuracy, auditors must exercise professional skepticism and critical judgment when interpreting AI-generated insights (Anomah et al., 2024). AI should be viewed as a complementary tool rather than a replacement for human auditors. Ensuring a balance between AI-driven automation and human expertise is essential for maintaining audit credibility (Tiron-Tudor & Deliu, 2022).

Transparency is also a critical ethical consideration. Stakeholders, including investors, regulators, and clients, must have confidence in AI-driven audit processes (Chakrabarti et al., 2025). Auditors should disclose the extent to which AI was used in audits, the methodologies applied, and the limitations of AI-generated findings. Transparent reporting fosters trust and reduces concerns about the opacity of AI-driven decision-making (Al-Omush et al., 2025).

Finally, ethical guidelines must be established to govern the responsible use of AI in auditing. Professional organizations such as the American Institute of Certified Public Accountants and the International Federation of Accountants should develop ethical frameworks that address AI's implications for financial reporting (Murikah et al., 2024). These guidelines should emphasize principles such as accountability, fairness, and data integrity.

By addressing ethical considerations proactively, auditing firms can uphold the integrity of AI-assisted audits while fostering trust and credibility in financial reporting (Munoko et al., 2020).

1.5 Contribution to Research Field

This thesis makes several significant contributions to the research field of auditing and IT. Primarily, it addresses a critical gap in the existing literature by exploring the impact of advanced IT tools—such as AI, blockchain, and cloud computing—on auditing practices within Jordan and the GCC region. By focusing on this under-researched geographical context, the study enriches the global discourse on digital transformation in auditing, offering insights that are particularly relevant to emerging economies.

One of the key contributions of this research lies in its empirical examination of how AI-driven tools and blockchain technologies influence audit quality, financial reporting transparency, and regulatory compliance. While prior studies have predominantly concentrated on developed economies, this thesis provides a nuanced understanding of the opportunities and challenges associated with IT adoption in a developing country like Jordan. The findings offer actionable recommendations for auditors, regulators, and policymakers aiming to modernize auditing practices in alignment with international standards.

Furthermore, this study advances theoretical frameworks by integrating interdisciplinary

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perspectives from accounting, IT governance, and cybersecurity. It critically evaluates the ethical, regulatory, and skill development implications of AI and blockchain in auditing, thereby addressing unresolved questions about algorithmic bias, data security, and auditor accountability. This comprehensive approach not only enhances the theoretical foundation of IT-auditing research but also underscores the importance of ethical AI governance in maintaining public trust in financial reporting.

Another notable contribution is the exploration of hybrid audit models that combine AI-powered analytics with traditional human judgment. This innovative conceptualization offers a balanced solution to the challenges posed by over-reliance on automated systems, ensuring that auditor oversight remains central to the assurance process. The study's emphasis on real-time monitoring, cost reduction, and improved risk assessment through AI-driven tools provides practical guidance for firms seeking to optimize their audit methodologies.

Additionally, this research contributes to the growing body of knowledge on KAMs in the banking sector. By examining the role of IT in shaping KAM disclosures, the study highlights the intersection of technological advancements and financial transparency. This focus is particularly timely given the increasing reliance on digital transactions and regulatory oversight in high-risk industries such as banking.

Finally, the thesis bridges the gap between technological innovation and practical implementation by proposing a structured framework for IT adoption in auditing. This framework emphasizes the need for robust cybersecurity measures, continuous professional development, and standardized regulatory guidelines. By addressing these critical dimensions, the study equips stakeholders with the tools necessary to navigate the complexities of IT-driven audits while upholding the highest standards of accuracy, security, and accountability.

1.6 Methodology

This thesis adopts a multi-faceted methodological approach to explore the impact of IT,

AI, and blockchain on auditing practices in Jordan and the GCC region. The research scope encompasses three distinct yet interconnected studies, each employing rigorous methodologies tailored to its objectives. These studies collectively aim to provide a comprehensive understanding of how technological advancements are reshaping auditing processes, enhancing transparency, and addressing challenges related to regulatory compliance, data security, and ethical considerations.

Methodology of Paper 1: Bibliometric Analysis of IT, AI, and Blockchain in Auditing

The first study focuses on analyzing the state of the art in the literature concerning IT, AI, and blockchain in auditing. A bibliometric analysis was conducted to map publishing activity, identify research trends, and highlight key topics within this domain. The dataset comprised 328 peer-reviewed studies published between 2017 and 2022, sourced from the Web of Science Core Collection—a highly reputable database known for its academic rigor. Using the VOSviewer software, the study visually represented relationships and patterns within literature, enabling the identification of influential authors, journals, themes, and countries contributing to the field. This methodology provides a systematic overview of the intellectual structure of IT-driven auditing research, offering insights into emerging trends and gaps in existing literature. By synthesizing these findings, the study establishes a foundational framework for understanding the evolving role of IT in auditing.

Methodology of Paper 2: Quantitative Analysis of Cloud-Based AI in Auditing

The second study investigates the potential enhancements of cloud-based AI in auditing through a quantitative approach. A structured questionnaire was distributed to external auditors in Jordan, with a sample size of 322 participants selected using a systematic random sampling technique. The population included 454 audit offices across Jordan, comprising diverse auditors such as partner-owner auditors, assistant auditors, and certified auditors. Data were analyzed using SmartPLS software, which employs structural equation modeling (SEM) to examine complex relationships among variables. This methodology allowed for the assessment of how cloud-based AI influences audit efficiency, accuracy, and decision-making while considering the mediating role of

auditors. The findings provide empirical evidence of the transformative impact of AI-driven tools on auditing practices, highlighting opportunities and challenges associated with their adoption.

Methodology of Paper 3: Investigating Key Audit Matters (KAMs) in the Banking Sector

The third study examines the disclosure of KAMs in the banking sector of Jordan and GCC countries, with a particular focus on IT-related disclosures. Utilizing a longitudinal dataset of 79 banks spanning 553 observations from 2016 to 2022, the study employed random-effects Poisson and logistic regression models to test its hypotheses. Data were collected from two primary sources: audit reports available on banks' websites and financial data obtained from the EIKON database and annual reports. The selection of banks as the focal point stems from their critical role in the economies of Jordan and the GCC, as well as their reliance on sophisticated IT systems. The inclusion of IT-related KAMs addresses the growing importance of cybersecurity, data privacy, and digital transformation risks in the banking sector. By analyzing auditors, banks, board of directors (BoD), audit committee (AC), and governance attributes, the study identifies factors influencing KAM disclosures and underscores their significance for stakeholders, including investors, regulators, and academics.

The research scope is designed to address the multifaceted implications of IT adoption in auditing, focusing on Jordan and the GCC region. This geographical focus is motivated by the shared economic characteristics and regulatory frameworks within the region, as well as Jordan's strong ties to the GCC despite not being a formal member. The banking sector serves as an ideal case study due to its reliance on IT systems, regulatory oversight, and the complexity of financial products and risks. By examining IT-driven transformations in auditing, the study bridges theoretical and practical dimensions, offering actionable insights for auditors, regulators, and policymakers.

The integration of bibliometric analysis, quantitative surveys, and econometric modeling ensures a holistic exploration of IT's impact on auditing. While bibliometric analysis

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provides a macro-level perspective on research trends, the quantitative studies offer micro-level insights into specific applications of AI and IT in auditing. Together, these methodologies address the research objectives, contribute to the academic discourse, and provide practical recommendations for enhancing IT adoption in auditing practices.

By adopting these rigorous and complementary methodologies, this thesis aims to advance the understanding of IT's transformative role in auditing, emphasizing the need for robust regulatory frameworks, continuous skill development, and ethical governance to ensure the credibility and reliability of financial reporting in the digital era.

1.7 Organization of the Thesis

This thesis is meticulously structured to provide a comprehensive examination of the impact of IT on auditing, with a particular focus on Jordan and the GCC region. By integrating theoretical insights, empirical evidence, and practical implications, the study aims to contribute to both academic discourse and professional practice in the field of IT-driven auditing. Below is an overview of the organisation of the thesis:

Chapter One: Introduction

The first chapter introduces the research topic, providing a detailed background on the transformative role of IT, AI, and blockchain in auditing. It highlights the significance of these technological advancements in enhancing audit quality, efficiency, and transparency while addressing the challenges associated with their adoption. The chapter also outlines the motivations for the study, emphasizing the need to explore IT's impact on auditing in emerging economies like Jordan. Additionally, it presents the research objectives, theoretical framework, and the structure of the thesis, setting the stage for subsequent chapters.

Chapter Two: Bibliometric Review of IT, AI, and Blockchain in Auditing

This chapter conducts a bibliometric analysis to map the state of the art in IT, AI, and blockchain applications within the auditing domain. The chapter identifies key research

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trends, influential authors, prominent journals, and significant themes. It visually represents relationships and patterns within the literature, offering a systematic overview of how technological innovations have reshaped auditing practices globally. This foundational analysis provides critical insights into existing knowledge gaps and emerging areas of interest.

Chapter Three: The Role of Cloud-Based AI in Shaping Audit Reports

The third chapter investigates the influence of cloud-based AI on audit reports, with a specific focus on the mediating role of auditors. Employing a quantitative approach, this chapter analyses data collected from external auditors in Jordan through a systematic random sampling technique. The findings highlight how AI enhances audit efficiency, accuracy, and decision-making while addressing potential limitations such as algorithmic biases and auditor judgment challenges. This chapter underscores the importance of balancing technological innovation with human oversight in ensuring audit integrity.

Chapter Four: The Effect of IT on Key Audit Matters (KAMs) in Jordan and GCC Banking Audits

The fourth chapter examines the impact of IT on the disclosure of KAMs in the banking sector of Jordan and the GCC countries. The chapter employs random-effects Poisson and logistic regression models to analyse how IT influences KAM disclosures. The study explores the roles of auditors, bank characteristics, board of directors, audit committees, and governance mechanisms in shaping KAM transparency. By focusing on IT-related KAMs, this chapter provides valuable insights into how technological advancements enhance financial reporting accuracy, regulatory compliance, and stakeholder trust in high-risk industries like banking.

Chapter Five: Synthesis of Findings, Implications, and Conclusion

The final chapter synthesises the findings from the preceding chapters, offering a holistic analysis of IT's role in auditing. It discusses the theoretical, practical, and policy implications of the study, emphasising the opportunities and challenges associated with IT adoption in auditing. The chapter concludes by summarising the contributions of the

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research to academic literature and professional practice, highlighting its relevance for auditors, regulators, and policymakers. Furthermore, it acknowledges the inherent limitations, and outlines recommendations for future research, particularly in the context of emerging economies, and underscores the importance of aligning local auditing practices with global standards.

By adhering to this structured approach, the thesis provides a nuanced understanding of how AI, blockchain, and cloud computing are reshaping auditing practices. It underscores the necessity for auditors to adapt to technological advancements while addressing ethical, regulatory, and skill development considerations. The findings from this study are expected to serve as a foundation for further research and policy development, ultimately enhancing the effectiveness of IT adoption in auditing in Jordan and beyond.

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**CHAPTER TWO: A BIBLIOMETRIC REVIEW OF
INFORMATION TECHNOLOGY, ARTIFICIAL
INTELLIGENCE, AND BLOCKCHAIN ON AUDITING**

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2.1 Introduction

The audit profession is experiencing growing sophistication due to technological advancements. It is widely acknowledged that both blockchain and artificial intelligence technologies are rapidly gaining momentum on a large scale. These technologies are technically advanced and carry significant economic implications (Moll & Yigitbasioglu, 2019). The main driving forces behind innovations today are artificial intelligence, and blockchain technologies. Both have caused significant changes in many aspects of life, including accounting, and auditing, and will have a significant impact on the digital economy, on future professions, and on how people live, and interact in the future (Smith, 2018). The audit process has been transformed by information technology from traditional audits to digital audits, or technology-based audits (Huang & Vasarhelyi, 2019). Auditors are no longer as interested in direct task-oriented accounting programs as they used to be. As a result, their roles have evolved to become more advisory. This requires the classical auditor to develop a new skill set, such as professional doubt, judgment, and critical thinking skills. Therefore, he plays the role of a modern auditor. This is what artificial intelligence and blockchain technology are expected to do in the auditing profession soon (Abdennadher et al., 2021).

Accounting aims to provide useful information to users and decision-makers, whereas auditing confirms that this information complies with International Accounting Principles and Standards (Demirkan et al., 2020). However, the auditing profession faces significant challenges because audit procedures differ from those used in traditional audits of accounting systems (Appelbaum et al., 2021). Due to the rapid development of information technology, addressing the challenges confronting the audit profession has become increasingly important (Knudsen, 2020). Firms' reliance on information technology in day-to-day operations is driving changes in work processes and business relationships (Vasarhelyi et al., 2018). In addition to the widespread availability of the internet, digital accounting systems, electronic commerce, and the use of websites and social media to disseminate financial information have further transformed the landscape (Alkhatib et al., 2019). Consequently, there is an increased need for new technologies, such as artificial intelligence and blockchain technology, to keep pace with the

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requirements of the audit profession amidst the rapid evolution of the digital business environment (Kend & Nguyen, 2020).

Information technology significantly affects modern and contemporary companies, as it increases their ability to store, capture, process, and analyze large amounts of data. Thus, it has an impact on the audit profession in many aspects, including the planning process, evidence collection, audit skills, audit knowledge, the risks faced by auditors, and the audit techniques used (Brown-Liburd et al., 2015; Salijeni et al., 2019). The spread of information technology has led many companies to rely heavily on the automation of accounting information systems to gain a competitive advantage. As a result, auditors no longer need sampling to evaluate controls; instead, they can analyze their relevant data using data analysis software based on artificial intelligence technologies (Munoko et al., 2020).

Information technology represented by artificial intelligence, and blockchain technologies contributes to adding value to companies as it saves time for management, and auditors because the workload is spread throughout the year, not only at the end of the financial cycle or during the audit process. It also contributes to providing more evidence than that provided in a traditional audit in the presence of ever-increasing big data (Elommal & Manita, 2022). Moreover, information technology helps to reduce costs, accelerate sales, improve organizational efficiency, and effectiveness, also enhances the confidence of auditors in the reports provided to the client, and thereby increases dependence on these outputs (Tarek et al., 2017).

The main objective of this study is to examine the influential and conceptual aspects of information technology in the audit profession. It aims to bridge a research gap by providing evidence-based recommendations for selecting and presenting relevant papers, authors, and journals in this field. Additionally, the study seeks to develop a coherent theoretical framework and offer a comprehensive visualization of the subject matter. To achieve these goals, the study utilizes a combination of bibliometric analysis and the VOSviewer software for a thorough review of the literature. Specifically, it focuses on

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analyzing the features and advancements of publications within clusters that explore the impact of information technologies like artificial intelligence and blockchain on the audit environment.

What sets this study apart from others is its integration of bibliometric techniques, the science mapping approach, and an integrative approach. By incorporating these methods, the study enables a comprehensive analysis of the interplay between two academic fields, providing unique insights and contributions to the existing literature. Additionally, the study focuses on one of the most important technological topics, where artificial intelligence and blockchain technologies serve as the cornerstone of the renaissance in the technology sector. This is particularly relevant considering the rapid adoption of modern technologies in the audit environment and the digital business environment.

Bibliometric research plays a vital role in understanding the auditing profession in the context of technological advancements and the transition to a digital business environment. Given the increasing global focus on the digital economy, e-governments, cryptocurrencies, artificial intelligence technologies, blockchain, cloud computing, augmented reality, virtual reality, Metaverse, big data, and others, the audit profession undergoes significant changes (Lamboglia et al., 2021). Auditors must keep up with these modern technologies to advance in their profession and achieve their goals in line with international accounting standards (Schmitz & Leoni, 2019). Bibliometric research can contribute by providing the necessary information to reconsider the formulation of accounting policies in response to financial crises, such as the COVID-19 pandemic and economic crises resulting from conflicts like the Ukrainian Russian war. This research helps reduce uncertainty regarding potential financial risks and provides insights into staying updated on technological developments, particularly in the economic and accounting fields, advanced financial technologies, and audits in the digital economy environment, which directly impact global economies.

This study expands upon the existing literature by providing a comprehensive summary of current and future trends in information technology, artificial intelligence research, and

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blockchain technologies in the auditing profession. It identifies leading researchers, institutions, and publications in these areas, making a valuable contribution to the field. While a conceptual framework exists to understand IT perspectives in the audit environment, few studies have delved deeply into modern IT technologies such as artificial intelligence and blockchain in the audit profession. Hence, there is a need for an appropriate conceptual framework within the relevant topics. Additionally, identifying key contributors in the fields of artificial intelligence and blockchain technologies, as well as future research directions and issues, is crucial to drive significant contributions in this field. Therefore, this article aims to analyze the scientific literature on information technology and its impact on the audit profession between 2017 and 2022.

The remainder of the paper is organized as follows: The next section provides an overview of the methodology and data used in the study, and Section 3 presents the findings of the bibliometric analysis, locating the key debates. Finally, in Section 4, the main conclusions are drawn, summarizing the major results, implications, future research, and limitations.

2.2 Methodology

Bibliometric analysis plays a decisive role in research studies. In this study, which dealt with the topic of Information Technology and auditing, bibliometric analysis was used to quantitatively analyze publication patterns, citations, and cooperation among authors, journals, and countries. Bibliometric analysis has provided valuable insights into the structure and dynamics of the research landscape. It enables researchers to identify influential authors who have made significant contributions to the field, as well as popular journals that publish high-quality research. Moreover, it allows the detection of emerging research trends, helping researchers stay up to date with the latest developments.

Additionally, the study utilizes the science mapping approach, which is a domain analysis and visualization technique. This approach is particularly valuable when dealing with a large volume of scientific documents. By employing science mapping, researchers can visually represent the intellectual structure of the research topic under investigation. It helps identify current and future research trends, highlights gaps in existing literature, and

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pinpoints the most influential authors, journals, and countries in the fields of information technology and auditing. The insights gained from science mapping aid researchers in formulating evidence-based recommendations for future research directions, thus contributing to the advancement of knowledge in information technology and audit.

Overall, the combination of bibliometric analysis and the science mapping approach provides a powerful methodology for comprehensively understanding the research area. It allows researchers to uncover quantitative insights, enabling them to make informed decisions, identify research gaps, and contribute to the scholarly discourse in their field of study. The research strategy is divided into five sections, which are detailed in the following paragraphs.

2.2.1 Data Collection

Finding research gaps and identifying research trends in any academic field is crucial for advancing knowledge (Faraji et al., 2022). While there have been various studies conducted on information technology and auditing, there is a lack of comprehensive and accurate research that provides a roadmap for future studies to map global research on the topic. This study aims to fill that gap by conducting a scientometric analysis to review the most focused research topics and identify gaps in the literature related to the relationship between information technology, artificial intelligence, blockchain technology, and auditing.

The papers for this investigation were systematically obtained from the core collection of the WoS database. Search queries with relevant keywords were used to identify relevant phrases in the titles and keywords of articles within the database, covering the period from 2017 to 2022. This study period ensures that the analysis captures the latest research advancements, trends, and contributions in the fields of information technology, artificial intelligence, blockchain, and their impact on auditing. By using this approach, the researchers ensure the relevance, availability, and reliability of the literature analyzed, contributing to the overall scholarly rigor and comprehensiveness of the paper. During the data collection process, the research results were filtered and limited to specialized

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publications in the fields of economics and management. This filtering process resulted in a selection of 328 research papers, which were then examined for their titles and keywords using theoretical and experimental methodologies.

2.2.2 *Choosing a Research Database*

Many databases, such as Dimensions Database, Google Scholar, Web of Science, and Scopus, can be used to map bibliographic data (Singh et al., 2021). For this study, the Web of Science Database was selected to conduct the scientometric analysis of information technology and auditing, aiming to include as many scientific publications as possible. The bibliometric analysis of journals was specifically performed using the Web of Science (WoS) Core Collection database, focusing on the Science Citation Index Expanded and the Social Sciences Citation Index. The choice of the WoS database was based on its reputation as a renowned index that covers a wide range of peer-reviewed articles and provides reliable bibliographic data (Bartolacci et al., 2020; Zhang et al., 2019).

With over 15,000 highly relevant journals and an extensive collection of more than 50,000,000 categorized documents, the WoS database offers a comprehensive source of information. It provides valuable metadata, including titles, keywords, abstracts, references, authors, journals, and citations, among other pertinent details, making it highly suitable for studies of this nature (Gaviria-Marin et al., 2019). The WoS database was chosen as a search engine due to its qualities and its widespread use by researchers. Moreover, it is frequently employed for the analysis of scientific publications. Each publication in the WoS database contains a wealth of information, such as the year of publication, title, abstract, authors, author affiliations, source journal, subject categories, and references.

2.2.3 *Detection of Keywords and Relevant Documents*

To obtain scientific publications that are directly related to information technology, artificial intelligence, blockchain technology, and auditing, the most related keywords were defined based on previously reviewed research on the study.

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Concerning the WOS Database, the following statements in Table 2.1 were typed on the "Web of Science Core Collection" database by using (ALL) as a field tag. When these keywords were entered into the WoS core collection database's search engine, (328) documents that were published between 2017 and 2022 (16 October) were detected. The Web of Science Categories have been filtered to include only those that specialize in economics, business, management, and public administration.

Table 2.1. Detection of keywords in WoS core collection database

Selected keywords	Number of exported documents
ALL= ("Information Technology" AND "Artificial Intelligence" AND "Blockchain" AND "Audit")	3 documents
ALL= ("Information Technology" AND "Blockchain" AND "Audit")	9 documents
ALL= ("Information Technology" AND "Artificial Intelligence" AND "Audit")	6 documents
ALL= ("Artificial Intelligence" AND "Blockchain" AND "Audit")	12 documents
ALL= ("Information Technology" AND "Audit")	137 documents
ALL= ("Artificial Intelligence" AND "Audit")	72 documents
ALL= ("Blockchain" AND "Audit")	89 documents

These keywords are frequently used together since they are connected and can help each other in a variety of ways. For example, information technology can be utilized to aid in the development and implementation of AI systems. Blockchain technology has the potential to create a safe and transparent record-keeping mechanism for financial transactions, and accounting data (Yen & Wang, 2021). Furthermore, auditing may be used to assure the integrity, and correctness of financial records, and statements that are prepared electronically using information technology tools, and functions (Secinaro et al., 2022).

2.2.4 Selection of Science Mapping Tool

To investigate any scientific field, a suitable science mapping technique must be used. Although other tools are available, the most important are VOSviewer, Gephi, CiteSpace, Sci2, and HistCite. Gephi is a free and open-source program for graph, network visualization, and exploration. CiteSpace is free scientific mapping software designed for

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visualizing, and analyzing trends, and patterns in the literature (Darko et al. 2020).

The VOSviewer software was used in this study to create maps based on the WOS Database data. VOSviewer could be used to build networks of scientific publications, journals, researchers, research organizations, countries, keywords, or terms. Co-authorship, co-occurrence, citation, bibliographic coupling, and co-citation links can connect items in these networks. VOSviewer contributes to map visualization and exploration by providing three map visualizations: network visualization, density visualization, and overlay visualization. Scrolling and zooming allow you to explore a map in detail, which is especially useful when working with large maps that contain thousands of items (Lemonakis et al., 2020). VOSviewer is designed primarily for bibliometric network analysis, but it can also be used to create, visualize, and explore maps based on any type of network data (Hocevar & Bartol, 2021).

Furthermore, the VOSviewer software was used to detect current trends, and gaps in the literature, possible areas of research, the most important countries, sources, and authors in the fields of information technology, and auditing, to accomplish this, scientometric techniques such as "bibliographic data" studies were used. For bibliographic data, a "co-occurrence analysis" was performed to identify the most frequently occurring words in the title, keywords, and abstracts of the publications. "Bibliographic coupling" is used for bibliographic data to identify contributing authors, and countries in publications (Mas-Tur et al., 2021).

A scientometric analysis is defined as a "quantitative study of science, communication in science, and science policy." Scientometrics aids in assessing the field-specific effects of academic studies as well as the impact of scientists, collaborative networks, and institutes. Scientometrics provides a description of influential research studies that result in the advancement, and evolution of the information technology, and auditing fields. (Saini et al., 2022). Using reproducible statistical techniques, researchers can quantify research output, citation rates, influential journals, scientists, countries, and regions engaged in the advancement of scientific discipline. They can also identify areas for increased or

decreased research work by mapping these trends (Waqas et al., 2019).

2.3 Findings and Discussions

2.3.1 Publication Output and Growth Trend

The number of papers published in each period by a specific body, such as a journal. Institutions, nations, or other entities are used to calculate publication activity. Indicators of publication activity provide a description of the topic's quantitative evolution, and structure, as well as the ability to identify the most representative journals, organizations, and countries publishing in a discipline (Chen & Xiao, 2016). Furthermore, we can identify the subjects addressed during the study time. This study investigated qualitative characteristics such as activity sector, study dimension (cross-sectional or longitudinal), or methodologies used in different investigations (quantitative study, qualitative study, etc.) using Microsoft Excel® worksheets.

This section first presents the key bibliometric analysis findings used to assess the evolution of the literature on information technology, and auditing during the research period (2017–2022). This article investigates the most relevant, and prolific institutions, countries, and authors, as well as their interrelationships. According to the findings, the literature on information technology and auditing have increased exponentially in recent years.

As seen in Fig. 2.1, publishing activity was relatively low in 2017, with just 26 publications. Nonetheless, there has been a rise in publications in 2018 and 2019. The development has several peaks in 2020 ($n = 76$), and an increasing pattern next year ($n = 93$ in 2021). By 2022, we note a decrease in the number of publications ($n = 54$), but since the year has not yet ended, the number of publications is expected to be higher until the end of 2022. Regarding citations, the 328 publications have a total of 2160 citations. The average number of citations is 6.58 per publication. We can see in Figure 2.1 that the number of citations has grown exponentially with the number of published papers.

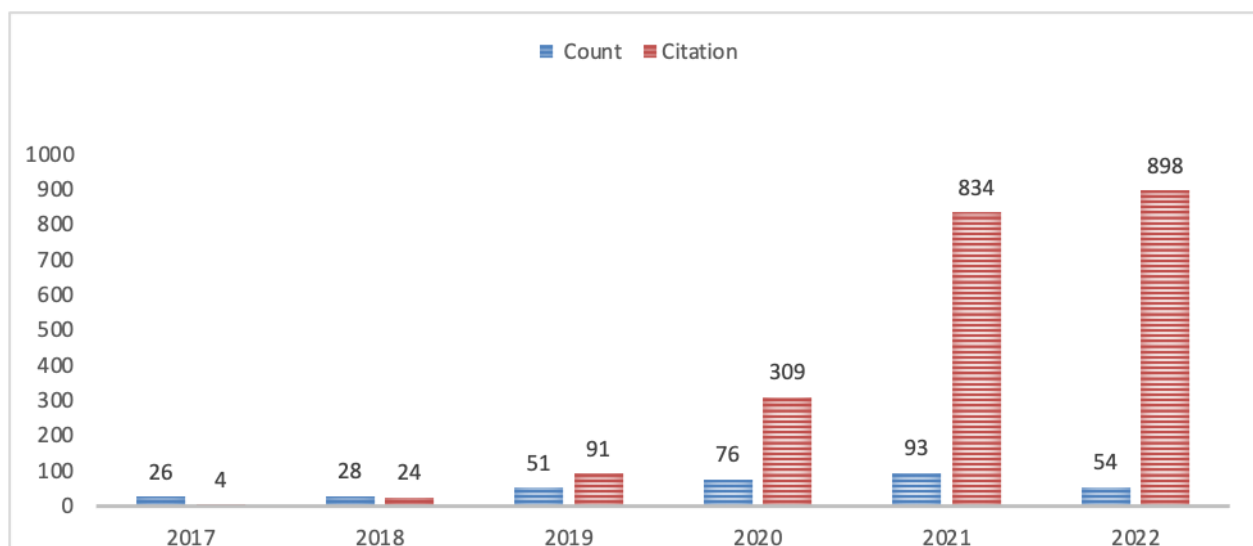
Because these subjects have a lengthy history, and have grown over time, it is quite

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difficult to determine a definite publication year for when the concepts of information technology, artificial intelligence, blockchain, and audit were originally presented. Since the mid-twentieth-century invention of the first computers, information technology has existed. Artificial intelligence has a long history, with roots reaching back to the 1950s. However, it was not until 1956 that the phrase "artificial intelligence" was coined.

Blockchain technology was launched in 2008 with the publication of the Bitcoin white paper, which proposed a decentralized, distributed database for safely, and transparently recording transactions. Auditing has a lengthy history stretching back to ancient civilizations, when scribes oversaw ensuring the correctness of financial records. Auditing, as we know it today, has changed over time, and is now controlled by professional norms, and rules.

Figure 2.1. Publication Years from 2017 to 2022



2.3.2 Top publications, countries, and journals

This section contains the most relevant publications, and countries on the issue. In Figure 2.2, we can identify the top countries by the number of publications to acquire a clearer view of the most influential countries. The top countries shown in Figure 2.2 account for 81.4 percent of all publications on the subject. The USA is the country that has contributed the most publications, with 101 publications. China is the runner-up with 34 publications.

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Countries all throughout the world have made substantial contributions to information technology, artificial intelligence, and blockchain technology, including the United States, China, Australia, England, and Europe. These nations have a substantial presence in the tech sector, with many top tech businesses, and research institutes based there. Many of the key participants in the AI sector, such as Google, Microsoft, and IBM, are headquartered in the United States, but China has recently emerged as a prominent player in the AI market.

Globally, blockchain technology has received extensive use, and development, with substantial contributions from scientists from most of the world to the advancement of future professions. Major accounting businesses, and professional organizations are headquartered in a variety of nations, including the United States, the United Kingdom, and Europe. These organizations have played an important role in defining professional audit standards and procedures.

Figure 2.2. The Most Contributed Countries/Regions

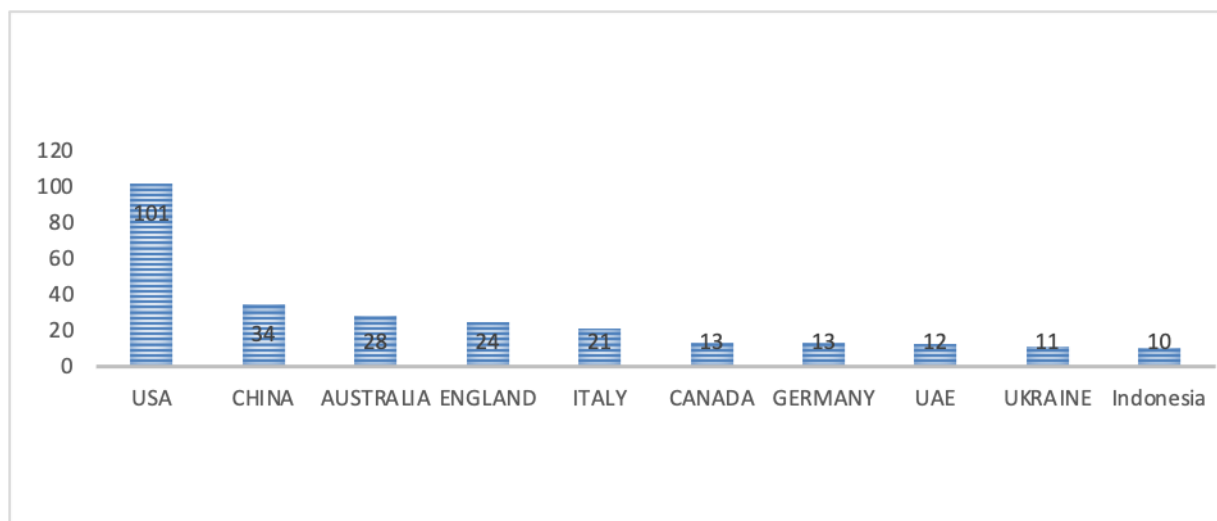


Figure 2.3 shows the list of journals with the highest presence of publications related to information technology, artificial intelligence, blockchain, and auditing. The first is the journal of emerging technologies in accounting, which has 30 publications, accounting for 9.14 % of the total. Accounting auditing accountability journal comes in second with 20

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publications, followed by journal of information systems 15 publications, international journal of accounting information systems 12 publications, current issues in auditing 11 publications. These 10 journals account for 35.67% of all papers published. As mentioned above, they mainly specialize in auditing and information technology.

Figure 2.3. The Most Contributed Journals



2.3.3 Bibliometric analysis: Mapping and visualizing

The following subsections examine the various maps produced by VOSviewer, beginning with a keyword co-occurrence analysis, and then moving on to a bibliographic coupling of authors.

2.3.3.1 Keyword co-occurrence analysis

One of the most efficient techniques for identifying patterns, and new study topics on a specific topic is co-occurrence analysis. It is a relational and multidimensional indicator. The investigation of co-occurrences, or joint appearances, of two terms in each text to determine the conceptual and thematic structure of a scientific issue is known as co-word analysis. Following the selection of the terms to be examined, networks of co-occurrences are built, and similarity measures are generated (Hong et al. 2019). These similar metrics are used in several statistical tests, such as clustering, and multidimensional scaling (MDS). Author connections, documents, journals, or keywords can all be displayed on

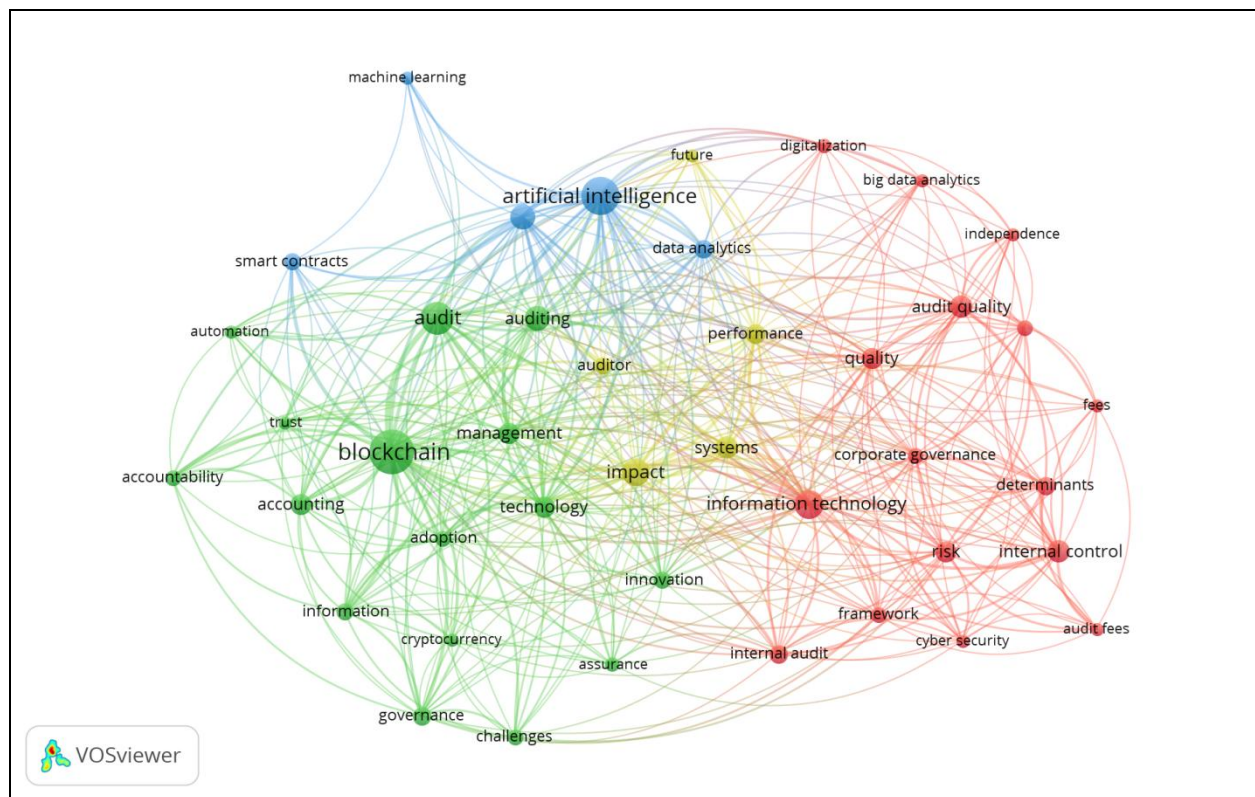
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science maps. The number of articles in which keyword maps appear is determined by their co-occurrence in titles, abstracts, and keywords. The main objective of mapping and clustering techniques is to provide insight into the structure of a network, both methodologies are commonly used in combined scientometric and bibliometric studies (Li et al., 2021).

The authors use the software VOSviewer to conduct keyword co-occurrence analysis, which creates a representation of a network of keywords or clusters with the total number of links, and their link strengths (Guleria & Kaur, 2021). The size of the circles associated with every item reflects the significance of the displayed words. Cluster analysis was used to identify current and future trends in information technology, artificial intelligence, blockchain, and auditing. The VOSviewer software accurately evaluates bibliometric maps, and the map can be displayed in a variety of ways, each of which focuses on a different aspect of the map (McAllister et al., 2022). This study considers all keywords and employs a thorough counting method.

Figure 2.4 illustrates a study subject's keyword co-occurrences and network visualization of the semantic structure related to auditing and information technology. This visualization is an extremely useful tool for determining the frequency with which a keyword is repeated, as well as the strength of relationships between keywords. Keyword clusters are represented by circles, and lines represent the connections between these keywords. In general, a shorter distance indicates a stronger relationship. We performed data cluster analysis based on keyword co-occurrence. Four major clusters describe significant research trends. The number and strength of their relationships were used to identify and classify these clusters. There are four distinct clusters, 438 links, and a total link strength of 874.

Figure 2.4. Co-occurrence of keywords



The red cluster includes the most important keywords, of which "information technology", and "audit quality" are some of the most important words with high frequencies, and strength. As we can see, the topics included in this cluster are related to the effects of information technology on internal control, and audit quality in the digital business environment, and big data analytics. The greatest interrelationships of the red cluster are with the green cluster, and together they would define a typology of studies focused on the consequences of the uses of technology in accounting, and the use of blockchain technology in auditing.

On the other hand, the blue cluster include keywords such as "artificial intelligence," "big data "and" machine learning," which address topics related to the fields of artificial intelligence technologies, and their various methods in big data analysis, and machine learning. Figure 2.4 shows that in the middle of the map emerges the yellow cluster, which includes keywords such as "future," "systems," and "performance." mostly related to the areas that dealt with the impact of modern technological systems on the performance of

auditors in the future.

2.3.3.2 Research trends related to information technology, artificial intelligence, and blockchain and their impact on auditing

Four co-occurrence networks were created using WoS data, and the VOSviewer application (www.vosviewer.com; van Eck & Waltman, 2010). All keywords (title and abstract) of papers relating to information technology, artificial intelligence, blockchain, and auditing research, as well as citation contexts surrounding citations of keyword studies for our research paper are network-based. Keywords were extracted from titles, abstracts, and citation contexts using the VOSviewer's text-mining component (van Eck, & Waltman, 2011). This application creates a detailed map of a term co-occurrence network (adjectives, and nouns). When two or more keywords appear in the same title, abstract, or citation context, this is referred to as co-occurrence. The proximity of two keywords is proportional to their similarity (relatedness in terms of co-occurrence). Therefore, words with a higher co-occurrence rate are more likely to be detected together.

The VOSviewer software includes a clustering function that categorizes keywords based on their frequency of occurrence (van Eck & Waltman, 2017). In this investigation, we built the map with the utmost care, and accuracy using the same parameters as in the VOSviewer: we included the most significant terms in the network. The number of clusters on the map was determined for readability purposes. Keywords unrelated to our research were carefully eliminated. Words that structure abstracts (for example, "practical implications", and "originality value") were removed, as were the names of cited authors.

Cluster 1: “The determinants of independence and audit quality in an information technology environment”

The red cluster "The determinants of independence, and audit quality in an information technology environment" has a total of 16 keywords. Table 2.2 shows the keywords that correspond to Cluster 1, as well as the number of occurrences, and linkages to these terms. The top issues in this study field include keywords like "audit quality," "digitalization," "big data analytics," "independence," and "information technology."

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The map illustrates that the red cluster covers the most important occurrences of keywords related to the determinants of independence, and audit quality in an information technology environment. Recently, there has been renewed interest in the formation of an independent audit committee as a board of directors' subcommittee to oversee the financial reporting, and auditing processes to improve the quality of financial reports, and control fraud committed by accountants, and managers (Habib, & Bhuiyan, 2016). An audit committee is an executive board subcommittee responsible for overseeing the quality, and integrity of a company's accounting, and financial reporting system, internal control system, and compliance with applicable laws, rules, and regulations. As an operating committee of the executive board, the audit committee can significantly alleviate the agency problem by reducing informational gaps between insiders, and outsiders, as well as between parties interested in financial decision-making (Bananuka et al., 2018).

Furthermore, the audit committee serves as a liaison between the firm's management, and external auditors. The audit committee usually sends a positive signal about the firm's earnings quality, and to increased stock liquidity, and stakeholder trust in annual financial reporting. An audit committee can aid in the reduction of fraudulent financial reporting practices while also improving earnings quality, investment decisions, and litigation (He et al., 2017). By encouraging communication with the board, an audit committee can improve a firm's internal control system and increase the independence of the external auditor at little or no cost to the auditor. Such Improved communication reduces information gaps between management, and the board, resulting in significantly better monitoring, and reporting quality (Adhikary & Mitra, 2016). Besides the presence of an audit, committee assists companies in performing better in financial markets, allowing them to acquire new customers, and become more competitive in their sector (Katmon et al., 2019).

Concerning audit quality in the information technology (IT) environment, the Public Company Accounting Oversight Board (PCAOB) Standing Advisory Group discussions on auditors' knowledge of information systems have highlighted the importance of

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information technology in general, and its importance particularly for audit quality, and external financial audits of public companies (Brasel & Williams, 2019). Audits in the IT environment could serve multiple objectives, and parties within, and outside the company; thus, different concepts of audit quality in the IT environment could exist. Definitions of this type might include concepts such as effect or effectiveness, completeness in relation to various criteria, efficiency, or cost. One of the goals of improving audit quality in the IT environment is to provide assurances to management that automated systems or processes are meeting their objectives (Dunn et al., 2021). The focus of management control responsibilities may be on computer-based information assets and processes. In these cases, standards established by organizations such as ISO, PCAOB, or AICPA help determine the quality of auditing in an IT environment (Hsieh & Brennan, 2022).

Table 2.2. Keywords in cluster 1 related to the determinants of independence, and audit quality in an information technology environment.

Keywords	Links	Total link strength	Occurrences
Information Technology	33	83	24
Audit Quality	23	45	14
Internal Control	22	45	14
Quality	24	43	12
Risk	26	45	12
Determinants	20	37	10
Internal Audit	21	35	10
Corporate Governance	22	27	7
Firms	19	26	7
Framework	19	29	7
Digitalization	13	19	6
Cyber Security	16	22	5

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Audit Fees	12	20	5
Big Data Analytics	14	19	5
Fees	13	17	5
Independence	12	17	5

Cluster 2: “Challenges of applying blockchain technology in the accounting and auditing professions.”

The green cluster "Challenges of applying blockchain technology in the accounting and auditing professions" has a total of 16 keywords. Table 2.3 shows the keywords that correspond to cluster 2, as well as the number of occurrences, and linkages to these terms. The top issues in this study include keywords like "blockchain," "technology," "adoption," "accounting," and "auditing."

The map demonstrates that the green cluster has a higher number of occurrences for some keywords and is related to all other clusters. Technology has brought about changes in the public and private sectors, providing transparency, and new management tools to improve information access (Alles & Gray, 2020). It has aided in the automation of accounting processes by increasing productivity, efficiency, information quality, customer service, and cost savings. In this context, blockchain technology emerged in 2008 as a tool for ensuring data reliability and security without the need for a central regulatory authority. Its distinguishing features are encryption, and the process of verifying transactions until they are registered, making the transaction safe, and irreversible (Li et al., 2019).

Blockchain technology allows for the verification of each transaction, potentially putting an end to random sampling. Thus, real-time auditing is feasible because the transaction data is recorded in the blockchain's ledger. Blockchain has the potential to transform fraud investigations, and forensic accounting, as well as to issue alerts, and investigate unusual transactions as they occur (Dyball & Seethamraju, 2021). As a result, the fact that blockchain could provide secure data management, and storage helps make the case for its

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use in the public sector (Sheldon, 2021).

Blockchain has the potential to disrupt or even eliminate certain established accounting functions, but it also introduces new risks that need to be considered (Cai, 2018; Muruganandham et al., 2022). One significant risk is the immutability of blockchain records, which creates challenges when it comes to rectifying errors or fraudulent transactions once they are recorded (Laroiya et al., 2020). Furthermore, the complexity of blockchain systems and their reliance on cryptographic algorithms introduce vulnerabilities that could be exploited by malicious individuals. Additionally, the reliance on smart contracts brings risks associated with coding errors and vulnerabilities, which can lead to incorrect or unintended financial transactions (Hasanova et al., 2019). To ensure the security and reliability of blockchain-based accounting and auditing systems, careful attention must be given to these risks, along with the implementation of robust safeguards and controls. Technology is still in its early stages and will likely undergo significant changes in the future. Entities that utilize this technology must acknowledge its advantages while also developing safeguards to protect against its flaws (Yu et al., 2018).

New technologies cause significant changes in the structure of public, and private organizations' processes, and activities. The difficulties in replacing or adapting systems, as well as the dearth of blockchain use cases illustrating the technology's use, and application, are the challenges of using blockchain technology in auditing, and government accounting (Chang et al., 2020). Furthermore, cultural issues were highlighted: "The major challenges in adopting blockchain are regulatory bureaucracies, and outdated processes." "To be able to work on these issues, a mindset shift, and modernization of certain processes are required, as well as financial support." In addition, "blockchain is an innovation that is still poorly understood by the general public." Furthermore, resistance to change, organizational culture, and the high cost of technology are among the most important challenges that delay the application of blockchain in auditing (Kouhizadeh et al., 2021).

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Table 2.3. Keywords in cluster 2 related to challenges of applying blockchain technology in the accounting, and auditing professions.

Keywords	Links	Total link strength	Occurrences
Blockchain	32	132	54
Audit	29	83	31
Auditing	28	55	17
Accounting	21	43	13
Management	25	58	12
Technology	30	65	12
Governance	22	38	10
Information	20	43	9
Innovation	22	36	8
Accountability	14	29	7
Adoption	22	37	7
Challenges	14	23	7
Assurance	17	21	6
Automation	14	19	5
Cryptocurrency	13	19	5
Trust	18	24	5

Cluster 3: “Analysis of accounting data using artificial intelligence technologies.”

The blue cluster "Analysis of accounting data using artificial intelligence technologies" has a total of 5 keywords. Table 2.4 shows the keywords that correspond to cluster 3, as well as the number of occurrences, and linkages to these terms. The top issues in this study field include keywords like "artificial intelligence," "big data," "data analytics," "smart contracts," and "machine learning."

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The map indicates that the blue cluster is connected to most of the other clusters, which may be essential for a discussion of current and future trends. Most economic activities, and professions have been significantly altered as big data, and digital technologies have expanded. Organizational structures and business models have undergone significant changes due to the scientific and technological revolution, leading to the emergence of new ones (Issa et al., 2016). Consequently, accounting activities, which record operations and provide essential data for decision-making, have faced threats, challenges, and opportunities that have been reshaped and will continue to reshape the field of accounting. As data collection and processing technologies have advanced, accounting activities have become more complex, allowing for the collection of larger volumes of data (Vărzaru, 2022).

The digitization of economic activities has led to the more efficient and effective development of these activities, driven by the difficulty of analyzing vast quantities of accounting data and the increasing complexity of economic processes. This digitization has influenced the accounting and auditing professions, with information technologies simplifying accounting processes and facilitating the management and control of big data (Rikhardsson & Yigitbasioglu, 2018).

In this context, cloud computing, considered one of the most important artificial intelligences (AI) technologies, plays a crucial role in the analysis of accounting data. By leveraging the capabilities of cloud computing, organizations can efficiently store, process, and analyze large volumes of accounting data (Balachandran & Prasad, 2017).

The scalability and flexibility of cloud infrastructure enable the seamless integration of AI algorithms and techniques for data analysis. Cloud computing allows for secure access and sharing of accounting data among different departments and stakeholders, facilitating collaboration and real-time decision-making. Moreover, cloud-based platforms provide the computational power and storage capacity necessary to handle complex artificial intelligence models, enabling organizations to derive valuable insights from their

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accounting data effectively (Yang et al., 2017).

The combination of cloud computing and AI technologies presents a powerful solution for the advanced analysis of accounting data (Tabrizchi & Kuchaki Rafsanjani, 2020). Using AI algorithms, such as machine learning and natural language processing, organizations can automate tasks, detect patterns, and extract meaningful information from accounting data. This enables enhanced financial management, improved risk assessment, and more informed business decisions (Darwish et al., 2019). The analysis of accounting data using AI technologies can uncover hidden trends, identify anomalies, and provide predictive insights, helping organizations optimize their financial processes, mitigate risks, and drive strategic decision-making (Pan & Zhang, 2021).

Table 2.4. Keywords in cluster 3 related to analysis of accounting data using artificial intelligence technologies.

Keywords	Links	Total link strength	Occurrences
Artificial Intelligence	35	119	40
Big Data	32	70	17
Data Analytics	25	42	10
Smart Contracts	13	23	8
Machine Learning	8	10	5

Cluster 4: “the impact of modern technological systems on auditors' performance in the future.”

The cluster "the impact of modern technological systems on auditors' performance in the future." has a total of 5 keywords as a yellow cluster. Table 2.5 shows the keywords that correspond to cluster 4, as well as the number of occurrences, and links to these terms. The top issues in this study field include keywords like "systems," "future," "performance," "impact," and "auditor."

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The map displays that the yellow cluster is linked to most of the keywords by attaching numerous keywords. The impact of modern technological systems on auditors' performance in the future is multi-faceted. The evolving landscape of technology necessitates the development of new audit procedures to effectively assess control and mitigate emerging business risks (Hoffman et al., 2018). The integration of technology-oriented audit procedures is becoming increasingly crucial as auditors strive to keep up with the rapid advancements in modern technological systems. Embracing analytics and leveraging digitalization are vital for auditors to enhance their audit practices and stay relevant in the ever-changing business environment (Rana et al., 2022). However, despite the well-documented advantages of IT-related audit procedures, some auditors face challenges in performing technology-enabled audit tasks proficiently. This highlights the need for auditors to enhance their technological competency and bridge the gap in utilizing analytics effectively during audits (Dutta et al., 2022).

In addition to individual auditor concerns, the utilization of technology among public sector auditors remains low. Many auditors in this sector predominantly focus on traditional IT controls rather than embracing advanced control measures tailored to modern technological systems. While human capital plays a critical role in driving innovation, performance, and competitiveness within organizations, auditors encounter various challenges in their pursuit of technology-driven auditing (Arena & Jeppesen, 2016). These challenges include staying updated with evolving technologies and addressing information security risks, overcoming limitations in qualified human resources and skills, establishing robust reporting structures for the IT audit function, ensuring adequate IT infrastructure, aligning technology with organizational performance, developing comprehensive audit methodologies for IT risk assessment, and acquiring deep knowledge of technological techniques in data analytics (Mahapatro, 2022).

To enhance auditors' future performance, concerted efforts are required to upskill auditors in technology-related areas, foster a culture of innovation within auditing practices, and establish effective frameworks for integrating technology into audit processes (Sarkar et al., 2021). By proactively embracing and leveraging modern technological systems,

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auditors can not only enhance their own performance but also contribute to the overall effectiveness, efficiency, and value-added nature of the audit function in an increasingly digitalized business landscape (Salijeni et al., 2019).

Table 2.5. Keywords in cluster 4 related to analysis of accounting data using artificial intelligence technologies.

Keywords	Links	Total link strength	Occurrences
Impact	33	72	21
Systems	29	61	14
Performance	19	43	11
Auditor	17	31	9
Future	15	23	5

2.3.3.3 Bibliographic coupling of authors

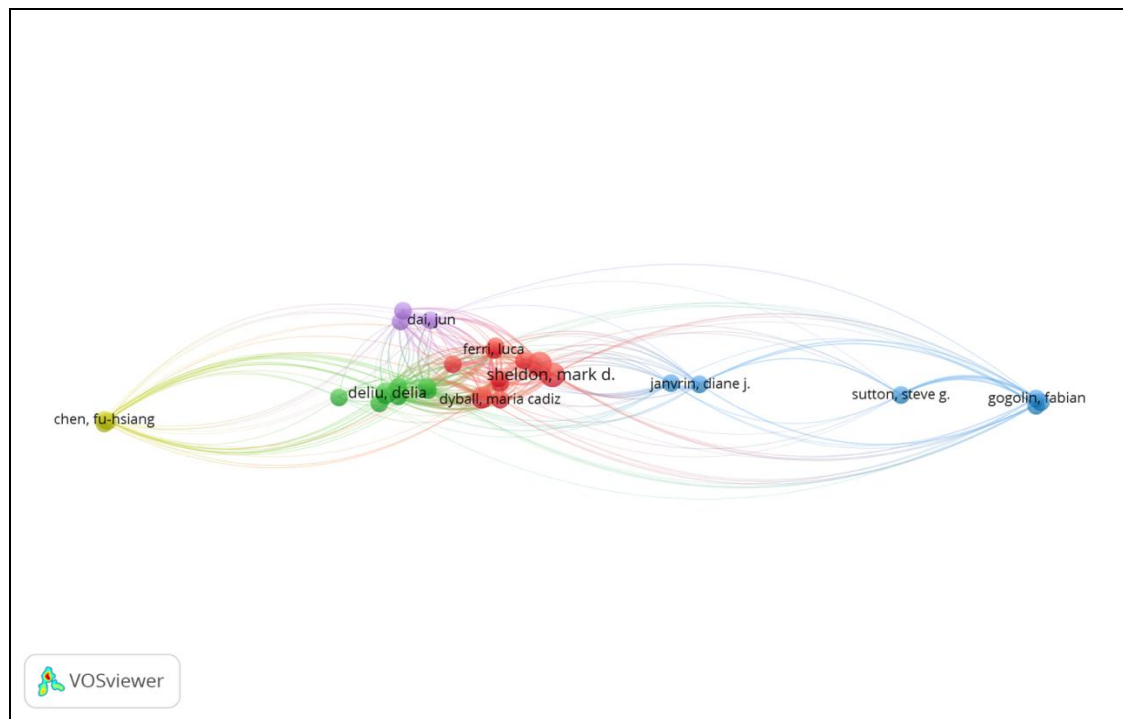
Author bibliographic coupling is an extension of bibliographic coupling, which refers to the phenomenon in which two authors cite the same study in studies published by these two authors. Based on the assumption of author bibliographic coupling, this indicates that there is a direct relationship between the number of references shared between the authors, and the percentage of similarity of their study, where the more references two authors have in common in their studies, the more similar their study is. Research on front mining and science mapping have both been examined to see how well document bibliographic coupling works.

Figure 2.5 shows the top 29 contributing authors ordered by the number of documents. Sheldon, Mark D., is the most published author during the study period of 2017 to 2022, where he has 4 published papers in the fields of information technology, artificial intelligence, and blockchain in auditing. Then there is Seethamraju, Ravi, who has 3 published papers. Each of the top 29 writers has an average of 10 publication citations connected to information technology, artificial intelligence, and blockchain in auditing.

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Sheldon, Mark D., is the author with the most citations among these top authors, with 38 citations. Then there is Elommal. Najoua, who has 28 citations.

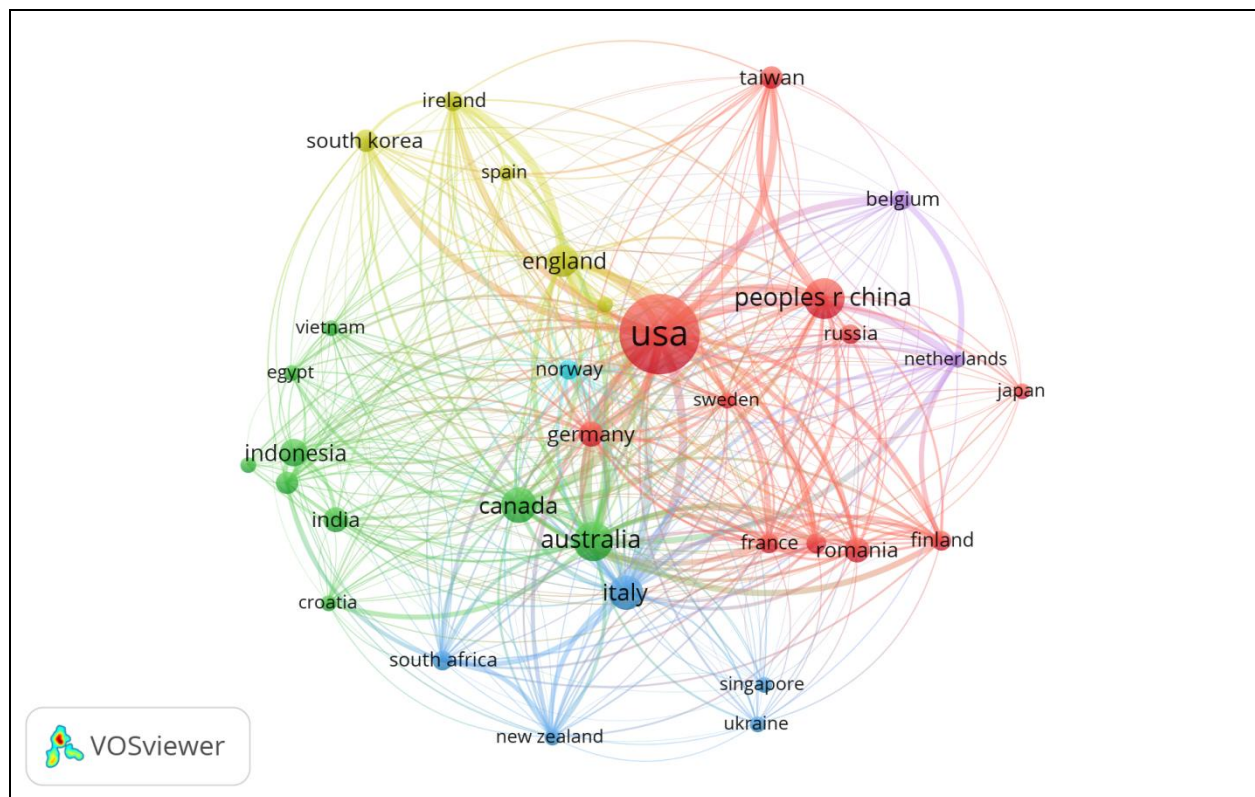
Figure 2.5. Bibliographic coupling of author's network visualization



2.3.3.4 Bibliographic coupling of countries

Figure 2.6 depicts the network of cooperation between countries and territories. The results are obtained by considering at least one threshold. More than a hundred of the most representative bibliographic connections are displayed. Items are represented by a circle. The size of the circle around an item represents its weight, and how important it is, so the item with the largest circle is the most relevant, and important for the object of study. The distance and the lines between different items indicate the links, and the relatedness of countries in this research field. The main advantage of the map is the ability to identify countries or territories with similar characteristics. Countries on the same continent have a similar profile and tend to appear together on the map.

Figure 2.6. Bibliographic coupling of countries' network visualization



As we can see from the map, the largest circle represents the circle of the United States, which is in close relation to other countries such as England, Canada, Australia, Germany, France, and Italy. The United States is the most cited country with 0.37 percent of the total citations for the countries shown on the map, and China is in second place with 0.0877 percent. We also notice that Norway represents a cluster on its own, with no other countries joining it; this indicates that it is an independent country working to establish its own entity in this field, and it is attempting to rise, and compete strongly. Figure 2.6 shows that the six clusters are closely related to discussions about the importance of information technology in general. As well as the impact of artificial intelligence, and blockchain technology on the development of the audit profession.

2.4 Conclusions, Research implications, Future research directions, and limitations

2.4.1 Conclusions

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This study makes a valuable contribution to the literature on information technology, artificial intelligence, and blockchain in auditing. By conducting a systematic review and clustering of papers, the study identifies key authors, topics, journals, and nations relevant to the field. It explores new research avenues to understand the economic impact and analysis of financial and accounting practices in the digital economy by integrating modern technologies such as blockchain, cloud computing, and artificial intelligence into auditing.

Despite the growing interest in information technology and auditing, the study acknowledges that research in this area is still in its early stages, with limited quantitative studies underway, leading to inconclusive results and unexplored issues in literature. Encouraging academics to develop new studies that apply and simplify modern technologies, such as cloud-based artificial intelligence in auditing, is vital for the advancement of the accounting and auditing profession, overall financial performance, and the growth of the fintech sector.

Addressing the challenges associated with applying modern technologies in the accounting and auditing professions is another practical implication of this study. The identified challenges, such as resistance to change, organizational culture, and high technology costs, need to be overcome to successfully integrate these technologies into auditing processes. Strategies should be developed to foster an innovative culture, provide training and resources to address skill gaps, and explore cost-effective approaches to technology implementation. The study also highlights the significant impact of modern technological systems on auditors' tasks and roles. As the world moves towards a digital economy, auditors need to develop new skills, including professional skepticism, judgment, and critical thinking. Investing proactively in the development of these skills is crucial for auditors to effectively adapt to the evolving demands of the digital business environment. Continuous professional development, training programs, and a focus on enhancing advisory and analytical capabilities can help auditors thrive in this new era.

Mostly, modern technological systems will significantly change the tasks of auditors due

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to the world's shifting towards the digital economy. This will lead to the development of new tasks and roles performed by auditors in the digital business environment. They will be less focused on accounting programs oriented towards direct tasks than they were in the past, and their roles will become more advisory. Auditors need to develop a new skill set, including professional skepticism, judgment, and critical thinking, to effectively fulfill these modern roles.

This study's originality lies in its comprehensive and systematic approach to analyzing the intersection of information technology, artificial intelligence, and blockchain in auditing. Utilizing bibliometric analysis with the reputable Web of Science core collection, it quantitatively assessed publishing activity, research trends, and popular topics. The study's relevance is underscored by the focus on the auditing profession amidst rapid technological advancements. By identifying four research trends, it offers insights for potential future research directions, urging auditors to embrace technology for enhanced audit quality and efficiency. VOSviewer and science mapping, used as visualization tools, enhance data understanding, revealing influential authors, journals, and relationships. Addressing challenges in technology integration for auditors, the research highlights practical implications for the profession's future performance, emphasizing the need for technological competent in auditing practices.

2.4.2 Practical and theoretical implications

The highlighted research trends in Information Technology and auditing have significant theoretical and practical implications. Firstly, audit firms should prioritize the development of audit methods in line with the demands of the digital economy and modern technological advancements, which enhance the role of modern auditors in professional skepticism, financial and accounting consulting. Moreover, audit firms must embrace digital platforms, artificial intelligence, cloud computing, and blockchain technology to offer audit services more efficiently, accurately, and reliably, ultimately leading to improved client satisfaction. Additionally, implementing robust cybersecurity measures to safeguard financial and non-financial data from espionage and hacking risks is crucial to protect the data security of audit clients. These insights can serve as valuable

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guidance for researchers, practitioners, and policymakers in advancing the auditing field concerning information technology and internet-related technologies.

Furthermore, to enhance their services' effectiveness, transparency, and risk management, traditional accounting processes should incorporate contemporary technologies. Both large audit firms and small audit offices should be encouraged to enter the market with innovation, competition, and the rapid adoption of accounting technological systems, resulting in a more transparent, inclusive, and accurate financial and accounting sector that aligns with the requirements of the digital environment. Therefore, integrating modern technologies, such as cloud-based artificial intelligence and blockchain technology in auditing, will lead to more efficient, innovative, and competitive auditing practices that adapt to changing client expectations and meet their needs in the digital age. This integration will also contribute to faster completion times and reduced costs.

Finally, the study's findings may have implications for policymakers and standard-setting bodies. As technology continues to shape the auditing profession, regulators may need to update existing guidelines and regulations to accommodate the use of IT, AI, and blockchain in audits. Therefore, future auditing research should target these critical areas to improve our understanding of this fast-developing business, uncover opportunities for innovation and growth, and drive its success.

2.4.3 Future research directions

Based on the examination of the research trends and discussions with auditors working in external audit firms in Jordan, several intriguing research avenues emerge to increase our understanding of this rapidly expanding business. Firstly, future research should explore a multi-database strategy to broaden the study's scope and incorporate a larger sample size from various locations, providing a more detailed review of the current situation and potential development areas in the use of modern technologies in the auditing industry.

Secondly, investigating the impact of emerging technologies, such as cloud computing, on the advancement of the auditing profession and their potential roles in enhancing business

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practices would be beneficial. Understanding how developing technologies like metaverse and virtual reality can be integrated into accounting and auditing and their influence on businesses is critical as technology evolves rapidly.

Thirdly, it is essential to investigate the impact of the COVID-19 pandemic on auditors' tasks and the extent to which digital technology has supported the sector in navigating financial challenges. This would offer insights into how digital technology can strengthen the auditing profession's resilience and adaptability during future crises.

2.4.4 Limitations

The paper acknowledges some limitations, such as using only one database (WoS core collection) to obtain the required data, which may have resulted in missing information from other sources. The study period is also considered relatively short. Furthermore, the topics of information technology, blockchain technology, and artificial intelligence have also been studied in accounting and auditing journals. However, it is noted that many types of research dealing with the same topics have been published in information systems journals, indicating that there may be missing information that was not included in this study. Therefore, it is suggested that future research on these topics should also be published in accounting and auditing journals. Directions for future research can be strengthened by taking the assessment to a new technological level and developing technology techniques with the variables "Information Technology, Artificial Intelligence, and Blockchain on Auditing" as the explanatory variables. These variables were identified as the most significant keywords acquired from the bibliometric analysis conducted in this paper, and they can serve as explanatory variables in future studies.

**CHAPTER THREE: CLOUD-BASED ARTIFICIAL
INTELLIGENCE AND AUDIT REPORT: THE
MEDIATING ROLE OF THE AUDITOR**

CHAPTER THREE

3.1 Introduction

In the contemporary corporate landscape, the audit report assumes a pivotal role in ensuring the reliability of financial statements and vital information (Thottoli & KV, 2022; Roszkowska, 2021). With ongoing transformations in the business environment and the rapid advancement of technology, the field of auditing has undergone significant evolution (Kend and Nguyen, 2020; Thottoli, 2022; Abu Afifa et al., 2024). Historically reliant on manual processes and paper records, especially in developing nations, auditing has experienced a profound shift with the advent of computers, digital technologies, and the increasing prevalence of automation and data-driven techniques (Salijeni et al., 2019; Abdullah & Almaqtari, 2024).

In the era of digital transformation, the integration of artificial intelligence (AI) into the audit process has emerged as a transformative force, presenting auditors with both opportunities and challenges (Yigitbasioglu et al., 2023; Moll and Yigitbasioglu, 2019). Acknowledging this paradigm shift, our study aims to explore the intricate relationship between cloud-based artificial intelligence (CBAI) and audit reports, with a specific focus on the mediating role undertaken by auditors. Through a thorough examination of this dynamic interplay, our research seeks to provide insights into how auditors navigate, interpret, and integrate AI-driven insights into the audit-reporting framework.

Abu Huson et al. (2024) anticipate that CBAI will significantly affect auditing methodologies. Enabling organizations to store and retrieve data and applications via the internet, CBAI offers increased flexibility, scalability, and cost-effectiveness compared to traditional on-premises servers or personal computers (Attaran & Woods, 2019; Ma et al., 2021). As businesses progressively migrate their financial data and applications to the cloud, CBAI becomes integral to accounting and auditing practices (Imene and Imhanzenobe, 2020). CBAI technology facilitates access to financial data from any location and at any time, simplifying financial management and keeping stakeholders informed of their financial performance (Carlsson-Wall et al., 2022).

CBAI, involving the use of AI technologies and algorithms deployed and executed on

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cloud computing infrastructure, provides several benefits to auditors (Appelbaum & Nehmer, 2020). These include the rapid and accurate analysis of large volumes of financial data, scrutiny and verification of financial records, and improvement of the reliability of financial statements (Moll & Yigitbasioglu, 2019; Leocádio et al., 2024). Furthermore, CBAI algorithms can swiftly and comprehensively identify anomalous patterns, behaviors, and relationships previously undetectable (Sun et al., 2023), empowering auditors to uncover fraud and irregularities more effectively than ever before (Noordin et al., 2022).

The integration of CBAI, which continuously learns and adapts to datasets stored in the cloud, has the potential to significantly streamline audit processes, enhance risk identification, and improve the accuracy of anomaly detection (Munoko et al., 2020; Kaur et al., 2020). However, incorporating CBAI into auditing also presents several challenges. Auditors must be vigilant about compliance with regulations and aware of the technological risks associated with machine learning, data science, and cybersecurity when implementing AI in auditing (Lamboglia et al., 2021; Le Anh et al., 2023).

Additionally, CBAI has the capability to uncover abnormalities, errors, and risks that traditional auditing methods might miss (Abu Huson et al., 2024; Alkan, 2022). While automation in auditing can lead to greater efficiency and allow auditors to focus on more complex, value-added tasks (Barr-Pulliam et al., 2022), it also brings forth considerations such as infrastructure and data management requirements, concerns about data privacy and security, and the ethical and societal implications of using AI in the auditing process (Marshall & Lambert, 2018).

As auditors grapple with the implications of these technological advancements, our investigation provides a nuanced exploration of the evolving landscape where technology intersects with financial accountability. The ensuing analysis aims to enhance understanding not only of contemporary auditing practices but also of the broader implications arising from the integration of AI technologies in traditional professional domains. Thus, our study embarks on a journey to unravel the complexities and

implications inherent in the intersection of CBAI and audit reporting, offering valuable perspectives on the challenges and opportunities faced by auditors in the digital age.

This study provides valuable insights into the impact of CBAI on the field of auditing, recognizing the transition in auditing methodologies from manual to digital approaches. It underscores the benefits of CBAI, including enhanced accessibility, efficiency, and scalable storage for the management of financial data (Gyau et al., 2023; Tiron-Tudor et al., 2021).

This study is structured as follows: Section 2 presents the theory, offers a comprehensive review of relevant literature, and establishes the research hypotheses. Section 3 elaborates on the research methodology employed in the study. Section 4 utilizes a descriptive-analytical approach to rigorously examine the data and analyze the findings. Section 5 offers a discussion of the results, exploring the practical and theoretical implications of CBAI on audit reporting. Finally, Section 6 summarizes the key conclusions drawn from the study, acknowledges the inherent limitations, and proposes directions for future research.

3.2 Theory and Hypotheses Development

The construction of the model draws on Everett Rogers' diffusion of innovations theory (2003). This theory has played a pivotal role in enhancing our comprehension of the adoption and dissemination of new ideas, technologies, or innovations within a social system (Rogers, 2010). The theory provides valuable insights into the factors that influence the diffusion process and the patterns by which innovations spread among individuals and communities (Chang, 2010). Rogers (2010) developed the theory through extensive research across various fields, including economics, communication, and technology adoption. They sought to explain why some innovations are adopted quickly and widely, while others struggle to gain acceptance (Owolabi Yusuf & Mat Derus, 2013). The theory posits that the adoption of an innovation follows a predictable pattern with five main stages: knowledge, persuasion, decision, implementation, and confirmation (Değerli et al., 2015; Elmghaamez & Elmagrhi, 2022).

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CBAI, a relatively recent and advanced technology, can be viewed as an innovation that aligns with the diffusion process described by Rogers (Almaiah et al., 2022). The theory helps explain how CBAI could gain traction and become increasingly prevalent in various industries, including auditing. This is especially evident in today's world, where there is a growing reliance on technology and automation to improve efficiency, productivity, and decision-making processes (Hasan, 2021). According to the diffusion of innovations theory, the adoption and diffusion of CBAI are influenced by several factors. One crucial factor is the perceived relative advantage of the innovation, which refers to the benefits it offers over existing alternatives (Almaiah et al., 2022).

CBAI provides organizations with scalable and cost-effective computing resources (Alkan, 2022; Huson et al., 2024). It eliminates the need for heavy investments in hardware and infrastructure, allowing organizations to pay for what they use on a subscription basis. Real-time data analysis capabilities enable businesses to gain valuable insights and make timely and informed decisions (Attaran & Woods, 2019). These benefits make CBAI appealing to organizations that aim to streamline their operations, enhance efficiency, and leverage advanced data analysis techniques to drive business growth (Dagilienė & Klovienė, 2019; Tiron-Tudor & Deliu, 2022). The diffusion of innovations theory has been widely applied and adapted to different contexts, providing valuable insights into the adoption and acceptance of new ideas and technologies (Min et al., 2019). By understanding the underlying principles of diffusion, organizations can develop effective strategies to introduce and implement CBAI and other innovations, fostering their successful integration into various industries and social systems.

Despite significant research on auditing and AI in general, the literature on the interaction between auditing and CBAI is limited. However, the potential impact of CBAI on the auditing industry is significant, as auditing is a suitable field for automation due to its reliance on manual labor, legal responsibilities, and market competitiveness (Otia & Bracci, 2022; Abu Huson et al., 2024). Major accounting firms such as PWC, EY, KPMG, and Deloitte are investing billions of dollars in AI, and it is estimated that 30% of financial

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audits will use AI by 2025 (Seethamraju & Hecimovic, 2022). Although previous research has explored the use of internet-related technology and tools, including computer-assisted audit techniques, their application remains limited. Auditors have been slow to adopt these technologies, even though they have the potential to enhance productivity and quality beyond simple applications like Excel spreadsheets (Jaber & Abu Wadi, 2018; Tiron-Tudor & Deliu, 2022).

Nonetheless, CBAI is expected to transform auditing processes. As Abu Huson et al. (2024) note, further research is needed to examine the potential benefits and limitations of adopting CBAI in auditing, as empirical data on its acceptance and performance expectations is scarce.

3.2.1 Cloud-Based Artificial Intelligence and Audit Report

Auditors and researchers face increasing pressure from audit clients to stimulate innovation in the auditing profession, leading to the adoption of advanced technologies such as cloud computing, the Internet of Things, robotic process automation, and AI (Al-Sayyed et al., 2016; Fotoh & Lorentzon, 2021; Thottoli & KV, 2022). These technologies hold the potential to revolutionize auditing practices by automating various audit tasks (Appelbaum & Nehmer, 2020; Moll & Yigitbasioglu, 2019; Aljawarneh et al., 2023).

CBAI, gaining popularity in recent years, offers diverse applications and secure data storage (Aziz & Andriansyah, 2023; Abdullah & Almaqtari, 2024). As auditors grapple with expanding volumes of financial data, AI technologies empower them to navigate this information swiftly and accurately (Janicot & Mignon, 2012; Thottoli & KV, 2022). Machine learning algorithms, in collaboration with CBAI, discern intricate patterns, anomalies, and trends in financial data, providing auditors with a comprehensive understanding of a company's financial health (Şen, 2023). The automation of routine tasks not only expedites the audit process but also minimizes the risk of human error, ensuring a more reliable and consistent audit outcome (Yigitbasioglu et al., 2023).

Appelbaum and Nehmer (2020) assert that incorporating CBAI in audits can enhance

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client confidence by assuring the use of cutting-edge technology and methods, thereby enhancing the credibility and integrity of audit reports. The migration of businesses to cloud computing, estimated to impact over \$1 trillion in IT expenditures in the next five years (Garrison et al., 2015), highlights the significant storage space provided by cloud computing (Lang et al., 2018). This allows users to transfer locally stored data to high-performance cloud servers, offering a virtual environment for developing and hosting services through Infrastructure as a Service (IaaS) (Fang et al., 2018).

CBAI represents an advanced phase of digital auditing. Earlier digital technologies, such as basic databases and auditing software, enabled initial digitization efforts, but cloud-based AI introduces more sophisticated functionalities, including predictive insights, real-time data analysis, and automation of complex data patterns that enhance accuracy and efficiency (Abu Huson et al., 2024).

CBAI has demonstrated significant potential for automating traditional manual audit tasks, resulting in cost reductions, particularly for large audit clients (Spring et al., 2022; Huson et al., 2024). A range of technologies, including data analytics, digital databases, and automated software systems (Brás et al., 2024), supports this transition from manual to digital auditing. While AI is a powerful tool that enhances auditing processes by automating complex analyses and identifying patterns, it is one component of a larger digital transformation. These other technologies also play crucial roles in enabling digital auditing by replacing manual data handling and analysis with digital methods (Abu Huson et al., 2024; Leocádio et al., 2024).

Additionally, CBAI provide valuable insights into business performance and trends, enabling better-informed decision-making by audit clients (Alkan, 2022). The utilization of CBAI in audits has the potential to enhance the quality and efficiency of audit services, instill greater confidence in the audit process, and provide valuable business insights (Han et al., 2023). CBAI facilitates continuous monitoring of financial data, enabling auditors to provide more real-time insights, enhancing the timeliness of audit reports, and enabling organizations to address issues promptly for improved financial governance

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(Carlsson-Wall et al., 2022). It aids auditors in identifying potential risks and anomalies in financial transactions, allowing for a more proactive and targeted risk management approach, focusing on areas requiring greater scrutiny and attention (Alkan, 2022).

However, cloud-based systems face challenges related to security and performance (Soveizi et al., 2023). Ensuring data integrity is a significant concern, as users may lack awareness of how their data is handled by cloud storage services (Chuka-Maduji & Anu, 2021). Trust issues arise with commercial entities providing cloud services, potentially concealing data loss and service errors for their own benefit. This becomes particularly problematic when users store large amounts of outsourced data in untrusted cloud storage without local data file copies (Aldossary & Allen, 2016). Effective methods for verifying data integrity are suggested in cases where clients have limited resource capabilities and rely solely on cloud storage (Handzic et al., 2008; Zhong et al., 2024). Based on these insights and theoretical concepts, we propose and examine the following hypothesis:

H1: There is a positive relationship between cloud-based artificial intelligence and audit reports.

3.2.2 Cloud-Based Artificial Intelligence and Auditors

According to Hu et al. (2016), ensuring data integrity in cloud storage is a critical responsibility for auditors and can be achieved through private or public auditability. Private auditability involves data owners directly auditing their data in the cloud storage service, while public auditability allows others to verify data authenticity (More & Chaudhari, 2016). However, the large volume of data files stored in the cloud makes frequent data checking by the owner impractical, consuming resources and hindering administrative and operational tasks (Fernando et al., 2013; Leocádio et al., 2024). Delegating data validation to a trusted third-party auditor can save the owner's computing resources (Li et al., 2020).

Several authors have highlighted the potential benefits of CBAI for auditors. Almufadda and Almezeini (2022) suggest that CBAI could enhance auditor efficiency by automating tedious tasks and reducing manual labor reliance, leading to faster and more accurate

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audits. Han et al. (2023) propose that CBAI could improve risk assessment by analyzing vast datasets to identify patterns and trends that humans may find challenging to detect, enabling auditors to identify potential fraud or issues affecting financial statements. Additionally, CBAI tools can facilitate auditor-client communication by generating easy-to-understand reports and visualizations, strengthening auditor-client relationships, and increasing trust in the audit process (Alkan, 2022; Tiron-Tudor & Deliu, 2022).

Furthermore, CBAI can provide auditors with access to new data sources, such as social media and IoT devices, enabling them to gain new insights into clients' businesses and identify potential risks (Abu Huson et al., 2024; Albawwat & Frijat 2021). Mustapha et al. (2021) highlights that the adoption of CBAI and large-scale information technology affects the audit methodology, requiring auditors to develop their understanding of computer basics and cloud mechanisms. In this regard, Puthukulam et al. (2021) underscores the importance of auditors acquiring technical and technological expertise to align with contemporary practices involving virtual transactions on the cloud and the internet. These practices significantly influence the evidence associated with diverse financial and accounting operations, consequently influencing the content of audit reports (Yigitbasioglu et al., 2023). Consequently, auditors must cultivate proficiency in technical and technological aspects, as highlighted by Imoniana et al. (2020). Drawing from prior research and relevant theoretical frameworks, we investigate the subsequent hypotheses:

H2: There is a positive relationship between cloud-based artificial intelligence and auditors.

H3: There is a positive relationship between the auditor and the audit report.

3.2.3 The Auditor between Cloud-Based Artificial Intelligence and Audit Report

In the evolving landscape of financial auditing, auditors find themselves at a pivotal junction, navigating the transformative realms of CBAI and the production of audit reports (Abu Huson et al., 2024; Alkan, 2022; Hasan, 2021). Cloud technology has revolutionized how financial data is stored and processed, compelling auditors to integrate advanced AI algorithms into their audit processes (Tiron-Tudor & Deliu, 2022; Yigitbasioglu et al.,

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2023). AI offers significant opportunities for enhancing efficiency and accuracy, allowing auditors to analyze large datasets with greater precision (Leocádio et al., 2024; Ng & Alarcon, 2020). However, this shift also requires auditors to develop new technical skills to effectively utilize AI while maintaining the core principles of audit reporting (Abu Huson et al., 2024).

Data analytics plays a crucial role in improving audit effectiveness and communication with stakeholders (Dagilienė & Klovienė, 2019). Bécue et al. (2021) emphasizes the importance of data analytics in CBAI auditing, highlighting how analysis, modeling, and visualization methods can detect patterns and anomalies, thereby enhancing audit planning and execution. Similarly, Cao et al. (2015) discuss the benefits of audit data analytics, including a better understanding of entity operations and risks, improved fraud detection, and enhanced stakeholder communication.

The increasing reliance on AI in auditing has prompted regulators to seek feedback on its impact and the need for standards and regulations governing technology use in audits (Fedyk et al., 2022; Kend & Nguyen, 2020). The use of various data analytics tools underscores the need for clear standards and guidelines to ensure responsible AI implementation in auditing (Abu Huson et al., 2024; Tiron-Tudor & Deliu, 2022).

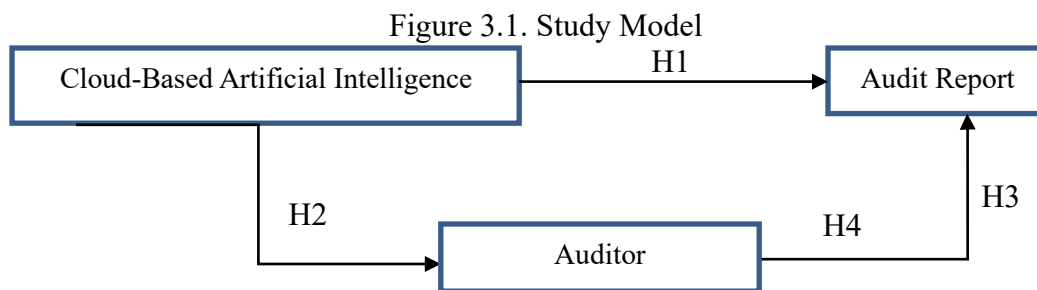
AI's predictive methods and intelligent algorithms are also enhancing fraud detection. Shrestha et al. (2019) highlight how machine-learning models help auditors identify patterns and behaviors indicative of fraud. Ng and Alarcon (2020) and Goel et al. (2020) emphasize that AI can detect fraudulent transactions that might otherwise go unnoticed in vast datasets. Additionally, Kaplan and Haenlein (2019) note that AI's ability to learn from historical data makes it a powerful tool for reducing false positives in fraud detection (Al-Sayyed et al., 2021).

As technology advances, the role of CBAI in auditing is expected to become even more significant, reshaping the auditor's responsibilities and necessitating a nuanced understanding of how CBAI influences evidence gathering, financial operations, and,

ultimately, the composition of comprehensive and insightful audit reports. Drawing on these prior investigations and theoretical frameworks, we propose the following hypothesis:

H4: The auditor mediates the relationship between cloud-based artificial intelligence and audit reports.

Grounded in theoretical foundations and prior literature, this study examines cloud-based artificial intelligence as an independent variable influencing the audit report, which serves as the dependent variable. Additionally, the role of the auditor is explored as a mediating variable within this relationship, providing insight into how auditors impact the effect of cloud-based AI on audit outcomes. This conceptual framework, depicted in Figure 3.1, reflects the study's approach to investigating the interconnected roles of technology and auditor expertise in shaping audit report quality and reliability.



3.3 Methodology

3.3.1 Research Design

This study is designed to investigate the mediating role of auditors between CBAI and audit reports. To achieve this objective, a quantitative research methodology was selected, employing a structured questionnaire to systematically collect data on the potential impacts of CBAI on auditing practices. The quantitative approach was chosen for its efficacy in empirically examining the relationships between variables and quantifying

their effects, thereby providing valuable and general insights into the auditing field (Thottoli, 2022).

3.3.2 Population and Sampling

The target population for this research comprises external auditors employed within audit firms across Jordan. According to the Ministry of Finance's 2023 records, there are 454 audit firms operating in the country, each employing a diverse range of auditors, including partner-owner auditors, assistant auditors, and certified auditors. From this population, 322 valid responses were obtained through the distribution of questionnaires, which were subsequently utilized for statistical analysis. A systematic random sampling technique was employed by selecting employees with odd ID numbers from various auditing firms for questionnaire distribution. Although systematic random sampling provides a strong foundation for representativeness, it is not without limitations. For example, this method assumes that the population is relatively homogeneous, which may not fully capture the diversity of perspectives within different audit roles or firm sizes. Additionally, although 322 responses are sufficient for statistical analysis, they may not account for all variability in the population, which could limit the generalizability of findings across different geographic regions or auditing contexts. Furthermore, while the study's methodological approach is sound, conducting an Exploratory Factor Analysis (EFA) followed by Confirmatory Factor Analysis (CFA) would have provided additional robustness. EFA could have helped identify underlying factors in the data, and CFA could have validated these factors, enhancing the precision and reliability of the measurement model. Recognizing these limitations helps to contextualize the results, ensuring that conclusions are interpreted with appropriate caution.

The sample size of 322 respondents is sufficient for statistical analysis due to several key factors. First, a sample of this size provides adequate precision for estimating population parameters, effectively reducing the margin of error and ensuring that the sample closely mirrors the broader population. This level of precision is critical for making accurate inferences about the entire population of auditors in Jordan based on the sample data. Additionally, with 322 respondents, the study possesses sufficient statistical power to

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detect significant differences or relationships between variables, even when the effect sizes are small. This capability allows for the identification of meaningful patterns and trends within the data, which is essential for robust statistical analysis. Furthermore, in social science research, sample sizes around 300 are frequently employed and broadly accepted for quantitative data analysis (Aithal & Aithal, 2020). The sample size of 322, therefore, fits well within this standard, rendering it both appropriate and practical for generating reliable and valid findings that can meaningfully contribute to the existing body of knowledge.

3.3.3 Data Collection

Data was collected through the administration of a structured questionnaire that was meticulously crafted and rigorously tested to ensure its accuracy, relevance, and reliability in addressing the study's hypotheses. The questionnaire was distributed to the study sample between April 3, 2023, and May 11, 2023, via the Office 365 Forms online survey platform. To enhance respondents' understanding and ensure the quality of the responses, detailed instructions and clarifications were provided alongside the questionnaire. Additionally, stringent measures were implemented to protect the anonymity and confidentiality of the participants' information.

The research methodology incorporated both primary and secondary data sources to enrich the study's findings. Primary data collection involved the direct acquisition of information pertinent to the research variables, aligning with the specific objectives of the study. Secondary data were sourced from a variety of internal and external materials, including academic periodicals, thesiss, books, scholarly articles, and reputable websites. These secondary sources served to complement the primary data, providing additional context and aiding in the interpretation of the research variables.

3.3.4 Questionnaire Construction and Evaluation

The development of the survey instrument was firmly rooted in insights drawn from prior

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research within the field. Specifically, the items addressing cloud-based artificial intelligence were adapted from existing studies, including three questions from Albawwat and Frijat (2021), two from Hu et al. (2018), and two from Oberoi et al. (2021), with the latter incorporating elements from the Financial Reporting Council's report on "The Use of Technology in the Audit of Financial Statements." Similarly, items related to the interaction between CBAI, and auditors were derived from two questions in Puthukulam et al. (2021) and two in Al-Sayyed et al. (2021). Lastly, questions concerning the relationship between CBAI and audit reports were adapted from three questions in Hu et al. (2016) and two in Al-Sayyed (2016).

To ensure the reliability and validity of the questionnaire, it underwent a rigorous evaluation process involving specialized academics from Jordanian universities and professionals certified as Jordanian Certified Public Accountants (JCPA). This process included a thorough review of the questionnaire, with all feedback and suggestions meticulously considered and incorporated to enhance the instrument's quality and relevance.

The finalized questionnaire encompassed a comprehensive range of topics relevant to CBAI, audit reports, and auditors. It included closed-ended questions to capture demographic information, as well as multiple-choice questions utilizing a Likert pentatonic scale, with response options ranging from "strongly agree" to "strongly disagree." This structured approach, aligned with prior research methodologies, facilitated the collection of quantifiable data, enabling the precise measurement of attitudes and perceptions related to the study's variables.

This robust methodological framework ensures that the study's findings are both reliable and generalizable, thereby contributing valuable insights to the broader field of auditing, particularly in the context of the increasing integration and utilization of AI technologies.

3.4 Data Analysis and Results

3.4.1 Demographic Characteristics of the Sample

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Table 3.1 presents the characteristics of the respondents. Among them, 70% were male, and 30% were female. In terms of educational qualifications, 81% held a bachelor's degree, 17% had a master's degree and 2% had a Ph.D. The majority specialized in accounting (99%), with a small percentage in finance (1%). The table also provides information on the audit firm's affiliation with an international audit network, showing 55% affiliation and 45% no affiliation. Additionally, the average number of employees in the audit company is 42, with respondents having an average of 8.5 years of experience. Furthermore, 63% of respondents reported that auditing companies listed on the Amman Stock Exchange, while 37% did not.

Table 3.1. Sample data description

Characteristics		Count	Percentage
Gender	Male	224	70%
	Female	98	30%
Age	< 30	126	39%
	31 - 50	170	53%
	> 50	26	8%
	Bachelor	262	81%
	Master	54	17%
	PhD	6	2%
Specialization	Accounting	318	99%
	Finance	4	1%
Position	Partner-owner auditor	17	5%
	Assistant external auditor	265	82%
	Certified external auditor	29	9%
	Others	11	3%
Years of experience in auditing	< 10	178	55%
	11-20	116	36%
	> 20	28	9%
Audit firm's affiliation with an international network	Yes	178	55%
	No	144	45%
Audit of companies listed on the Amman stock exchange	Yes	204	63%
	No	118	37%

3.4.2 Assessment of the Measurement Model

To check and estimate the interactive relation between the model variables, we used the

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causal-predictive structural equation modeling (SEM) method with PLS 4 software. Covariance-based SEM (CB-SEM) is based on the indeterminacy of item scores (Rigdon et al., 2017). PLS-SEM, on the other hand, operates on fixed latent scores and aims to maximize the prediction of endogenous components rather than the model fit (Hair et al., 2019). PLS-SEM can deal with very difficult and complex structural models, such as second-order models, and small sample sizes, and isn't strict on data normality. Figure 3.2 shows the load items of different scales and f^2 in the model and shows the significance R^2 of each variable within the inner model.

Figure 3.2. Measurement model

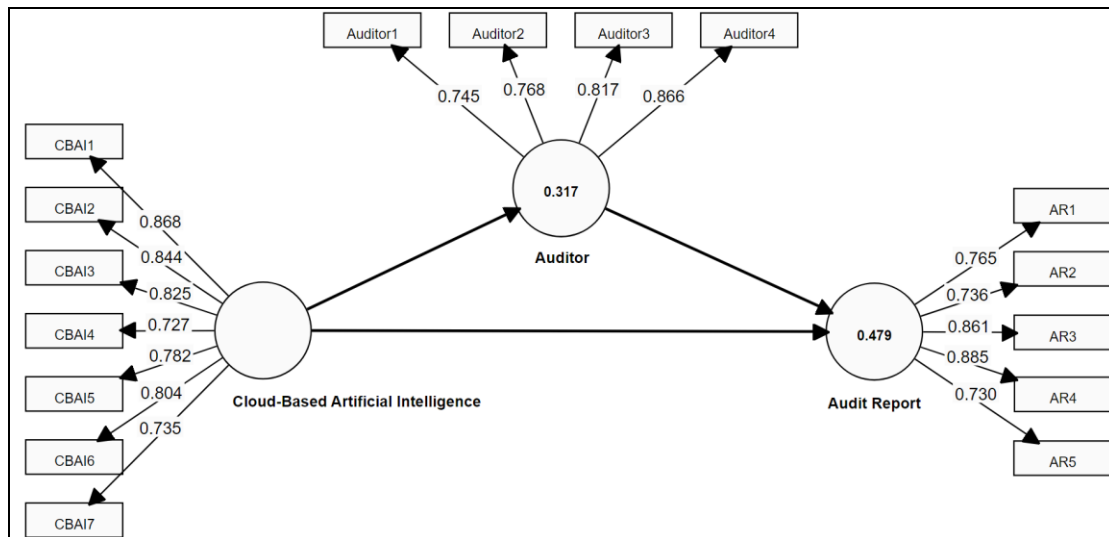


Table 3.2. Mean and Standard Division (SD)

Measures	Mean	SD
Audit Report	4.05	.708
Auditor	4.10	.347
Cloud-based AI	4.04	.515

As shown in Table 3.2, the mean rating for the Audit Report measure was 4.05 (SD = .708), indicating a generally positive perception. Similarly, the Auditor measure showed the highest mean score at 4.10 (SD = .347), with minimal variability.

The loads in Figure 3.2 for the outer model were predominantly above the 0.7 threshold, and their corresponding B-values played a crucial role in table 3.6. This observation is complemented by the values in Table 3.3, where Cronbach's alpha (α) exceeded 0.70, along with composite reliability (CR) and average variance extracted (AVE) both surpassing 0.70 and 0.50, respectively. Additionally, as indicated in Table 3.3, the Fornell–Larcker criterion was met, as the square of each variable's AVE exceeded the inter-correlations. Moreover, the newly introduced heterotrait–monotrait (HTMT) ratios adhered to the prescribed thresholds of <0.90 (Henseler et al., 2015), as illustrated in Table 3.4. Consequently, we can assert that the measurement model has achieved internal consistency, as well as convergent and discriminate validity.

Table 3.3. Reliability, convergent and divergent validity based on the Fornell–Larcker approach

Instruments	1	2	3	α	CR	Rh o	AVE	R2
1. Audit Report	0.798			0.856	0.871	0.897	0.637	0.479
2. Auditor	0.583	0.800		0.813	0.830	0.877	0.641	0.317
3. Cloud-based AI	0.636	0.563	0.799	0.906	0.910	0.925	0.639	

Table 3.4. Divergent validity based on heterotrait-monotrait (HTMT) ratio

Measures	1	2	3
1. Audit Report			
2. Auditor	0.680		

Table 3.5 presents the Variance Inflation Factor (VIF) values for the inner model, which is a crucial step in evaluating multicollinearity within the structural model. The VIF values for the constructs—audit report, auditor, and cloud-based artificial intelligence— are generally below the commonly accepted threshold of 3.3, as recommended by Kock (2015). This indicates a low level of multicollinearity among the indicators within each latent construct, suggesting that the variables are sufficiently independent to contribute uniquely to the model.

Table 3.5. Variance Inflation Factor (VIF) Values for Model Items

Items	VIF
AR1	2.238
AR2	2.122
AR3	3.218
AR4	3.272
AR5	1.740
Auditor1	1.535
Auditor2	1.687
Auditor3	1.879
Auditor4	2.085
CBAI1	3.222
CBAI2	3.264
CBAI3	2.759
CBAI4	2.482
CBAI5	2.064
CBAI6	2.199
CBAI7	2.011

The results summarized in Table 3.5 reinforce the model's validity, with all VIF values confirming that multicollinearity does not pose a significant issue, thereby ensuring that the structural paths between constructs can be interpreted with confidence.

In the preceding sections, the reliability and validity of the model items have been rigorously established, alongside an assessment of the VIF to ensure there is no

multicollinearity among the variables. These foundational checks confirm the robustness of the model constructs. The subsequent step in the analysis involves estimating the coefficients for the structural model, which are comprehensively presented in Table 3.6.

The observed direct impact of cloud-based AI methods on investment decisions on the audit report is both positive and significant ($\beta = .451$, $\rho = .000$). Similarly, the direct effect of cloud-based AI on auditors is positive and significant ($\beta = .563$, $\rho = .023$). Additionally, the direct effect of auditors on the audit report is positive and significant ($\beta = 0.329$, $\rho = .000$). The mediating impact of auditors on the association between cloud-based AI and the audit report is also significant ($\beta = .185$, $\rho = .000$, see Table 3.6). Moreover, the variance explained by the model R^2 is 0.479, translating to 47.9% for the audit report (refer to Table 3.3). Falk and Miller (1992) established a benchmark for R^2 values, suggesting that the lowest recommended level should be 0.10. In our study, the R^2 indicates a large effect.

Table 3.6. Direct and Interaction effects

Relationships	β	T	ρ	LO	UP	Decision
Auditor -> Audit Report	0.329	4.309	0.000	-	-	Accepted
Cloud-based AI -> Audit Report	0.451	5.973	0.000	-	-	Accepted
Cloud-based AI -> Auditor	0.563	10.294	0.000	-	-	Accepted
Interaction effect						
Cloud-based AI -> Auditor -> Audit Report	0.185	4.122	0.000	0.101	0.277	Accepted

3.5 Discussion

This section presents a comprehensive analysis of the empirical findings, exploring the intricate relationship between cloud-based AI and audit reports. It emphasizes the pivotal mediating role played by auditors. The results reveal a direct, positive, and statistically significant impact of cloud-based AI on both audit reports and auditors. Additionally, auditors demonstrate a positive influence on audit reports. Auditors emerge as crucial mediators in the relationship between cloud-based artificial intelligence and audit reports,

supported by notable beta values and p-values approaching zero in the analysis.

3.5.1 Alignment with Existing Research

The first hypothesis aligns seamlessly with insights from Barr-Pulliam et al. (2022), emphasizing the potential of Cloud-based AI to enhance audit quality, efficiency, and overall effectiveness. Cloud-based AI improves data processing speed and precision, facilitating the efficient handling of diverse data types. AI systems, employing advanced algorithms, meticulously analyzing extensive datasets, uncovering patterns, trends, and anomalies overlooked by traditional auditing methods. This results in cost and time savings, amplifying audit efficacy and improving the quality of audit reports. These findings are consistent with the perspectives of Alkan (2022) and Kaur et al. (2020).

Regarding the second and third hypotheses, supporting evidence from other studies reinforces the positive impact of cloud-based AI on auditors, thereby influencing audit reports. Works by Attaran and Woods (2019) and Abu Huson et al. (2024) underscore the transformative potential of integrating AI technologies, especially when deployed on cloud computing infrastructure, into the auditing process. Cloud computing, with its flexibility, scalability, and cost-effectiveness, has become integral to modern auditors' practices. The synergy of AI and cloud computing equips auditors with advanced analytical capabilities, ensuring efficient processing of vast financial data with speed and accuracy. This contributes to the overall reliability of audit reports, in line with Sun et al. (2023). However, it is essential to acknowledge that the applicability of these findings to external auditors in Jordan may vary due to unique cultural, regulatory, and technological factors. Further research specific to the Jordanian context is necessary to ascertain the extent and significance of these positive outcomes.

The statistically significant and positive impact of cloud-based AI on auditors aligns with existing literature, as highlighted by Imoniana et al. (2020) and Mustapha et al. (2021). These studies emphasize the pivotal role of AI in augmenting auditors' capabilities and performance. Cloud-based AI enhances risk assessments by providing auditors access to extensive data repositories, excelling in identifying patterns and trends that may elude

human auditors and minimizing the probability of errors or biases. Furthermore, the integration of AI technology has the potential to automate mundane tasks, allowing auditors to focus on more intricate responsibilities that demand discretionary judgment, thereby enhancing their role in shaping audit reports. While some studies present divergent views, such as Munoko et al. (2020), who anticipate that audit clients may perceive cloud-based AI as a potential threat to their data privacy or control, additional research is required to explore potential variations and contingencies.

Importantly, the study reveals a positive and statistically significant direct impact, supporting the fourth hypothesis that auditors mediate the relationship between cloud-based artificial intelligence and audit reports. This suggests that auditors play a crucial mediating role, using their expertise and interpretative skills to translate AI-generated insights into meaningful and reliable audit reports. While concerns may exist about users perceiving cloud-based AI as a potential threat to data privacy or control, the study indicates that users of financial information and audit reports can benefit from its integration into the audit process. This foster enhanced transparency, objectivity, and assurance regarding the accuracy of financial statements. Additionally, users gain from expedited and more precise audits, leading to reduced costs and minimized disruptions to business operations, consistent with the findings of Sunyaev (2020) and Spring et al. (2022). Furthermore, AI technology can proactively identify areas of risk, empowering users to take preventive measures. Despite initial skepticism or resistance towards cloud-based AI, users often recognize its inherent value over time.

3.5.2 Theoretical Implications

This study extends the theoretical understanding of cloud-based AI's role in auditing. By emphasizing the transformative impact of AI on audit practices, this research highlights the importance of up skilling auditors to harness AI tools effectively, prompting a reevaluation of the competencies required in auditing. Additionally, the findings support the notion that AI can reinforce ethical standards by increasing transparency and accountability.

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The study contributes to theoretical frameworks by demonstrating how AI can be leveraged to address complexities in modern auditing, thereby positioning auditors as strategic partners who can interpret AI-driven insights within the broader audit process. However, AI systems, particularly those based on neural networks, may introduce biases if they are trained on data that do not fairly represent diverse audit situations. This presents a critical area for future research to ensure that AI-driven auditing is both accurate and equitable.

3.5.3 Practical Implications

From a practical perspective, the incorporation of cloud-based AI into auditing practices offers substantial benefits, particularly for auditors operating in Jordan. The use of AI tools can significantly reduce the time and resources required for traditional audit engagements, allowing auditors to focus on more complex tasks that require professional judgment. This shift not only enhances the quality and efficiency of audit reports but also strengthens the auditor's role as a guardian of ethical standards, thereby bolstering the credibility of financial statements.

For audit clients, the adoption of cloud-based AI translates into more precise and comprehensive audits, improved decision-making processes, better collaboration with auditors, and potential cost savings. However, practical challenges such as ethical concerns related to data manipulation and opinion shopping must be addressed to ensure that the use of AI does not compromise the integrity of the audit process.

Additionally, the successful adoption of cloud-based AI in auditing requires ongoing investment in training and professional development to equip auditors with the necessary digital skills. As the auditing profession in Jordan continues to evolve, embracing these technological advancements will be crucial for driving innovation, enhancing the quality of audit services, and maintaining the profession's relevance in an increasingly complex business environment. Further empirical research focusing on the Jordanian context is essential to gain deeper insights into the practical implications of cloud-based AI for external auditors, particularly in relation to regulatory frameworks and organizational

adaptability.

3.5.4 Global Implications and Cultural Considerations

Although this study is focused on Jordan, the findings have broader applicability, as the integration of cloud-based AI is reshaping audit practices worldwide. However, the distinctive cultural, regulatory, and technological landscape of Jordan may impact the ease and effectiveness with which AI can be adopted within its auditing sector. For instance, Jordan's regulatory framework may not yet fully accommodate the advanced capabilities and implications of AI technologies, which could present challenges for local auditors attempting to incorporate AI-driven methodologies into their work. Additionally, local norms around data privacy, organizational transparency, and trust in AI systems may further influence AI adoption and acceptance among audit clients and professionals.

Nonetheless, as global auditing practices continue to evolve and standardize, insights drawn from Jordan's experience with cloud-based AI can contribute to a deeper understanding of how AI may function within different regulatory and cultural environments. For example, Jordan's context underscores the importance of adapting AI applications to comply with local regulations and meet specific client expectations, which may differ significantly from those in other regions. Furthermore, as more countries explore cloud-based AI for auditing, Jordan's experience could offer valuable lessons on managing potential barriers, such as regulatory restrictions and stakeholder resistance, that may arise in similar cultural or regulatory settings.

Thus, this study's findings emphasize that, while cloud-based AI holds significant potential to elevate audit quality globally, the path to integration is complex and must be sensitive to regional distinctions. The insights gained here could encourage global auditing standards bodies and professional organizations to develop adaptable frameworks that consider both the benefits, and the regional challenges associated with AI in auditing. Consequently, Jordan's experience may serve as a useful model for other emerging markets aiming to leverage cloud-based AI in ways that align with local values, regulatory requirements, and market dynamics, ultimately contributing to a more inclusive and

adaptable global audit practice.

3.6 Conclusion

This study shed light on the intricate relationship between cloud-based AI and audit reports with a specific emphasis on the mediating role played by auditors. The outcomes furnish compelling evidence of substantial and positive benefits arising from the incorporation of cloud-based AI in auditing, thereby amplifying audit effectiveness and elevating the caliber of audit reports. Cloud-based AI contributes to enhanced accessibility, flexibility, scalability, rapid verification and processing of financial statements, improved communication between auditors and audit clients, and significant cost savings. Empowering auditors with advanced analytical capabilities, cloud-based AI ensures the adept processing of extensive financial data with both celebrity and precision. The findings underscore a paradigm shift from traditional manual audit methodologies towards digital approaches, illustrating the potential of cloud-based AI to stimulate innovation and excellence within the realm of auditing.

3.6.1 Limitations

While this study offers valuable insights into the impact of cloud-based AI on auditing, it is subject to several limitations. Given the relative novelty of cloud-based AI, auditors may perceive it as a current trend, potentially leading to a favorable bias in their assessments. The study primarily examines the immediate implications of cloud-based AI without extensively exploring potential indirect or unintended consequences. Additionally, critical issues such as data privacy, security, system integration, and ethical considerations are not comprehensively addressed. The "black box" nature of AI algorithms also presents challenges for the transparency of audit decisions, which may hinder stakeholders' understanding of AI-driven conclusions. Furthermore, the study's specific focus on auditing practices within Jordan may limit its applicability to other regions with different regulatory, cultural, or technological landscapes. Lastly, the study's focus was mainly on the auditing context, and additional perspectives from specialized journals in information technology and computer science could offer a more comprehensive understanding of the broader implications of cloud-based AI.

3.6.2 Future Research Directions

Future research should examine the long-term implications of cloud-based AI on auditing practices, addressing critical aspects such as ethical considerations, security vulnerabilities, and the potential biases embedded within AI-driven auditing systems. Cross-disciplinary studies that incorporate insights from information technology, computer science, and cybersecurity could offer a more holistic view of AI's influence on the field. Furthermore, researchers should explore the broader economic and social impacts of AI in auditing, including public perceptions of AI-audited financial statements and potential improvements in quality of life. Exploratory studies are recommended to capture emerging trends and unforeseen impacts. Lastly, future research should consider the indirect effects of AI adoption, such as shifts in auditor-client relationships and the evolution of auditing standards, to provide a comprehensive understanding of AI's transformative impact on the auditing profession.

**CHAPTER FOUR: INFORMATION TECHNOLOGY AND
AUDITING: EXAMINING KEY AUDIT MATTERS IN
BANKING WITHIN JORDAN AND THE GULF
COOPERATION COUNCIL**

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4.1 Introduction

The audit profession has faced significant challenges in the wake of recent financial crises, causing a decline in public trust regarding the reliability of audited financial reports (Bryan, 2022; Damitio, 2023). This issue has prompted greater scrutiny of the information included in auditors' reports (Albitar et al., 2020). A notable event was the collapse of four US banks in March 2023, which, alongside previous financial crises like the global financial meltdown in 2008, prompted a reevaluation of the significance of audit reports adhering to the International Standard on Auditing (ISA) (Shikha & Kapsis, 2023).

Stakeholders who rely on financial statements are increasingly advocating for more transparency and additional information concerning audit findings, particularly in relation to Key Audit Matters (KAMs) (Sierra-García et al., 2019; Mihret et al., 2022). This growing demand has exposed a disparity between the content of traditional audit reports and the information that stakeholders require in financial statements. This, in turn, has triggered debates on the need for substantial changes in auditors' reports to mitigate misunderstandings (Maroun, 2017). In response to these concerns, regulatory authorities and professional organizations have collaborated to develop a more robust reporting framework, aiming to enhance the trustworthiness of audit reports and bolster confidence in audit opinions (Austin et al., 2021).

To address these challenges, the International Auditing and Assurance Standards Board (IAASB) has introduced new audit report standards designed to bridge the information gap and asymmetry between independent auditors and stakeholders (Sinclair & Cordery, 2016). These standards, aimed at increasing transparency and trust in the audit profession, have resulted in significant alterations to traditional audit reports. These changes, initiated under ISA 701, pertain to "Key Audit Matters" (KAMs), which are defined as "those matters that, in the auditor's professional judgment, were of most significance in the audit of the financial statements of the current period" (IAASB, 2015).

ISA 701 allows auditors to determine which matters to present as KAMs in their annual reports. The primary objective of including these KAMs is to provide more

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comprehensive disclosures, especially concerning matters that auditors consider significant, such as issues, events, and risks that require professional judgment (Kend & Nguyen, 2020; Mah'd & Mardini, 2022). Notably, among these significant matters are those related to technology, particularly considering the rapid technological advancements and the ongoing digital transformation within the banking sector and other industries (Sneller et al., 2017; Abdullatif & Al-Rahahleh, 2020).

The emergence of Information Technology (IT) has brought about a profound transformation in banking operations, enabling financial institutions to streamline processes, enhance customer experiences, and expand their reach (Gomber et al., 2018). While IT has delivered numerous benefits, it has also introduced complex challenges related to data security, privacy, and the reliability of financial reporting (Abu Huson et al., 2024). Consequently, auditors have assumed a pivotal role in safeguarding the integrity and accuracy of financial statements within an increasingly digitized banking landscape (Al-Okaily et al., 2023).

Despite the growing importance of IT in the banking sector and its potential impact on financial reporting, there is a lack of comprehensive studies examining how IT-related risks are addressed in audit reports, particularly in the context of Jordan and the GCC countries. This research gap highlights the need for an in-depth analysis of the factors influencing the disclosure of IT-related KAMs and the role of corporate governance in enhancing audit transparency. This academic study seeks to investigate the disclosure of KAMs in the banking sector within Jordan and the GCC countries, focusing on how auditors, banks, boards of directors, audit committees, and governance attributes—including IT committees—influence these disclosures and identify risks associated with Information Technology. These nations, which include Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates, share similarities in their economic structures, reliance on oil revenues, and the rapid adoption of IT within their banking sectors. Nevertheless, they also exhibit distinctive cultural, regulatory, and economic characteristics that necessitate a thorough examination of IT-related audit challenges and opportunities specific to this region.

Jordan and the GCC countries are chosen for this study due to the distinctive attributes of their banking sectors, which include the prominence of Islamic banking, varying regulatory frameworks, and differing levels of IT adoption. While Jordan is not a member of the GCC, it consistently exports highly qualified accountants and auditors to the GCC, making an examination of the audit profession in this region highly relevant and significant.

This study contributes to the existing literature by providing a detailed analysis of how IT-related risks are disclosed in audit reports within the banking sectors of Jordan and the GCC countries. It provides insights into the influence of auditors, banks, boards of directors, audit committees, and governance attributes—including IT committees—on KAM disclosures. By highlighting the role of corporate governance in enhancing audit transparency, this research underscores the importance of robust governance structures in mitigating IT-related risks and improving the quality of financial reporting. By focusing on the banking sectors of Jordan and the GCC countries, this study also contributes to the literature by examining KAM disclosures in regions characterized by unique regulatory frameworks and cultural factors, offering a broader understanding of how KAMs are applied in different contexts.

This paper is organized as follows: Section 2 discusses contextual auditing information in Jordan and GCC countries. Section 3 presents a comprehensive review of relevant literature and establishes the research hypotheses. Section 4 elaborates on the research methodology employed in the study. Section 5 adopts a descriptive-analytical approach to rigorously examine the data and dissect the findings. Section 6 summarizes the key conclusions drawn from the study, explores the practical and theoretical ramifications, proposes directions for future research, and acknowledges the limitations inherent in the investigation.

4.2 Contextual Information on Auditing in Jordan and GCC Countries

The legislation governing Key Audit Matters (KAMs) in Jordan and the Gulf Cooperation Council (GCC) countries is primarily influenced by international accounting standards, Islamic finance principles, and local regulations (Mah'd & Mardini, 2022). These nations adhere to International Financial Reporting Standards (IFRS) for financial reporting, with auditors obligated to ensure compliance with national laws and regulations. Each jurisdiction has specific authorities overseeing auditing and accounting standards (Griffith, 2020).

In Jordan, the Jordanian Certified Public Accountants Association oversees the audit profession and confirms that the independent auditor's report adheres to the most recent international auditing standards. Specifically, Jordanian audit firms are required to implement International Standard on Auditing No. 701 as of December 15, 2016 (Abdullatif et al., 2023). According to Jordanian Companies Law No. 22 of 1997, amended by No. 30 of 2018, the comprehensive adoption of IFRS mandated by the International Accounting Standards Board (IASB) is required. Listed companies must undergo an annual statutory audit, except for limited and general partnerships with capital less than 100,000 JDs. Empowered by Accountancy Law No. 73 of 2003, the Jordanian Association of Certified Public Accountants recommends auditing standards for adoption by the Higher Committee of the Accountancy Profession, which has embraced all international auditing standards released by the International Auditing and Assurance Standards Board (IAASB).

In Saudi Arabia, the Saudi Organization for Certified Public Accountants (SOCPA) plays a crucial role in setting auditing and accounting standards under the Ministry of Commerce's supervision (Bakr & Napier, 2022). Established in 1992, SOCPA is responsible for formulating standards for both accounting and auditing, adopting international standards, granting professional licenses for Certified Public Accountants (CPAs), and overseeing auditing firms' performance. Before SOCPA's establishment, national auditing standards did not adequately meet financial statement users' needs,

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resulting in increased demands for better disclosure practices. Alqahtani (2021) emphasizes that Saudi Arabia and other GCC nations fully implemented ISA 701 as of January 1, 2017. Considering Saudi Arabia's adherence to Islamic principles, auditors face challenges related to complying with Sharia principles, particularly in sectors like banking and finance (Azid & Alnodel, 2019).

Qatar has experienced economic growth fueled by its natural gas and oil resources. The expansion of businesses has necessitated a robust auditing environment to support economic diversification (Biygautane et al., 2018). The Qatar Financial Markets Authority and the Qatar Central Securities Depository oversee the auditing framework, working to harmonize practices with international standards to foster transparency and dependability in financial reporting (Abdelqader et al., 2022). Auditors in Qatar commonly adhere to global standards, such as ISA issued by IAASB. The auditing landscape in Qatar presents challenges, including geopolitical risks, economic fluctuations, and adherence to Sharia principles, particularly in the financial and investment sectors (Ibrahim & Truby, 2021).

Oman is notable for adopting leading Corporate Governance (CG) practices in line with international standards, as recognized by capital market regulators (Al Lawati & Hussainey, 2022). The Omani government has improved the CG system and disclosure levels. The 2015 Omani CG code emphasizes the Audit Committee's (AC) role in overseeing financial reporting, enhancing voluntary disclosure, and minimizing information asymmetry. The code outlines specific standards for AC members responsible for evaluating internal control and risk management, including a majority of independent members and at least one member with accounting or financial expertise. Additionally, the code restricts the AC chair from serving concurrently on other committees within the same company (Capital Market Authority, 2015).

The Kuwait Stock Exchange (KSE) has formulated new regulations to oversee the auditing of listed companies. Article 161 mandates the appointment of a minimum of one external auditor during the company's general meeting. An amendment in August 1994 stipulates that companies listed on the stock market must engage at least two external

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auditors from different audit firms, effective for financial statements starting January 1995 (KSE, 2016). This requirement enhances transparency and efficiency in the market, aligning with stock exchange obligations. The proposed resolution emphasizes that all KSE-listed companies must have a minimum of two auditors from distinct accounting offices, adhering to ISA. The audit offices must conduct the Joint Audit professionally, ensuring its objectives are met through universal principles (Aljouan, 2021).

The UAE's audit regulations are overseen by government bodies such as the Financial Audit Authority, State Audit Institution, Dubai Financial Services Authority, and Abu Dhabi Accountability Authority (Malagila et al., 2020). Federal Law 2 of 2015 governs accounting and auditing practices for companies in the UAE. Articles 26-32 outline requirements for financial statements aligning with International Accounting Standards and mandating the appointment of auditors for all companies, with Article 245 necessitating audit reports. Circular No. 162 (2018) from the Central Bank bars auditors of commercial banks from offering non-audit services to the same bank. The UAE Auditors Law (Federal Law No. 22 of 1995) guides the audit profession with 53 articles across eight chapters, primarily regulated by the State. Audit firms must register with the Ministry of Economy, which maintains auditors' records. Articles 5 and 6 detail the prerequisites for becoming an auditor, while the law covers auditors' rights, duties, and disciplinary measures. Although the law does not specify auditing standards, the UAE adheres to International Auditing Standards (Barghathi et al., 2021).

In Bahrain, auditing firms are categorized into local firms, foreign branches, and those linked to international entities. The Big Four wield substantial influence, mandated by the Central Bank of Bahrain (CBB) to audit financial institutions (Joshi et al., 2010). Legislative Decree No. 26 of 1996 regulates auditing services, outlining the requirements for auditor licensing. Article 205 of Bahrain CCL No. 21 of 2001 mandates the annual appointment of auditors during the firm's AGM (Said & Khasharmeh, 2014). Regarding auditor independence, Article 61 of CBB and Financial Institutions Law No. 64 of 2006 sets conditions for an auditor to be deemed independent. Before assigning an auditor, licensees must ensure they possess the necessary skills, resources, and independence

(CBB, 2015). The absence of locally established auditing and accounting standards in Bahrain is due to the dominance of international accounting firms and a lack of local initiatives. As a result, companies follow IFRS, while auditing firms adhere to ISA. However, a limited understanding of ISA undermines audit quality, especially among smaller firms. Additionally, a scarcity of experienced auditors persists due to inadequate educational and training infrastructure.

Islamic finance principles, including Sharia compliance, are integral to the audit process in these countries, necessitating a thorough examination of financial transactions to ensure alignment with Islamic financial tenets (Al-Malkawi & Pillai, 2018). These legal and regulatory frameworks enhance transparency and accountability in financial reporting, fostering investor confidence and economic stability in the region. Auditors must stay updated with evolving regulations to address KAMs effectively in each GCC country (Hazaea et al., 2020). Audit matters can evolve over time, and auditors must remain informed about the latest regulations and economic developments in each country to conduct thorough and effective audits (Köhler et al., 2020). Furthermore, specific audit matters for a particular company may vary depending on its size, industry, and unique circumstances (Zeng et al., 2021).

In summary, KAMs in Jordan and the GCC countries are tailored to address the distinct challenges posed by each nation's economic structure, business activities, and regulatory frameworks. These specific areas of focus are crucial for auditors to provide comprehensive and reliable audits, encouraging confidence in financial statements and contributing to the integrity of the region's financial markets.

4.3 Literature Review and Hypotheses Development

4.3.1 Enhanced Audit Report Featuring KAMs

In the ever-evolving landscape of external auditing, the introduction of KAMs has marked a pivotal moment and triggered vigorous debate within the audit literature. Some academics and regulatory bodies, such as Segal (2019) and the IAASB (International Auditing and Assurance Standards Board, 2015), contend that this transformative

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development has ushered in a new era of transparency by effectively conveying audit findings to stakeholders and adding significant communicative value to the audit report. KAMs, as emphasized by Kharuddin et al. (2022) and Sierra-García et al. (2019), represent the focal points where auditors dedicate substantial attention, grapple with significant audit risks, and apply their professional expertise to rigorously assess the accuracy and completeness of the presented financial information.

Conversely, there are opposing views suggesting that the incorporation of KAMs in the audit report leads to heightened legal liability, complicates the audit process, and diminishes its effectiveness, as argued by Sirois et al. (2018). Furthermore, Cordoş and Fülöp (2015), in their examination of whether investors, shareholders, and users of audit reports are content with the changes in ISA 701, concluded that there is still a demand for greater confidence in the audit report and a need for additional reassurance. They assert that the inclusion of KAMs in the auditor's report enhances stakeholders' confidence in the accuracy of financial statements, aiding them in making investment decisions. Moreover, the literature on audit reports posits that the disclosure of KAMs should enhance the quality of the audit process, aligning it with stakeholders' interests (Al Lawati & Hussainey, 2022; Velte & Issa, 2019). KAMs serve as a potent tool for external auditors to underscore specific areas within financial statements that they consider of paramount significance (Santana et al., 2019).

The primary objective of the auditing process is to ensure the accuracy, reliability, and fairness of financial statements and reports (Abu Huson et al., 2024; Sierra-García et al., 2019). This objective aligns with agency theory, which elucidates the relationship between auditors and stakeholders (Corten et al., 2018). According to agency literature, a higher quality audit is achieved when the audit committee exercises greater oversight and demands expanded audit coverage (Raimo et al., 2021). The disclosure of KAMs empowers auditors to provide stakeholders with a means to self-assess, enabling them to conduct more informed financial analyses and make better investment decisions (Gold et al., 2020). From the perspective of agency theory, an increase in information provision, oversight, and demand for comprehensive audit coverage leads to reduced information

asymmetry and improved financial reporting and audit quality (Shahzad 2019; Almeida, 2014). According to the above findings, the following hypothesis is proposed:

H1: There is a positive (negative) relation between the amount of disclosed KAMs and the audit firm's characteristics.

4.3.2 Synergies of Key Audit Matters and Corporate Governance

KAM and corporate governance are critical elements in the financial reporting landscape, playing essential roles in ensuring the transparency, accountability, and reliability of financial statements (Carcello et al., 2011; Rahaman & Karim, 2023). Research by Hellman (2011) and others has underscored the symbiotic relationship between auditors and clients, as well as the impact of corporate governance on the audit process. Previous studies have indicated that close ties between auditors and clients can threaten auditor independence. For instance, Bamber and Iyer (2007) and Alawaqleh et al. (2021) found that auditors closely aligned with clients were more likely to endorse client-preferred treatments of materiality issues, potentially compromising audit effectiveness. However, maintaining an appropriate level of engagement is essential, as excessive distance between auditors and clients can also be detrimental.

International Standards on Auditing (ISA) 260 and ISA 315 emphasize the importance of auditors understanding the entity and its environment, which necessitates interaction with those involved in corporate governance to gain insights into business matters and internal control systems (Fera et al., 2022). Corporate governance focuses on establishing a framework of practices, processes, and structures that govern relationships among a company's stakeholders, including shareholders, management, customers, financiers, regulators, and the wider community (Velentzas et al., 2017). Effective corporate governance is vital for instilling investor confidence, safeguarding shareholder interests, and fostering sustainable business practices (Jaffar et al., 2023). It encompasses principles and guidelines that guide the behavior and decision-making processes of the board of directors, management, and other stakeholders (Gebrayel et al., 2018).

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The correlation between KAMs and corporate governance is significant, as both contribute substantially to the overall integrity of financial reporting (Velte, 2020). Identifying KAMs requires a comprehensive understanding of a company's operations, risks, and financial reporting processes (Rahaman & Karim, 2023). A robust system of corporate governance facilitates auditors' access to relevant information and ensures cooperation from management in addressing audit concerns (Al Lawati & Hussainey, 2022). The board of directors, a key component of corporate governance, plays a vital role in overseeing the audit process, promoting a culture of accountability, and encouraging ethical conduct within the organization (Sharma et al., 2008; Chen et al., 2016; Bepari, 2023).

In examining the audit process, Fera et al. (2022) highlights the pervasive impact of corporate governance across all phases of auditing activities. From the client acceptance phase onward, auditors are prompted to consider the quality of the firm's corporate governance, with a strong board of directors playing a pivotal role in defining and monitoring the firm's strategies. Carcello et al. (2011) assert that stronger corporate governance correlates with more favorable client acceptance recommendations. As auditors navigate the risk assessment phase, the influence of corporate governance becomes more pronounced, affecting auditors' assessments of inherent risk and control environment risk. A robust board of directors and an expert audit committee are considered essential for effective internal control, shaping auditors' risk assessments (Bepari, 2023; Velte, 2020). Furthermore, audit committees with members possessing significant financial expertise are more likely to engage deeply with auditors, ensuring that critical audit matters are identified and communicated effectively (Ghafran & O'Sullivan, 2013). This enhanced disclosure not only improves the quality of financial reporting but also strengthens stakeholder trust in the company's governance practices (Bliss et al., 2007; Gebrayel et al., 2018).

During the execution phase of the auditing process, evidence suggests that stronger corporate governance results in less extensive substantive audit testing (Sharma et al., 2008). Considering the entire audit process, auditors consider client governance when making audit decisions. This empirical evidence, combined with the acknowledgment of

the fundamental role of corporate governance characteristics in the audit process by ISA 701, substantiates the interest in this field of study. The interplay between KAMs, client-auditor relationships, and corporate governance highlights the intricate dynamics shaping the audit profession, contributing to the ongoing discourse on enhancing the integrity of financial reporting (Fera et al., 2022).

Therefore, depending on the previous discussion, the following hypothesis is formulated:

H2: There is a positive (negative) relation between the number of disclosed KAMs and board of directors and audit committee attributes.

4.3.3 Key Audit Matters in Information Technology

External auditor reports have traditionally faced criticism for their generic language, offering limited insights into the audit process and leaving stakeholders in ambiguity (Roszkowska, 2021; Salijeni et al., 2021). Responding to this, the IAASB initiated changes to enhance the transparency of auditor reports, reflecting a shift towards greater clarity in the audit profession (Rahaman et al., 2023). Auditors now provide more detailed information on audit procedures, findings, and concerns, recognizing the complexity and risks associated with technology-driven business operations (Salijeni et al., 2019; Asbahr & Ruhnke, 2019). Technology's profound impact on modern business, including its influence on processes, data management, and financial reporting, necessitates auditors' assessment of its implications on financial statements (Abu Huson et al., 2024; Gelinis et al., 2018; Malik et al., 2022). With technology permeating various business aspects like financial transactions and data management, Key Audit Matters (KAMs) have become essential for addressing technology-related challenges, underscoring their significance in the audit profession (Sneller et al., 2017).

The emergence of new risks, such as cybersecurity threats and data breach, requires auditors to focus on dynamic technology-related risks, making them central in the external audit process (Mökander & Floridi, 2023; Kend & Nguyen, 2022). KAMs related to technology, particularly in areas like cybersecurity measures and IT systems and controls

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over financial reporting, demand auditors' attention (Sneller et al., 2017; La Torre et al., 2021). The banking sector, heavily reliant on intricate technology for accounting and financial reporting systems, faces risks related to transaction volumes and automated procedures (Palepu et al., 2020; Maharaj, 2023). Auditors scrutinize areas like logical access management to mitigate security vulnerabilities and ensure appropriate changes to applications and data (Vasarhelyi et al., 2018). Moreover, compliance with data privacy regulations, exemplified by the General Data Protection Regulation (GDPR) in Europe, is a prominent KAM, with auditors evaluating entities' adherence to these laws (Li & Newman, 2022; Mahanti & Mahanti, 2021).

As auditors grapple with auditing complex IT systems and assessing their accuracy and reliability, KAMs focus on system controls, data integrity, and disaster recovery plans (Samiolo et al., 2024). With digital transformation initiatives accelerating, KAMs help identify risks associated with these projects, promoting proactive risk management within organizations (Boolaky & Quick, 2016; Humphreys & Trotman, 2022). Lastly, technology-related KAMs enhance transparency and prompt management to address risks promptly, strengthening the overall control environment and empowering stakeholders to make informed decisions (Rahaman et al., 2023; Imdieke, 2022).

In parallel, the integration of governance principles with IT management practices is crucial for understanding the relationship between governance and IT, particularly concerning KAMs in audit reports. A prime example of this integration is demonstrated by the Control Objectives for Information and Related Technologies (COBIT) 2019 framework (Abass et al., 2023; De Haes 2020). COBIT offers a comprehensive governance structure that aligns IT objectives with business goals, ensuring that technology investments contribute to strategic outcomes while managing associated risks (COBIT, 2019). Through delineating clear lines of responsibility, accountability, and decision-making within IT governance structures, COBIT enhances transparency and ensures that IT initiatives align with organizational objectives (Alkhaldi et al., 2017).

Moreover, COBIT emphasizes the significance of information management, stressing the

need for accurate, timely, and secure data to drive effective decision-making and improve business performance (COBIT, 2019). By adhering to COBIT principles, organizations can establish robust governance mechanisms that optimize technology use, improve operational efficiency, foster innovation, and mitigate risks within the IT landscape (COBIT, 2019; Gelinas et al., 2018). This framework guides auditors in identifying and addressing KAMs related to IT, ensuring that technology investments are aligned with business objectives and effectively managed to mitigate risks and enhance organizational performance. In accordance with the findings, the following hypothesis is posed:

H3: There is a positive (negative) relation between the amount of IT disclosed KAMs and board of directors and audit committee attributes.

4.4 Method

4.4.1 Sample

The study focuses on Jordan and the Gulf Cooperation Council (GCC) countries, which include Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates. This focus is based on the shared characteristics and economic integration within this region, as well as the practical relevance of including Jordan, which has strong ties to the GCC despite not being a formal member. The rationale behind selecting banks for this study is to investigate whether specific Key Audit Matters (KAMs), particularly those related to IT, influence company characteristics. According to the report by Accountancy Europe (2019), IT systems are one of the top three categories of concern in European banking, highlighting the importance of this matter in banks. IT-related KAMs can provide critical information for stakeholders, such as investors, auditors, and academics, especially given the scarcity of disclosures on this topic.

Data was collected from two main sources: audit characteristics data were obtained from available audit reports on the respective banks' websites, and other data were collected from the EIKON database and annual reports. The study covers 9 banks from Bahrain, 15 banks from Jordan, 11 banks from Kuwait, 7 banks from Oman, 9 banks from Qatar, 11 banks from Saudi Arabia, and 17 banks from the United Arab Emirates for the period from

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2016 to 2022. The year 2016 was chosen as the starting point because it was the first year when KAM disclosure became mandatory, and 2022 was the last available year. This provided a total of 553 observations (79 banks across 7 years).

Banks were selected as the focus of this study due to their central role in the economies of Jordan and the GCC countries, as well as their critical reliance on IT systems. The banking sector's complexity, particularly regarding financial products, credit risk, and regulatory compliance, makes it a prime candidate for investigating KAMs, especially those related to IT. As banks undergo rapid digital transformation, IT-related risks such as cybersecurity and data privacy have become increasingly important, necessitating their disclosure in audit reports. Furthermore, banks in Jordan and the GCC are highly regulated, with mandatory annual audits, making KAMs an essential tool for providing transparency to stakeholders, including investors, regulators, and the public. The inclusion of IT-related KAMs helps bridge the information gap between auditors and stakeholders by highlighting significant risks and issues. Additionally, the unique regulatory frameworks, including the prevalence of Islamic banking and economic reliance on oil revenues, make the region's banking sector an ideal context for examining how IT risks are managed and disclosed in audit reports, contributing to enhanced governance and audit transparency.

4.4.2 Models

To examine whether inconsistencies between Key Audit Matters (KAMs) are associated with characteristics of audit firms, banks, Boards of Directors (BoD), and Audit Committees (AC), we employ the following models:

Model 1:

$$\text{KAM}_{it} = \beta_0 + \beta_1 \text{Audit firms characteristics}_{it} + \beta_2 \text{Banks characteristics}_{it} + \beta_3 \text{Country}_{it} + \beta_4 \text{Year}_{it} + \mu_{it}$$

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Model 2:

$$KAM_{it} = \beta_0 + \beta_1 \text{BoD characteristics}_{it} + \beta_2 \text{Audit Committee characteristics}_{it} + \beta_3 \text{Banks characteristics}_{it} + \beta_4 \text{Country} + \beta_5 \text{Year} + \mu_{it}$$

Model 2a:

$$KAM_{it} = \beta_0 + \beta_1 \text{BoD characteristics}_{it} + \beta_2 \text{Banks characteristics}_{it} + \beta_3 \text{Country} + \beta_4 \text{Year} + \mu_{it}$$

Model 2b:

$$KAM_{it} = \beta_0 + \beta_1 \text{Audit Committee characteristics}_{it} + \beta_2 \text{Banks characteristics}_{it} + \beta_3 \text{Country} + \beta_4 \text{Year} + \mu_{it}$$

Model 3:

$$ITKAM = \beta_0 + \beta_1 \text{BoD characteristics}_{it} + \beta_2 \text{Audit Committee characteristics}_{it} + \beta_3 \text{IT committee}_{it} + \beta_4 \text{Banks characteristics}_{it} + \beta_5 \text{Country} + \beta_6 \text{Year} + \mu_{it}$$

Model 3a:

$$ITKAM = \beta_0 + \beta_1 \text{BoD characteristics}_{it} + \beta_2 \text{IT committee}_{it} + \beta_3 \text{Banks characteristics}_{it} + \beta_4 \text{Country} + \beta_5 \text{Year} + \mu_{it}$$

Model 3b:

$$ITKAM = \beta_0 + \beta_1 \text{IT committee}_{it} + \beta_2 \text{Audit Committee characteristics}_{it} + \beta_3 \text{Banks characteristics}_{it} + \beta_4 \text{Country} + \beta_5 \text{Year} + \mu_{it}$$

4.4.3 Variables

To achieve our objectives, we used three types of dependent variables. First, KAM is measured as the number of key audit matters disclosed in the audit report (Following Pinto & Morais, 2019; Ferreira & Morais, 2019; Sierra-García et al., 2019; Kitiwong & Srijunpetch, 2019, Abu & Jaffar, 2020; Zeng et al., 2021; Camacho-Miñano et al., 2022; Hategan et al., 2022). Furthermore, to the best of our knowledge, we are the first to use the ITKAM variable that it is a dummy variable that equals 1 if the key audit matter disclosed is related to information technology issue, and otherwise 0.

Concerning auditor characteristics, the authors followed prior research (Sierra-García et al., 2019; Kend & Nguyen, 2020; Camacho-Miñano et al., 2022; de Riquebourg & Maroun, 2022; Baatwah et al., 2022; Parte et al., 2022; Rahaman & Chand, 2022; Al-mulla & Bradbury, 2022; Abdullatif et al., 2023; Gambetta et al., 2023). Auditor that it is a categorical variable that equals 0 if the audit firm is a non-BIG-4, 1 if the audit firm is Deloitte, 2 if the audit firm is EY, 3 if the audit firm is KPMG and 4 if the audit firm is PwC. Big-4 audit firms have a stronger incentive to finish their work rapidly to maintain their reputation. Moreover, switch that it is a dummy variable that equals 1 if the audit firm has changed from the previous year, and otherwise 0. Then, the leg report is measured as the number of days between the year-end date and the date of signing the audit report. Finally, Pages report that it is measured as the number of pages of the audit report.

Regarding banks' characteristics, we used the variables that have been most widely used in the literature in relation to our aims. Firstly, Size that it is measured as the natural logarithm of total assets (Birindelli & Ferretti, 2015; Baatwah et al., 2022; Parte et al., 2022). As prior research we consider the proxies for risk areas that are utilising in the CAMELS system (Gambetta et al., 2015, 2016, 2017; Quoc Trung, 2021; Abuzarqa & Tarnoczi, 2021).

Firstly, Capital ratio that is measured as a bank's core equity capital to its total risk-

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weighted assets. Second, the natural logarithm of Provision for Loan Losses (PLL) captures asset quality. Then, Efficiency ratio that it is calculated by dividing its non-interest expenses by income is a proxy for management skills. The higher the efficiency ratio, the higher the difficulty for the bank to earn a profit and, thus, to raise its capital (Abuzarqa & Tarnoczi, 2021). To proxy for bank liquidity, we used Loans, the higher the loans imply, the lower the capability of bank liquidity (Gambetta et al., 2017). Liquidity is a crucial aspect that reveals a bank's proficiency to achieve its financial liabilities (Mohamed et al., 2023). Adequate liquidity implies how the banks had sources to deal with the short-term liabilities. Furthermore, to proxy for profitability we used Return on Assets (ROA) that it is calculated by dividing net income to total assets (Gambetta et al., 2016; Pinto & Morais, 2019; Fera et al., 2022). The higher this ratio, the greater the return on assets achieved and expanded by the banks (Quoc Trung, 2021). Lastly, Sensitive Risk is calculated as other interest-bearing liabilities to total assets. If a bank fails to manage these risks satisfactorily, its profits, capital and liquidity can be damaged (Quoc Trung, 2021). The higher the Sensitivity to market, the higher the risk of changes in market situations, which can adversely affect a bank's profit or capital (Abuzarqa & Tarnoczi, 2021).

In relation to the corporate governance mechanisms, as previous studies (Velte, 2018, 2020; Abu & Jaffar, 2020; Fera et al., 2022; Elmarzouky et al., 2022; Jaffar et al., 2023; Rahaman & Karim, 2023) we use the traditional proxies to measure the Board of Directors characteristics. First, BoDIND which measured as the percentage of independent members in the BoD. Earlier literature proposes that the percentage of independent members on the BoD is critical to the governance mechanism power (Elmarzouky et al., 2022). Secondly, BoDMEET is measured as the number of BoD meetings. Boards that meet frequently allow directors to identify and resolve potential matters, particularly those related to key audits (Jaffar et al., 2023). Lastly, BoDSIZE which is measured as the number of BoD members. Firms with a large board will be associated with good governance practices, mitigating risk matters (Fera et al., 2022). Furthermore, for study audit committee characteristics we include ACIND that it is measured as the percentage of independent audit committee members. Deneuve et al. (2023) stated that when the audit committee

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comprises exclusively independent directors, management might be persuaded by pressure from auditors, and they could be more different KAM disclosures. Also, we included the variable ACEXP that it is a dummy variable that equals 1 if all the audit committee members have expertise in accounting, finance or similar, and otherwise 0 (Wuttichindanon & Issarawornrawanich, 2020; Rahaman & Karim, 2023).

Moreover, we utilised the ACMEET variable that is measured as the number of audit committee meetings. According to Abu & Jaffar (2020), the identified active audit committee can reduce the number of KAMs. Furthermore, ACSIZE that it is measured as the number of audit committee members. We think that more members in the AC could bring more opportunities to discuss the risk associates in the audit report as KAMs (Rahaman & Karim, 2023). Finally, we use the variable IT committee that it is a dummy variable that takes the value 1 if the bank has an IT committee belongs to the Board of Directors, and 0 otherwise.

Then, we control for countries, years and Islamic finance. Country is categorical variable that it is 0 if the companies belong to Bahrain (9 firms); it is 1 if the companies belong to Jordan (15 firms); it is 2 if the companies belong to Kuwait (11 firms); it is 3 if the companies belong to Oman (7 firms); it is 4 if the companies belong to Qatar (9 firms); it is 5 if the companies belong to Saudi Arabia (11 firms); it is 6 if the companies belong to United Arab Emirates (17 firms). Year is categorical variable that it is 0 if the companies belong to 2016; it is 1 if the companies belong to 2017; it is 2 if the companies belong to 2018; it is 3 if the companies belong to 2019; it is 4 if the companies belong to 2020; it is 5 if the companies belong to 2021; it is 6 if the companies belong to 2022. Finally, we include the variable Islamic finance refers to financial activities that adhere to Shariah (Islamic law). Two fundamental principles of Islamic banking are the sharing of profit and loss and the prohibition of the collection and payment of interest by lenders and investors. It is a dummy variable that equals 1 if the bank has financial activities that adhere to Shariah, and otherwise 0.

4.5 Results

4.5.1 Descriptive Results

In Table 4.1, the descriptive statistics of the variables are presented. Panel A offers continuous variables, on average, the sample had 2 KAMs, varying from 0 to a maximum of 7. This shows that the distribution for the number of KAMs may be skewed, affording support to the Poisson model. Furthermore, the number of disclosed KAMs for each firm-year divided by the average number of KAMs found in the year has a mean of almost 1 with a maximum of 4.085. Moreover, regarding the number of days from year-end to the date of its auditor's report, the mean audit delay is more than 47 days with a minimum of 8 days and a maximum of 236 days. Regarding the number of pages of the audit report, on average it has 5.329 pages, with a maximum of 11 pages.

Regarding the bank characteristics, on average, the banks have 30973.21 million American dollars in assets, capital ratio is 13.65%, loan loss provisions of 171.943 million American dollars, whereas the mean loan is 21141.57 million American dollars. The mean efficiency ratio is 47.81% and the mean ROA is 1.43%, with a minimum of -10% and a maximum of 4.064%. Lastly, the average sensitive risk is 0.817.

According to the Board of Directors, on average, the data reveals that more than 40% of members are independent, has 7 meetings and almost 10 directors. Regarding the Audit Committee, on average, the sample discloses that more than 48% are independents members, has more than 6 meetings and almost 4 members.

Panel B shows the descriptive statistics for the dichotomic/category variables. The dependent variable ITKAM shows that just 13.56% of the sample has disclosures a KAM related to information technology issues. Most audit firms are Big-4, with a total market share of 98% according to the sample, leading for Deloitte (28.93%), KPMG (27.67%) and EY (25.86%). The data reveal that 20.07% of the samples have changed auditors in the period of study. Furthermore, 16.46% of the sample has formed an IT committee. Finally, 53 firms (67.09% total sample) have Islamic finance.

Table 4.1. Descriptive Statistic

Panel A: Continuous Variables				
Variables	Mean	Std. Dev.	Min	Max
KAM	2	1.372	0	7
KAM2	0.999	0.646	0	4.085
Lag report (N° days)	47.236	21.343	8	236
Pages report (N° pages)	5.329	1.904	1	11
Size (millions American dollars)	30973.31	49053.91	404.57	324373.8
Capital Ratio	13.648	4.819	2.247	39.473
Loan loss provisions (millions American dollars)	171.943	271.149	-289.412	2396.239
Efficiency Ratio (%)	47.811	24.424	0.276	339.632
Loans (millions American dollars)	21141.57	33076.03	5.740	25012.23
Return On Assets	1.143	1.310	-10.007	4.064
Sensitive Risk	0.817	0.846	0.207	1.050
BoDIND (%)	40.731	18.495	0	100
BoDMEET	7.333	2.907	3	23
BoDSIZE	9.776	1.893	5	16
ACIND (%)	48.070	33.399	0	100
ACMEET	6.213	2.360	2	23
ACSIZE	3.656	0.850	2	8
Panel B: Dichotomic/Category Variables				
Variables		Freq.	Percent	Cummul.
ITKAM	No	478	86.44	86.44
	Yes	75	13.56	100.00
KAM3	No	310	56.06	56.06
	Yes	243	43.94	100.00
Auditor	Non-big-4	13	2.35	2.235
	Deloitte	160	28.93	31.28
	EY	143	25.86	57.14
	KPMG	153	27.67	84.81
	PwC	84	15.19	100.00
Switch	No	442	79.93	79.93
	Yes	111	20.07	100.00
ACEXP	No	281	50.81	50.81
	Yes	272	49.19	100.00
IT committee	No	462	83.54	83.54
	Yes	91	16.46	100.00
Islamic Finance	No	182	32.91	32.91
	Yes	371	67.09	100.00

In Table 4.2 we can observe that companies belong to Saudi Arabia shows a higher mean of KAMs in all the periods with a total mean of 3.069 KAMs reported. Furthermore, Kuwait and Jordan follow the leader with a total average KAMs of 2.052 and 2.048, respectively. However, Oman presents the lower total mean of KAMs with a value of

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1.326.

Table 4.2. Means of KAM by Country and Year

Country	Year	2016	2017	2018	2019	2020	2021	2022	Total
Bahrein		0.889	1.000	1.000	0.889	2.223	2.112	1.889	1.428
Jordan		2.867	2.600	2.000	1.867	1.667	1.734	1.600	2.048
Kuwait		2.636	2.364	2.091	2.000	1.909	1.727	1.636	2.052
Oman		2.000	1.429	1.000	1.143	1.429	1.143	1.143	1.326
Qatar		1.667	1.556	2.556	1.667	1.556	1.445	1.445	1.698
Saudi Arabia		4.636	4.636	2.727	2.727	3.000	2.091	1.909	3.039
United Arab Emirates		2.412	2.294	1.882	2.000	2.059	1.705	1.588	1.991

Regarding Table 4.3, we can see that it is the audit firm Deloitte that reports the higher mean of KAMs (2.325). Although, it is also the one that signs the most reports. Surprisingly, on the other hand, audit firms that are not big-4 (1.764) have a higher average than PwC (1.607) and EY (1.685).

Table 4.3. Means of KAM by Auditor

Auditor	Mean	Std. Dev.	Freq.
Non-Big 4	1.769	1.641	13
Deloitte	2.325	1.147	160
EY	1.685	1.281	143
KPMG	2.189	1.693	153
PwC	1.607	0.982	84

According to the KAM related to IT (see Table 4.4), there are two countries that do not disclosure any (Bahrein and Saudi Arabia). United Arab Emirates and Jordan are the countries with the highest number of IT-related KAMs, 36 and 25, respectively.

Table 4.4. Number of ITKAM by Country and Year

Country Year	2016	2017	2018	2019	2020	2021	2022	Total
Bahrein	0	0	0	0	0	0	0	0
Jordan	1	0	1	6	5	6	6	25
Kuwait	1	1	0	0	0	0	0	2

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Oman	0	0	0	1	1	1	1	4
Qatar	0	0	3	2	1	1	1	8
Saudi Arabia	0	0	0	0	0	0	0	0
United Arab Emirates	7	4	3	5	6	6	5	36

4.5.2 Empirical Results

Table 4.5 presents the Pearson correlation matrix. This correlation and the variance inflation factors (VIF) indicate that our model does not have a serious multicollinearity problem (the largest VIF is 5.01 for Size).

Table 4.5. Pearson Correlation

	KAM	Deloitte	EY	KPMG	PwC	Nonbig4	Switch	Lag report	Pages report	BoD independ.	BoD meeting	BoD size
KAM	1.000											
Deloitte	0.151	1.000										
EY	-0.135	-0.376	1.000									
KPMG	0.085	-0.394	-0.365	1.000								
PwC	-0.121	-0.270	-0.249	-0.261	1.000							
Nonbig4	-0.026	-0.099	-0.091	-0.096	-0.065	1.000						
Switch	0.029	0.018	-0.027	-0.007	0.014	0.011	1.000					
Lag report	0.054	-0.179	0.065	0.047	0.083	0.010	0.022	1.000				
Pages report	0.343	0.092	-0.152	0.026	0.088	-0.127	0.050	0.039	1.000			
BoD independ.	-0.039	-0.195	0.046	0.122	0.054	-0.039	0.020	0.124	-0.004	1.000		
BoD meeting	-0.016	0.204	0.067	-0.189	-0.105	0.002	0.017	-0.101	-0.005	-0.179	1.000	
BoD size	-0.062	0.060	-0.015	-0.003	-0.072	0.043	0.080	0.001	-0.129	-0.056	0.147	1.000
AC independ.	-0.059	-0.190	0.054	0.124	0.022	-0.009	0.057	0.128	-0.061	0.495	-0.132	0.357
AC expertise	-0.054	-0.227	0.037	0.157	0.010	0.080	0.008	0.163	-0.143	0.224	-0.179	0.144
AC meeting	-0.113	0.018	0.088	-0.115	-0.023	0.086	0.048	0.056	-0.130	0.170	0.140	0.235
AC size	0.053	0.150	-0.009	-0.059	-0.089	-0.034	0.027	-0.025	0.080	-0.139	0.284	0.161
IT Committee	-0.021	0.104	0.038	-0.154	0.029	-0.036	0.057	0.097	0.097	0.032	0.113	0.503
Size	0.288	0.008	-0.074	0.146	-0.027	-0.175	-0.048	-0.317	0.296	0.083	0.002	-0.143
Capital ratio	-0.022	-0.090	0.015	0.195	-0.055	-0.219	0.007	0.098	-0.025	0.050	-0.059	-0.148
PLL	0.194	0.045	-0.028	0.072	0.074	-0.446	-0.016	-0.103	0.280	-0.005	0.036	-0.218
Efficiency ratio	0.053	-0.064	0.030	-0.023	-0.007	0.192	0.022	0.323	-0.043	-0.064	-0.021	-0.061
Liquidity	0.054	0.043	-0.011	0.016	-0.049	-0.032	-0.011	-0.247	0.040	0.135	-0.001	0.186
ROA	0.254	0.058	-0.076	0.053	0.006	-0.126	-0.032	-0.318	0.305	0.074	0.062	-0.129
Sensitive risk	-0.019	0.037	-0.081	-0.031	0.026	0.153	0.005	-0.151	-0.020	0.037	0.099	0.073

Table 4.5. Pearson Correlation (Continued)

	AC independ	AC expertise	AC meeting	AC size	IT Committee	Size	Capital ratio	PLL	Efficiency ratio	Liquidity	ROA	Sensitive
AC independ.	1.000											
AC expertise	0.277	1.000										

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AC meeting	0.242	0.306	1.000									
AC size	-0.069	0.186	0.128	1.000								
IT Committee	0.231	0.084	0.148	0.148	1.000							
Size	0.037	-0.022	-0.130	0.125	-0.282	1.000						
Capital ratio	-0.027	0.002	-0.144	-0.105	-0.104	-0.103	1.000					
PLL	-0.093	-0.186	-0.201	0.035	-0.188	0.614	0.097	1.000				
Efficiency ratio	-0.056	0.083	0.163	-0.038	0.047	-0.397	-0.108	-0.266	1.000			
Liquidity	0.185	0.065	-0.050	0.100	0.081	0.310	0.081	-0.009	-0.672	1.000		
ROA	0.029	-0.051	-0.099	0.154	-0.234	0.336	-0.281	0.450	-0.379	0.290	1.000	
Sensitive risk	0.078	0.092	0.179	0.190	0.092	-0.009	-0.594	-0.129	0.047	0.009	0.109	1.000

Bold correlations are significant at the 5% level.

To test our hypotheses, the balanced panel data is proposed. This method allows us to consider effects, thus improving the estimation, and controlling the time factor. Several analyses are performed to identify the best statistical model (not included). Firstly, we select between pooled OLS and random effects, using the Breusch-Pagan test; then between pooled OLS and fixed effects, using the restrictive F-test; and finally, between random and fixed effects, using the Hausman test. We conclude that the random effects approach is better than the others.

To test our first hypothesis (Table 6), due to the nature of the dependent variable KAM, we employed the random-effect Poisson regression model because it is statistically suitable when the dependent variable is a count (Pinto & Morais, 2019; Bepari, et al., 2022). We confirm two tests to see if the model fits well. First, the goodness of fit chi square test accepted the null hypothesis, and the model fit well. Secondly, we checked the overdispersion with likelihood ratio test accepted the null hypothesis and there is no overdispersion.

The results of Model 1 indicate that the variable Auditor (EY vs. non-Big 4; KPMG vs. non-Big 4; PwC vs. non-Big 4) has a negative and significant coefficient with KAM as the dependent variables, which implies that a report signed by the audit firms as EY, KPMG and PwC reduce the number of KAMs reported. The results are in line with Sierra-García et al. (2019) and Baatwah (2022). Regarding the pages, the variable of the pages, the variable has a positive and significant relation with the number of KAM reported, which implies that higher number of pages means higher number of KAMs disclosed. The size of

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the bank is significant and positive regarding the number of KAMs disclosed, which suggests that auditors in large banks make more effort and disclose more KAMs. Indeed, bigger banks tend to improve stronger control from auditors. This result is in line with some previous studies such as Oghuvwu & Orakwue (2019), Pinto & Morais (2019), Abdelfattah et al. (2021), Fera et. al. (2022). Moreover, the efficiency ratio is positive and significant with the number of KAMs, which means the higher this ratio is, the less efficient the bank is, and therefore less efficient banks reveal a higher number of KAMs. Lastly, those banks that has financial activities that adhere to Shariah disclosures lower number of KAMs. Thus, H1 is supported regarding certain characteristics of Auditor and bank.

To test our second hypothesis, we focus on the corporate governance characteristics of the company. As international Standard of Auditing 701 stated the auditor will communicate the Key Audit Matters with those charged with governance. Therefore, we believe that, as previous studies (Velte, 2020; Wuttichindanon & Issarawornrawanich, 2020; Abu & Jaffa, 2020; Elmarzouky et al., 2022; Fera et al., 2022; Zhang & Shailer, 2022; Jaffar et al., 2023) the number of KAMs will depend on the efficiency of corporate governance qualities such as the board of directors and the audit committee. In Table 6, Model 2, we can observe that the board size is significantly and negatively associated to the number of KAMs. When a BoD is smaller, they tend to disclosure a greater number of KAMs. This result is in line with Jaffar et al. (2023). Furthermore, the AC meeting variable is positive and significant regarding the number of KAM. The more AC meetings, the higher the number of KAMs. Similar results are found by Al Lawati & Hussainey (2022). Regarding the bank's characteristics, the results presented in Table 6 show that SIZE, PLL and Efficiency ratio have a positive and significant association with the number of KAMs disclosed. We could conclude that larger, conservative and more complex banks disclosed a higher number of KAMs from the audit firms. However, we found a negative and significant relationship between CAPITAL and SENSITIVITY with the number of KAMs. The results show that banks with a lower capital level (lower efficiency) and with lower sensitivity to market risk tend to disclose a higher number of KAMs. Lastly, Islamic finance variable is negative and significant associate with the risks disclose in the audit

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report. That's means those banks that has financial actions that adhere to Shariah disclosures lower risks KAM. Thus, H2 is supported regarding certain corporate governance variables.

We want to go further and split Model 2 into Model 2a and 2b (see Table 4.6). Thus, we have just run the regression with both governance variables separately. First, if we consider just BoD we have the same result, board size is significantly and negatively associated with the number of KAMs. However, regarding the AC, we do not find any association with the dependent variable. Regarding banks' characteristics, we show similar results with Models 1 and 2.

Table 4.6. Empirical Models

Variables	KAM (Model 1)	KAM (Model 2)	KAM (Model 2a)	KAM (Model 2b)
Auditor (non-big 4 reference)				
<i>Deloitte</i>	-0.026 (0.236)	-	-	-
<i>EY</i>	-0.318** (0.130)	-	-	-
<i>KPMG</i>	-0.292** (0.252)	-	-	-
<i>PwC</i>	-0.436*** (0.141)	-	-	-
Switch	-0.069 (0.042)	-	-	-
Lag report	0.071 (0.047)	-	-	-
Pages report	1.102*** (0.073)	-	-	-
BoD independent	-	-0.021 (0.002)	-0.022 (0.002)	-
BoD meeting	-	0.081 (0.079)	0.031 (0.131)	-
BoD size	-	-0.541*** (0.147)	-0.506*** (0.074)	-
AC independent	-	-0.005 (0.009)	-	-0.006 (0.001)
AC expertise	-	-0.002 (0.051)	-	-0.036 (0.070)
AC meeting	-	0.152** (0.077)	-	0.139 (0.131)
AC size	-	0.072	-	0.017

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		(0.439)		(0.207)
Size	0.223*** (0.070)	0.249** (0.091)	0.246*** (0.891)	0.238 (0.210)
Capital ratio	-0.055 (0.074)	-0.021** (0.008)	-0.022*** (0.008)	-0.023 (0.210)
PLL	0.004 (0.008)	0.024** (0.011)	0.026** (0.011)	0.025* (0.014)
Efficiency ratio	0.003** (0.001)	0.005*** (0.001)	0.005*** (0.001)	0.005* (0.003)
Liquidity	-0.0967 (0.066)	-0.072 (0.083)	-0.063 (0.083)	-0.073 (0.212)
ROA	0.098 (0.225)	0.024 (0.029)	0.028 (0.029)	0.022 (0.044)
Sensitive risk	-0.049 (0.439)	-0.948* (0.483)	-0.834* (0.488)	-0.921* (0.553)
Islamic finance	-0.182*** (0.052)	-0.326*** (0.074)	-0.325*** (0.073)	-0.343*** (0.122)
Country dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Observations	553	553	553	553
Wald chi ²	1247.00	118.80	116.12	1009.78
Log likelihood	-753.134	-815.678	-816.694	-818.6358
Prob > chi ²	0.000***	0.000***	0.000***	0.000***

Coefficient and Standard errors in parentheses are presented *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Models 1,2, 2a and 2b: Random-effects Poisson regression.

To test our third hypothesis, we consider the ITKAM variable that it is a dummy variable that takes the value 1 if the auditor has disclosed an IT risk KAM, and 0 otherwise. Hence, we employ Random-effects Logistic regression. The Hosmer-Lemeshow statistic discloses that the model is well calibrated. Regarding Model 3 of the governance mechanisms (Table 4.7), we provide evidence that BoD independent and IT committee variables are positive and significantly associated with ITKAM. If the board of directors has a higher number of independents, it tends to reveal ITKAMs. Furthermore, those banks that have an IT committee directly dependent on the BoD are more prone to disclosure ITKAMs. However, none of the control variables are significant.

Related to Model 3a, having an IT committee directly dependent on the BoD are more prone to disclosure ITKAMs, Moreover, consider audit committee variables, AC independent is negative and significantly relates to number of KAMs. Model 3b shows evidence that BoD independent and IT committee variables are positive and significantly

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associated with ITKAM, However, AC independent variables are negative and significantly associated with ITKAM.

Table 4.7. Empirical Models

Variables	ITKAM (Model 3)	ITKAM (Model 3a)	ITKAM (Model 3b)
IT committee	1.538* (0.877)	1.663* (0.931)	1.717* (0.919)
BoD independent	0.025* (0.014)	-	0.031** (0.015)
BoD meeting	-0.934 (0.806)	-	-1.035 (0.826)
BoD size	-0.572 (1.645)	-	-0.576 (1.715)
AC independent	-	-0.017** (0.009)	-0.020** (0.009)
AC expertise	-	0.506 (0.518)	0.382 (0.517)
AC meeting	-	-0.024 (0.743)	0.237 (0.739)
AC size	-	-0.312 (1.298)	-0.423 (1.295)
Size	-1.576 (1.415)	-1.027 (1.420)	-1.347 (1.470)
Capital ratio	-0.073 (0.085)	-0.061 (0.092)	-0.063 (0.089)
PLL	0.020 (0.094)	0.017 (0.098)	0.011 (0.095)
Efficiency ratio	-0.017 (0.020)	-0.011 (0.021)	-0.013 (0.021)
Liquidity	1.495 (1.379)	1.041 (1.365)	1.304 (1.425)
ROA	0.027 (0.354)	0.109 (0.387)	0.102 (0.388)
Sensitive risk	-4.940 (4.165)	-4.500 (4.657)	-4.937 (4.399)
Islamic finance	-0.694 (0.843)	-0.162 (0.883)	-0.694 (0.874)
Country dummies	No	No	No
Year dummies	Yes	Yes	Yes
Observations	553	553	553
Wald chi ²	20.66	19.61	23.91
Log likelihood	-167.222	-167.286	-164.438
Prob > chi ²	0.424	0.594	0.646
Hosmer-Lemeshow chi ²	8.09	10.12	6.01

Coefficient and Standard errors in parentheses are presented ***p<0.01, **p<0.05, *p<0.1
Models 3, 3a and 3b: Random-effects Logistic regression.

4.5.3 Robustness Test

To assess the robustness of the results and the dependent variable, the authors use two alternative measures. Firstly, we created the dependent variable KAM2 that it is measured as the number of disclosed key audit matters (as previously counted) for each firm-year observation divided by the average number of KAMs detected in the fiscal year in the audit report (Fera et al., 2022; Muñoz-Izquierdo et al., 2023). Secondly, we used a second alternative proxy, KAM3 that it is a dummy variable that equals 1 if the number of key audit matters disclosed for the year is greater than the median of the distribution, and otherwise 0 (Pinto & Morais, 2019; Jaffar et al., 2023).

For the first dependent variable (KAM2), we study possible problems as the model might not be identified in other respects. Consequently, we evaluate autocorrelation and heteroskedasticity as it makes the results less efficient. In our model, we are given the presence of heteroscedasticity and autocorrelation, and we correct it with Prais-Winsten regression, correlated panels corrected standard errors (PCSEs) estimators. For dependent variable KAM3 we use Random-effects logistic regression because of the nature of the variable.

We repeat all our previous analyses using an alternative measure of KAM (See Table 4.8). First, we estimated models 1 and 2 by replacing the number of KAM reported with KAM2 that is measured as the number of disclosed key audit matters (as previously counted) for each firm-year observation divided by the average number of KAMs detected in the fiscal year in the audit report. The results are consistent with the reported results for Hypotheses 1 and 2. Secondly, we use KAM3 that it is a dummy variable that equals 1 if the number of key audit matters disclosed for the year is greater than the median of the distribution, and otherwise 0 replacing in model 1 and 2. The results are consistent with our main analyses but provide stronger support for Hypotheses 1 and 2.

Table 4.8. Empirical Models. Robustness test

Variables	KAM2	KAM2	KAM3	KAM3

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	(Model 1)	(Model 2)	(Model 1)	(Model 2)
Auditor (non-big 4 reference)				
<i>Deloitte</i>	-0.025 (0.189)	-	-1.211 (2.192)	-
<i>EY</i>	-0.335* (0.192)	-	-5.112** (2.263)	-
<i>KPMG</i>	-0.313* (0.206)	-	-4.997** (2.349)	-
<i>PwC</i>	-0.435** (0.198)	-	-5.664** (2.365)	-
Switch	-0.028 (0.041)	-	-0.134 (0.455)	-
Lag report	0.084* (0.473)	-	1.032 (0.637)	-
Pages report	0.847*** (0.049)	-	7.081*** (1.151)	-
BoD independent	-	-0.014 (0.001)	-	0.042 (0.012)
BoD meeting	-	0.062 (0.069)	-	0.033 (0.630)
BoD size	-	-0.576*** (0.167)	-	-1.158 (1.366)
AC independent	-	-0.0001 (0.007)	-	-0.006 (0.007)
AC expertise	-	-0.014 (0.061)	-	-0.009 (0.422)
AC meeting	-	0.134* (0.075)	-	1.053* (0.613)
AC size	-	-0.083 (0.155)	-	-0.044 (1.107)
Size	0.279*** (0.0516)	0.302*** (0.887)	2.858*** (0.980)	1.633** (0.661)
Capital ratio	-0.057 (0.010)	-0.018 (0.011)	-0.049 (0.100)	-0.116* (0.061)
PLL	0.006 (0.006)	0.015** (0.070)	0.193* (0.118)	0.181** (0.071)
Efficiency ratio	0.003*** (0.009)	0.003*** (0.001)	0.028* (0.148)	0.017* (0.010)
Liquidity	-0.148*** (0.040)	-0.109 (0.077)	-1.519* (0.779)	-0.793 (0.588)
ROA	0.042 (0.196)	0.011 (0.026)	-0.049 (0.216)	.0006 (0.248)
Sensitive risk	-0.211 (0.610)	-1.135* (0.666)	-6.326 (5.113)	-7.256*** (2.831)
Islamic finance	-0.136*** (0.038)	-0.273*** (0.089)	-0.239 (1.018)	-0.881 (0.678)
Country dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Observations	553	553	553	553
R ² -adjusted	0.543	0.272	-	-

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Wald chi ²	4674.68	1991.34	67.08	79.86
Log likelihood	-	-	-177.512	-256.791
Prob > chi ²	0.000***	0.000***	0.000***	0.000***

Coefficient and Standard errors in parentheses are presented *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
Model 1 and 2: Prais-Winsten regression, correlated panels corrected standard errors (PCSEs).
Model 3: Random-effects logistic regression.

4.5.4 Endogeneity Test

The endogeneity problem is defined as the existence of correlation between the dependent variable and the error term. The first step was to include the dependent variable as an explanatory variable, using the lags of the dependent variable as regressor (Arellano & Bond, 1991; Arellano & Bover, 1995). Thus, we run an analysis to monitor the potential endogeneity effect. As previous studies, we employ the lagged dependent variable approach to confirm that increase or decrease in number of KAMs and ITKAM disclosed by auditors is not determined by previous year (Baatwah et al., 2022; Muñoz-Izquierdo et al., 2023). We use two-step system generalized method of moments (GMM) estimators of KAM. The lag of the dependent variable is our instrumental variable for testing endogeneity. The results are presented in Table 4.9. The evidence shows that endogeneity does not impact on the main findings of this study, as there is a statistically significant relation between KAMs and certain auditors, banks and governance characteristics. These results support our main models' findings.

Table 4.9 Empirical Models. Endogeneity test (Two-step GMM)

Variables	KAM (Model 1)	KAM (Model 2)	ITKAM (Model 3)
KAMlag /ITKAMlag	0.386*** (0.157)	0.498*** (0.016)	0.589*** (0.071)
Auditor (non-big 4 reference)			
<i>Deloitte</i>	-0.930 (1.599)	-	-
<i>EY</i>	-1.638* (1.461)	-	-
<i>KPMG</i>	-2.739* (1.727)	-	-
<i>PwC</i>	-3.658** (1.847)	-	-
Switch	-0.901 (0.825)	-	-

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Lag report	-0.097 (0.693)	-	-
Pages report	2.157* (1.309)	-	-
IT committee	-	-	0.745* (0.416)
BoD independent	-	0.002** (0.001)	-0.005 (0.002)
BoD meeting	-	-0.035 0.057	-0.157 (0.175)
BoD size	-	-0.753*** 0.130	-0.921*** (0.319)
AC independent	-	0.001 (0.001)	-
AC expertise	-	-0.102 (0.069)	-
AC meeting	-	0.168 (0.317)	-
AC size	-	1.278*** (0.341)	-
Size	1.148* (0.199)	0.216 (0.133)	-0.186 (0.411)
Capital ratio	-0.006* (0.202)	-0.037** (0.017)	-0.068*** (0.028)
PLL	0.0019 (0.126)	-0.006 (0.016)	0.113* (0.068)
Efficiency ratio	0.005 (0.002)	0.007** (0.001)	0.020*** (0.006)
Liquidity	-0.853 (0.218)	-0.199 (0.121)	-0.036 (0.445)
ROA	-0.053 (0.616)	0.016 (0.026)	0.067 (0.090)
Sensitive risk	-1.047 (1.182)	-3.244 (1.247)	-1.023 (0.083)
Islamic finance	-0.247* (0.131)	-0.111* (0.117)	-0.121* (0.034)
Country dummies	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Observations	474	474	474
AR (1) (p-value)	-1.69 (0.091)	-4.67 (0.000)	-2.21(0.002)
AR (2) (p-value)	-1.27 (0.427)	-1.90 (0.570)	-1.32 (0.633)
Hansen test (p-value)	7.86 (0.548)	52.59 (0.622)	9.10 (0.704)
Diff-Hansen test (p-value)	4.76 (0.313)	57.60 (0.453)	4.25 (0.236)

Coefficient and Standard errors in parentheses are presented *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

4.6 Conclusions

4.6.1 Summary of Key Findings

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This study investigates the factors influencing the disclosure of KAMs, particularly those related to Information Technology, in the banking sector within Jordan and the GCC countries. The research examines how various characteristics of audit firms, banks, boards of directors, and audit committees impact the extent and nature of KAM disclosures.

The findings reveal that larger banks and those with more complex operations tend to disclose a higher number of KAMs. In addition, the presence of an IT committee and a higher proportion of independent board members are positively associated with the disclosure of IT-related KAMs, underscoring the growing importance of technological governance in the banking sector. This suggests that banks with robust governance mechanisms, particularly those focused on IT risk management, are more likely to provide detailed KAM disclosures, enhancing transparency and trust in financial reporting.

Additionally, the analysis of bank-specific characteristics reveals that banks with larger assets and greater operational complexity are more likely to disclose more KAMs. This result indicates that as the size and complexity of the bank increases, the auditor's professional judgment identifies more significant areas that warrant disclosure, aligning with the expectations of stakeholders who rely on this information.

4.6.2 Theoretical Implications

This study contributes to the existing literature by highlighting the importance of KAM disclosures in enhancing the transparency and informativeness of audit reports. The findings support agency theory, suggesting that increased disclosure, particularly of IT-related KAMs, can reduce information asymmetry between auditors and stakeholders. The positive association between independent board members and IT-related KAM disclosures underscores the role of corporate governance in ensuring comprehensive and reliable financial reporting. Moreover, the study provides empirical evidence supporting the effectiveness of International Standard on Auditing (ISA) 701 in improving audit quality and stakeholder confidence.

4.6.3 Practical Implications

The practical implications of this study are manifold. For auditors, the findings emphasize the need for a thorough understanding of IT risks and the importance of detailed KAM disclosures in audit reports. This can enhance stakeholder trust and confidence in the financial statements. For bank management, especially in the GCC and Jordan, the results highlight the value of having an IT committee and independent board members to ensure effective governance and risk management. Regulatory authorities can use these insights to further refine auditing standards and promote best practices in corporate governance, ultimately contributing to the stability and transparency of the financial sector.

4.6.4 Study's Limitations and Future Research Directions

Despite its contributions, this study has several limitations. Firstly, the focus on banks in Jordan and the GCC countries limits the generalizability of the findings to other regions and industries. Secondly, the study relies on publicly available data, which may not capture all relevant aspects of KAM disclosures and audit practices. Thirdly, the study period (2016-2022) may not fully reflect long-term trends and the evolving nature of audit practices and IT risks. Lastly, the study does not account for potential differences in the interpretation and application of auditing standards across different countries and audit firms.

Future research can address these limitations by expanding the scope to include other regions and industries, thereby enhancing the generalizability of the findings. Longitudinal studies spanning a more extended period could provide deeper insights into the evolving nature of KAM disclosures and audit practices. Additionally, qualitative research methods, such as interviews with auditors and stakeholders, could offer a more nuanced understanding of the factors influencing KAM disclosures. Further research could also explore the impact of specific regulatory changes and technological advancements on audit practices and KAM disclosures, providing valuable insights for policymakers and practitioners.

In conclusion, this study underscores the critical role of KAM disclosures, particularly

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those related to IT, in enhancing the transparency and reliability of audit reports. By identifying the factors associated with the number and nature of KAM disclosures, this research provides valuable insights for auditors, bank management, and regulatory authorities, contributing to the ongoing efforts to improve audit quality and stakeholder confidence in the financial sector.

**CHAPTER FIVE: FINAL CONCLUSIONS AND
IMPLICATIONS**

5.1 Introduction

This final chapter provides a comprehensive synthesis of the research findings, theoretical contributions, and practical implications derived from the investigation into the impact of IT on auditing practices, with a specific focus on Jordan and the GCC region. Considering the growing digitization of audit processes, this study has sought to critically evaluate how emerging technologies—particularly AI, blockchain, and cloud-based systems—are transforming the audit landscape in terms of methodology, regulatory compliance, risk assessment, and disclosure practices.

The integration of IT into auditing has introduced both significant opportunities and considerable challenges, demanding an adaptive response from auditors, regulators, and institutions alike. The research, structured around three core objectives, has offered a multi-dimensional analysis: from a bibliometric assessment of IT-related auditing literature to an empirical examination of AI-driven audit reporting, and finally to an econometric analysis of KAMs in the banking sector. Together, these studies elucidate the multifaceted nature of digital transformation in auditing, particularly within developing economies that are actively navigating the shift towards international regulatory and technological standards.

This chapter begins with a summary of the key findings from each research objective, drawing connections across the chapters to illustrate how the empirical evidence informs broader academic debates and professional practice. It then explores the theoretical and practical implications of the study, highlighting the role of institutional readiness, technological acceptance, auditor capabilities, and ethical governance in shaping IT adoption outcomes. Furthermore, this chapter outlines the limitations inherent in the research and offers recommendations for future investigations that could extend and deepen understanding of the evolving audit landscape.

By concluding the thesis with a focused reflection on the study's contributions and limitations, this chapter reinforces the urgency of aligning technological innovation with robust auditing frameworks. It provides stakeholders, including scholars, practitioners,

regulators, and educators—with critical insights to support the sustainable advancement of IT-integrated auditing, particularly within emerging market contexts. Ultimately, this chapter affirms the importance of proactive engagement with digital technologies in ensuring the relevance, reliability, and accountability of the auditing profession in the digital era.

5.2 Summary of Key Findings

This section synthesizes the principal findings of the thesis, structured around the study's three core research objectives. Each objective reflects a distinct yet interconnected dimension of how IT is transforming the auditing profession, particularly within the context of Jordan and the GCC countries. The study adopts a multi-methodological approach—comprising bibliometric analysis, quantitative modeling, and econometric techniques—to investigate both the theoretical and practical implications of digital transformation in auditing. The following subsections summarize the key insights derived from each research objective, highlighting their academic contributions and practical relevance for audit professionals, regulators, and policymakers in emerging economies.

5.2.1 First Objective

The first objective of the thesis focused on establishing a comprehensive understanding of the state-of-the-art developments in the integration of IT into auditing. Chapter Two provided a bibliometric foundation for this analysis, revealing significant transformations in how auditing is conceptualized, studied, and practiced considering technological advancements—particularly AI, blockchain, and automation. Using bibliometric techniques and science mapping, this study went beyond a traditional literature review by quantifying the structural dynamics of academic contributions, identifying conceptual interlinkages, and visualizing the intellectual progression of the field.

The key findings emphasize a marked shift in the audit profession's research orientation from conventional assurance methods to those grounded in digital infrastructure and algorithmic decision-making. The widespread emergence of IT in auditing is not merely an operational enhancement but represents a profound paradigmatic shift that is reshaping

audit methodologies, professional competencies, and regulatory discourse. The bibliometric evidence underscores how auditing has evolved into a technology-driven function that increasingly intersects with digital ecosystems, where real-time monitoring, automated risk assessment, and data visualization are becoming embedded in standard audit procedures.

Crucially, the findings show that while global discourse on IT in auditing is rapidly expanding, there remains a considerable underrepresentation of empirical insights from developing economies, including Jordan and the GCC countries. This gap reinforces the importance of contextualized research that considers institutional infrastructure, local regulatory frameworks, and region-specific technological readiness. The thesis addressed this void by situating the bibliometric analysis within the broader thesis framework, setting the stage for more focused empirical examinations in subsequent chapters. The results of RO1 thus serve as both a diagnostic tool and a strategic entry point into understanding the foundational forces shaping IT adoption in auditing at a global and regional level.

Moreover, the review demonstrated that the audit profession is entering an era where competencies in AI-driven analytics, blockchain verification, and cybersecurity are as vital as financial reporting knowledge. These raises pressing questions regarding the adequacy of current educational curricula, the preparedness of auditing firms, and the adaptability of regulatory bodies. The analysis also highlighted the shifting expectations placed on auditors, who are increasingly seen as both data interpreters and guardians of digital trust in an environment marked by big data complexity and evolving cybersecurity threats.

5.2.2 Second Objective

The second research objective examined the impact of cloud-based artificial intelligence on audit reporting, with a particular focus on how auditors mediate the integration of AI technologies within audit environments. Using a quantitative approach grounded in structural equation modeling, this chapter analyzed data collected from external auditors in Jordan and provided empirical insights into the mechanisms through which cloud-based

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AI influences audit efficiency, accuracy, and decision-making quality. The findings revealed that while AI significantly enhances technical performance metrics, its effective implementation is fundamentally shaped by auditors' perceptions, organizational readiness, and regulatory clarity.

Central to these findings is the application of the TAM, which illuminated how perceived usefulness and ease of use shape auditors' intention to adopt AI-driven tools. Auditors who viewed AI as enhancing their professional judgment, automating repetitive tasks, and improving fraud detection were more likely to adopt it in their engagements. However, where skepticism existed—due to lack of training, insufficient regulatory guidance, or technological complexity—resistance to adoption emerged. These findings reaffirm the cognitive-behavioral underpinnings of technology acceptance and underscore the importance of fostering digital literacy and trust in AI systems through professional development and supportive infrastructure.

To complement TAM's focus on individual user behavior, the analysis was also informed by Diffusion of Innovations Theory, which offered a broader sociotechnical lens through which to interpret AI adoption. Diffusion of Innovations Theory posits that the diffusion of technology occurs through distinct adopter categories—innovators, early adopters, early majority, late majority, and laggards—each characterized by varying degrees of openness to innovation and risk. Within the Jordanian audit context, the findings suggest that a small group of progressive audit firms and technologically inclined auditors have emerged as early adopters of cloud-based AI. These innovators have begun integrating AI into risk assessments, sampling strategies, and reporting practices. Meanwhile, a more cautious majority remains hesitant, citing lack of regulatory clarity, implementation costs, and concerns over AI's interpretability.

This theoretical interplay between TAM and Diffusion of Innovations Theory reveals that cloud-based AI adoption is not merely a matter of individual intention but is influenced by broader organizational culture, peer influence, and perceived institutional legitimacy. The relative advantage of cloud-based AI—such as real-time data analytics, cost reduction, and

improved audit trail visibility—was recognized, but adoption remained uneven due to uncertainty regarding observability and trialability, two critical attributes identified in Diffusion of Innovations Theory. In other words, while the benefits of AI were conceptually understood, auditors lacked low-risk opportunities to experiment with or observe its practical application within their firms, which impeded widespread diffusion.

Moreover, the study revealed that auditors play a dual role as both beneficiaries and gatekeepers of AI in the audit process. As mediators, auditors interpret and contextualize AI-generated outputs, exercising judgment in areas where machine logic may fall short—such as materiality assessments, ethical evaluations, or industry-specific considerations. This mediating function positions auditors as critical actors in translating technological innovation into professional assurance, but it also increases the demand for updated competencies, ethical safeguards, and clearer governance mechanisms.

5.2.3 Third Objective

The third research objective explored the influence of IT on the disclosure of KAMs in the banking sector of Jordan and the GCC countries. Using a robust econometric design—random-effects Poisson and logistic regression models—this study investigated how various determinants, including auditor characteristics, bank-specific factors, BoD attributes, and AC governance, shape the nature and frequency of KAM disclosures in an increasingly digital audit environment. The findings offer nuanced insights into how IT-enabled audit processes intersect with institutional governance and regulatory frameworks to affect the transparency and communicative value of audit reports in the high-risk, technology-intensive banking sector.

A central contribution of this research lies in its demonstration that IT adoption has not only transformed audit procedures but has also significantly influenced the reporting behavior of auditors, particularly in their articulation of KAMs. The increasing use of AI-driven tools, data analytics, and blockchain-enabled transaction verification has enhanced auditors' ability to identify and communicate material audit issues with greater precision and timeliness. However, the empirical evidence revealed that this potential is mediated by

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organizational and institutional variables. Specifically, audit firms with higher technological readiness and auditors with advanced IT literacy were more likely to report a greater number of KAMs, including those relating to cybersecurity risks, digital asset valuation, and IT governance weaknesses—issues that were traditionally underreported in conventional audits.

Furthermore, the analysis underscored the pivotal role of bank-level governance in influencing the quality of KAM disclosures. Banks with larger boards, independent audit committees, and more technologically skilled directors were associated with more transparent and detailed KAM reporting. This finding reflects the alignment between IT-enhanced audit practices and strong corporate governance structures that facilitate open communication, risk awareness, and accountability. Conversely, weaker governance environments, often marked by lower audit committee independence or limited IT oversight, were linked to more generic and less informative KAM disclosures.

The research also confirmed that auditors' experience and affiliation (e.g., Big 4 vs. non-Big 4) play a significant role in determining the scope and sophistication of KAM reporting. Auditors from larger firms are more likely to leverage IT in risk assessments and, correspondingly, are more transparent in articulating complex audit issues. This highlights the uneven diffusion of digital auditing capabilities across audit firms, with implications for regulatory consistency and the comparability of audit quality in the region.

Crucially, the findings contribute to the literature by demonstrating how the disclosure of KAMs functions not only as a communication mechanism but also as a signal of the auditor's technological capability, professional skepticism, and responsiveness to evolving stakeholder expectations. In this regard, the study intersects with Agency Theory by highlighting how KAM disclosures serve the informational needs of a broader range of users, including regulators, investors, and the public. Particularly in the banking sector highly sensitive to information asymmetry—KAMs related to digital vulnerabilities and system integrity are becoming increasingly material to stakeholder decision-making.

The research also raises critical policy implications. The variation in IT-related KAM disclosures across banks and jurisdictions indicates the need for greater harmonization in guidance on how digital risks and controls should be addressed within audit reports. Regulatory bodies in Jordan and the GCC may benefit from issuing more specific standards or illustrative examples regarding the disclosure of IT-centric audit matters, particularly as banking operations become increasingly digital and cross-border.

5.3 Broader Implications and Contributions

5.3.1 Theoretical Implications

This thesis contributes significantly to the theoretical landscape of auditing and information technology by integrating established models—specifically the TAM and Diffusion of Innovations Theory—to explain the processes underlying the adoption of emerging technologies in auditing. These frameworks are particularly relevant within the context of Jordan and the GCC region, where audit practices are undergoing gradual digital transformation amidst unique regulatory, economic, and institutional conditions.

The TAM, which underpins the overall conceptual approach of this study, offers critical insights into auditors' behavioral intentions to use AI and cloud-based technologies. Although not directly applied in empirical testing, TAM provides a foundational understanding of how perceptions of usefulness and ease of use influence the willingness of auditors to adopt technological innovations. The findings of Chapter Three support the core tenets of TAM: auditors who perceive cloud-based AI tools as enhancing audit accuracy and efficiency demonstrate a stronger inclination to integrate such technologies into their workflows. However, the data also suggests that perceived barriers—such as lack of transparency in AI decision-making or limited digital literacy—undermine these intentions, pointing to the necessity of modifying TAM to account for contextual variables in emerging markets, such as cultural attitudes, regulatory readiness, and training infrastructure.

More substantively, Diffusion of Innovations Theory was explicitly employed in Chapter

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Three to interpret the spread of cloud-based AI within the auditing profession. The theory's categories of adoption—innovators, early adopters, early majority, late majority, and laggards—proved particularly useful in segmenting audit firms based on their technological maturity and openness to innovation. The empirical results reveal that while a segment of audit firms in Jordan shows enthusiasm for AI adoption due to its operational and strategic benefits, others remain hesitant due to cost concerns, regulatory uncertainty, and risk aversion. This confirms that the pace and extent of innovation diffusion in the audit field are uneven and heavily contingent on organizational and environmental conditions. The study thus extends the applicability of Rogers' model by emphasizing that institutional support, regulatory alignment, and auditor education are pivotal diffusion channels in the audit profession within developing economies.

In contrast, Chapter Two, which employed bibliometric methodology, was not grounded in a specific theoretical model but contributed implicitly to theory development by mapping the evolution and conceptual clusters of IT-related auditing research. While no formal theory was applied in Chapter Two, the analysis identified the intellectual structure and thematic emergence of key domains such as blockchain, AI auditing, and real-time analytics. This mapping offers a descriptive foundation upon which future theoretically grounded research can be built.

Finally, Agency Theory further enriches the analysis by examining how IT integration affects the principal-agent relationship between auditors and key stakeholders, particularly in the context of KAMs. Empirical evidence suggests that reliance on advanced IT tools enhances transparency and accountability, especially in high-risk sectors like banking. However, this also raises concerns about the potential dilution of human oversight and the need for redefining accountability frameworks when audit decisions are partially or fully automated.

In conclusion, the theoretical contribution of this study is rooted in its integrative application of multiple theoretical perspectives, whereby TAM and Diffusion of Innovations Theory elucidate the individual and organizational factors influencing IT

adoption. Complementing these, Agency Theory offers insights into the institutional and governance-related dimensions of digital transformation in auditing. Collectively, this multi-theoretical approach establishes a comprehensive analytical framework that enables a nuanced examination of the enablers and challenges associated with the integration of information technology in auditing—particularly within the dynamic and evolving context of emerging economies.

5.3.2 Practical Implications

The findings of this thesis yield significant practical implications for auditors, regulators, policymakers, and audit educators within the context of emerging economies, particularly Jordan and the GCC countries. By investigating the impact of emerging technologies, namely AI, blockchain, and cloud computing—across three interconnected studies, the research provides actionable recommendations for strengthening audit quality, promoting digital transformation, and addressing context-specific barriers to technology adoption.

Firstly, the empirical analysis in Chapter Three, grounded in Diffusion of Innovations Theory, identifies substantial variance in how audit firms adopt cloud-based AI. The practical takeaway is that not all firms are equally equipped or motivated to integrate advanced technologies. Regulators and professional bodies should thus adopt a staggered and differentiated approach to capacity-building, recognizing that “early adopters” may serve as models or training hubs for lagging firms. Policy interventions could include incentives for digital investment, targeted funding for small and medium-sized audit practices, and regulatory sandboxes that allow safe experimentation with AI-powered tools.

Secondly, the study highlights that auditor readiness and training are critical determinants of successful IT integration. Across both Chapter Three and Chapter Four, auditors expressed concerns over interpretability of AI-generated insights, ethical considerations, and regulatory clarity. These findings point to an urgent need for enhanced technical and ethical training within the audit profession. Professional certification programs should include mandatory modules on algorithmic transparency, data governance, and hybrid

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audit techniques that combine AI analytics with professional judgment. Universities and continuing education programs must also modernize their curricula to prepare future auditors for a technologically augmented environment.

Thirdly, regulatory authorities must respond to the challenges of AI- and blockchain-enabled auditing by developing or updating frameworks that address the evolving nature of auditory evidence, auditor responsibility, and data privacy. Findings from Chapter Four, which examined KAMs in the banking sector, underscore the importance of regulatory clarity in ensuring consistency and transparency in IT-related audit disclosures. Policymakers in Jordan and the GCC should align national auditing standards with international best practices while accommodating local legal and cultural contexts. This includes clarifying auditors' obligations when using AI-based risk models and ensuring that blockchain-verified data meets sufficiency criteria.

Fourthly, for audit firms and technology developers, the thesis underscores the importance of user-centered system design. The research indicates that perceived complexity remains a major barrier to adoption, particularly among less digitally mature firms. Therefore, audit software must prioritize usability, explainability, and modular integration into existing workflows. Developers should collaborate with practitioners in co-design processes that ensure tools are not only technically advanced but also practically adaptable to diverse audit settings.

Fifthly, real-time auditing and continuous monitoring, discussed in the context of AI capabilities in Chapter Three, present an opportunity to shift from reactive to proactive audit methodologies. These demands rethinking traditional audit cycles and investing in cloud-based infrastructure that supports secure, continuous data flows. Such infrastructure not only improves operational efficiency but also enhances fraud detection and regulatory compliance in sectors with high transaction volumes, such as banking—further elaborated in Chapter Four.

Finally, although Chapter Two did not employ a formal theoretical model, its bibliometric

analysis provides practical value by mapping intellectual trends and identifying gaps in global research. For practitioners and researchers alike, this mapping highlights underexplored intersections between auditing and technologies such as blockchain, suggesting directions for future inquiry and innovation.

In sum, the practical implications of this study emphasize that digital transformation in auditing is not a purely technical matter—it is also strategic, regulatory, and educational. Effective implementation of IT in audit practice requires systemic alignment across policy, infrastructure, auditor training, and software development. The recommendations outlined here are particularly vital for emerging economies like Jordan and the GCC region, where the pace of digital audit adoption must be accelerated without compromising audit integrity, ethical standards, or stakeholder trust.

5.4 Limitations of the Study

Despite the comprehensive scope and methodological rigor adopted in this thesis, certain limitations should be acknowledged to contextualize the findings and their applicability. First and foremost, the research is geographically constrained to Jordan and the GCC countries. While this regional focus provides valuable insights into the unique challenges and opportunities associated with IT adoption in auditing within emerging economies, the results may not be generalized to other regions with different regulatory, technological, or institutional frameworks.

Secondly, the reliance on bibliometric analysis in Chapter Two, while effective in mapping the intellectual structure of the literature, is inherently limited by its dependence on the selected database (Web of Science). Consequently, relevant publications indexed elsewhere or in grey literature may have been omitted, potentially biasing the representation of global trends and key contributors.

The quantitative survey in Chapter Three also presents several limitations. The study employed a structured questionnaire administered to Jordanian auditors to investigate the influence of cloud-based artificial intelligence on audit reports. Although the sample size

was statistically adequate, the self-reported nature of survey responses may introduce response bias, particularly in areas concerning the perceived usefulness and ease of use of AI technologies.

In Chapter Four, while the econometric models employed, namely, random-effects Poisson and logistic regressions, provided robust insights into the determinants of KAM disclosures in the banking sector, the models may be affected by omitted variable bias. Certain qualitative factors, such as institutional culture, audit firm reputation, or internal risk management protocols, were not captured due to data unavailability. In addition, while the inclusion of both Jordanian and GCC banks enriches the analysis, variability in data quality and disclosure practices across countries could influence the consistency and comparability of results.

Lastly, the theoretical framework utilized—while comprehensive in integrating the TAM, Diffusion of Innovations Theory, and Agency Theory—may benefit from supplementary lenses such as Institutional Theory or Stakeholder Theory to capture additional dimensions of organizational behavior in technology adoption.

These limitations provide an important context for interpreting the findings and underscore the need for cautious extrapolation. Nonetheless, they also serve as avenues for future research to address and build upon.

5.5 Recommendations for Future Research

Considering the limitations identified and the findings obtained, several directions for future research are proposed. First, expanding the geographical scope beyond Jordan and the GCC to include other developing and developed economies could provide comparative insights into how different institutional environments mediate the adoption of information technology in auditing. Such cross-country studies would enhance the generalizability of results and contribute to a global understanding of digital transformation in the audit profession.

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Secondly, future bibliometric analyses could incorporate additional databases such as Scopus, Google Scholar, and Dimensions to provide a more holistic and inclusive mapping of the literature. A meta-analysis of empirical findings could also be conducted to synthesize and quantify the effects of specific IT tools—such as blockchain or robotic process automation—on audit outcomes.

From a methodological standpoint, longitudinal studies tracking the evolution of auditors' perceptions and practices regarding IT adoption would be valuable. Such studies would capture dynamic changes in attitudes, skill development, and regulatory responses over time, offering a deeper understanding of the diffusion process as theorized by Rogers.

In the context of Chapter Three, future research could extend the quantitative model to incorporate structural or contextual moderators, such as firm size, IT maturity, or industry type, to better understand the conditions under which AI technologies yield the greatest audit benefits. Additionally, qualitative case studies could complement the quantitative findings by exploring the lived experiences of auditors using AI systems, revealing insights into human-machine interaction, trust in automation, and ethical dilemmas.

Regarding Chapter Four, future research could explore the content and tone of KAM disclosures using textual analysis or machine learning techniques to assess how IT-related risks are communicated. Furthermore, research could examine the influence of regulatory interventions or changes in audit standards on KAM reporting behavior in digitally advanced versus digitally lagging banks.

Lastly, there is scope for further theoretical refinement in IT-auditing research. Incorporating interdisciplinary frameworks from behavioral economics, sociology, or strategic management could yield novel insights into how auditors, firms, and regulators co-evolve in response to technological change. Additionally, the integration of sustainability reporting and environmental audit practices, especially as digital tools enable more real-time, granular, and traceable disclosures—represents an emerging frontier for future studies.

5.6 Conclusion

This thesis has examined the transformative impact of information technology on auditing practices in Jordan and the GCC region through a multi-method research design spanning bibliometric, quantitative, and econometric analyses. The findings underscore those technologies such as artificial intelligence, blockchain, and cloud computing are not merely ancillary tools but fundamental catalysts reshaping audit quality, efficiency, and transparency.

Through bibliometric analysis, the study identified global research trends and intellectual foundations in IT-auditing scholarship, revealing an increasingly interdisciplinary and technology-driven landscape. The empirical findings from the survey of Jordanian auditors confirmed the pivotal role of cloud-based AI in enhancing audit decision-making and reducing manual effort, mediated by the auditor's competence and perception of AI utility. The econometric analysis of KAM disclosures in the banking sector further illuminated how IT adoption intersects with audit governance structures and sector-specific risk dynamics.

Theoretically, the integration of TAM, Diffusion of Innovations, and Agency Theory provided a holistic lens to interpret the interplay between technological adoption, human behavior, and institutional accountability. Practically, the study offers a roadmap for audit firms, regulators, and policymakers aiming to modernize audit practices in emerging economies. It highlights the importance of investing in auditor training, ensuring regulatory clarity, and adopting robust cybersecurity and ethical AI practices.

In conclusion, while IT adoption in auditing presents several challenges—ranging from data security to algorithmic bias—it also offers unparalleled opportunities to elevate the relevance and reliability of audit services in the digital age. This research contributes to a growing body of literature that seeks to align audit practice with the realities of a data-intensive, technology-driven financial environment. As auditing continues to evolve, the findings and recommendations of this thesis are intended to serve as both a scholarly

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contribution and a practical guide for navigating the complexities of IT-enabled assurance in the 21st century.

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