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Investigating the Extent and Impact of AI Applications on Audit Firms Performance in Saudi Arabia

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Abstract

This study investigates the extent and impact of AI applications on audit firm performance in Saudi Arabia, focusing on operational efficiency and audit quality in the context of Vision 2030's digital transformation agenda. Data were collected from 35 audit firms through a structured questionnaire targeting senior auditors and managers, using a two-part survey that included demographic data and variables related to AI adoption, operational efficiency, and audit quality. Descriptive statistics and regression analysis were employed to assess AI adoption levels and examine its effects. The findings reveal that AI adoption among Saudi audit firms is in its early stages, with significant variability based on firm size and technological readiness. AI positively impacts operational efficiency through task automation and predictive insights, reducing manual effort and enhancing productivity. Additionally, AI improves audit quality by reducing errors and increasing consistency. However, the results emphasize that AI's benefits are contingent on strategic integration, proper implementation, and effective training. This research provides valuable insights for audit firms and policymakers, highlighting the transformative potential of AI in modernizing the auditing landscape and achieving Vision 2030 objectives.

Keywords: *SDG, Artificial Intelligence, Audit, Firm Performance, Decent Work and Economic Growth, Vision 2030.*

Introduction

The global auditing landscape is currently experiencing a paradigm shift driven by rapid technological advancements. Artificial Intelligence (AI) has emerged as one of the most transformative technologies, promising to reshape how audits are conducted and offering new possibilities for operational efficiency, data analysis, and decision-making (Kemuma Ondeyo, 2023). Unlike traditional auditing methods that rely heavily on human judgment and manual processes, AI applications offer automation, precision, and speed (Javaid et al., 2022). AI technologies in auditing can perform tasks such as data extraction, anomaly detection, and risk assessment with greater accuracy and at a fraction of the time. Consequently, AI is not only transforming operational efficiency but also enhancing the quality and reliability of audits, which is paramount for maintaining trust in financial reporting (Antwi et al., 2024).

In Saudi Arabia, AI adoption across sectors is gaining momentum as the Kingdom pursues its ambitious Vision 2030 agenda. Vision 2030 is a comprehensive strategy aimed at diversifying Saudi Arabia's economy, reducing its dependency on oil, and promoting sectors like finance, healthcare, and tourism (AlNemer, 2024). A key component of this vision is digital transformation, which includes leveraging cutting-edge technologies like AI, Big Data, and the Internet of Things (IoT) to create a knowledge-based economy. Within this broader digital landscape, the audit sector has an essential role to play. By integrating AI technologies, audit firms can provide more transparent, efficient, and high-quality financial audits, which aligns with Vision 2030's objectives of building a robust and transparent economy that attracts both local and international investment.

However, while the potential benefits of AI in auditing are clear, the extent of AI adoption within audit firms in Saudi Arabia and its specific impacts on operational efficiency and audit quality remain underexplored. This research seeks to fill this gap by addressing two primary objectives: to assess the extent of AI adoption within audit firms in Saudi Arabia, and to analyse the impact of AI applications on the operational efficiency and audit quality of these firms.

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The Context of AI in Auditing

The application of AI in auditing represents a significant departure from traditional methods. In conventional audits, auditors manually sift through vast volumes of financial data, perform routine calculations, and apply sample testing to make inferences about an organization's financial health (Odhiambo, 2022). While effective, these methods are often time-consuming, labour-intensive, and susceptible to human error. In contrast, AI systems can process and analyse large datasets at high speed, identifying patterns, anomalies, and risks that might be missed by human auditors (Aitkazinov, 2023). Machine learning algorithms, for instance, can detect irregularities and fraudulent activities with greater accuracy, allowing audit firms to deliver higher-quality audits and reduce the likelihood of oversight (Mitan, 2024).

AI applications can also enable predictive analytics, helping auditors forecast potential risks and advising clients on preventive actions. By analyzing historical data and identifying trends, AI-driven tools can provide insights into a company's future financial performance, making audits more forward-looking rather than solely retrospective (Jejeniwa et al., 2024). Additionally, AI can support continuous auditing, where data is monitored in real time, enabling audit firms to offer ongoing assurance rather than annual or quarterly reviews (Blessing, 2024). This shift is particularly relevant in an era where financial scandals and fraud can rapidly erode public trust and damage reputations.

Importance of AI Adoption in the Saudi Arabian Auditing Sector

As Saudi Arabia seeks to attract foreign investment and diversify its economy, the integrity of its financial and regulatory systems becomes paramount (Almutairi et al, 2024). Investors and stakeholders demand transparency, reliability, and efficiency in financial reporting, which requires a high standard of auditing practices (Fung, 2014). AI, with its ability to enhance audit quality and efficiency, aligns directly with these demands. Audit firms that adopt AI are better equipped to provide comprehensive, high-quality audits, thereby fostering trust in the financial system and encouraging investment (Roszkowska, 2021).

Furthermore, AI adoption in auditing contributes to the broader goals of Saudi Vision 2030. Vision 2030 underscores the need to modernize the Kingdom's infrastructure and reduce its reliance on oil by cultivating a diversified, technology-driven economy. By adopting AI, audit firms can strengthen the financial sector's foundation, ensuring that it operates with integrity and efficiency. This digital transformation supports Vision 2030's objectives in several ways:

- *Building a Robust Digital Economy*: Vision 2030 aims to position Saudi Arabia as a regional leader in digital innovation. AI-driven auditing practices can serve as a benchmark for other industries, demonstrating how technology can enhance operational performance and build a knowledge-based economy.

- *Increasing Transparency and Accountability*: The government's emphasis on accountability aligns with the objectives of high-quality audits. By adopting AI, audit firms can provide more accurate and transparent assessments, which is crucial for maintaining investor confidence and promoting a culture of transparency within the Kingdom.

- *Enhancing Economic Diversification*: As Saudi Arabia moves towards economic diversification, it must develop strong institutions capable of supporting a complex, multi-sector economy. High-quality audits, enabled by AI, contribute to a stable financial environment, which is essential for attracting investments in non-oil sectors such as tourism, healthcare, and technology.

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Scope of the Study

This study aims to investigate two fundamental aspects of AI adoption in Saudi Arabia's audit sector. The first objective is to assess the extent of AI adoption within audit firms. This involves exploring the current status of AI applications in the auditing field, identifying the types of AI technologies commonly used, and examining the factors influencing AI adoption within the sector. Understanding these factors is crucial, as they shed light on the challenges and opportunities that Saudi audit firms face in integrating AI.

The second objective of this research is to analyse the impact of AI applications on the operational efficiency and audit quality of these firms. Operational efficiency refers to the extent to which AI can streamline and automate auditing processes, allowing firms to save time, reduce costs, and increase productivity. Audit quality, on the other hand, relates to the accuracy, reliability, and thoroughness of the audit process. By examining these aspects, the study aims to provide insights into how AI adoption affects overall audit firm performance and whether it enables firms to meet the high standards expected in today's dynamic financial environment.

By exploring the extent of AI adoption and analysing its impact on operational efficiency and audit quality, this research contributes valuable insights into the potential of AI to transform auditing practices. The study also underscores the relevance of AI adoption in achieving Saudi Vision 2030's objectives, particularly in building a diversified economy, enhancing transparency, and fostering digital innovation.

As AI continues to evolve and new applications emerge, the findings of this research will remain relevant for audit firms, policymakers, and researchers interested in the intersection of technology and finance. This study ultimately serves as a foundation for understanding AI's role in the Saudi auditing sector and sets the stage for future research on AI's broader impact across various industries in Saudi Arabia and beyond.

Review of Literature

The integration of Artificial Intelligence (AI) within audit practices is a relatively recent development, but its potential to transform the auditing profession has generated significant interest among academics and practitioners. This literature review examines the body of work surrounding AI adoption in auditing, focusing on three major themes: (1) AI adoption in audit firms, (2) impact of AI on operational efficiency, and (3) impact of AI on audit quality. Additionally, this review considers literature on AI's challenges and benefits within the context of Saudi Arabia, particularly as they relate to Saudi Vision 2030.

AI Adoption in Auditing

AI adoption in the auditing field has been widely recognized as a response to growing complexities in financial data and reporting standards (Estep et al., 2024). Many scholars have examined the factors influencing AI adoption, particularly in regulated sectors like finance and auditing. According to (Barr-Pulliam et al., 2022) the digital transformation in auditing, driven by AI and data analytics, represents a shift from traditional audit practices to more automated, data-driven processes. He also argues that the adoption of AI allows audit firms to automate repetitive tasks and enables auditors to focus on complex, judgment-based activities, thus enhancing the profession's value.

Further, (Fedyk et al., 2022) identify cost reduction, enhanced efficiency, and improved audit quality as major drivers for AI adoption in audit firms. Their study reveals that large audit firms are more likely to adopt AI technologies due to their financial capacity and access to resources required for technology implementation (Vitali & Giuliani, 2024). Smaller firms, however, often face budget constraints and are therefore slower to adopt AI. This disparity suggests that firm size and resource availability play a critical role in the extent of AI adoption within the auditing industry.

More specifically, (Cao et al., 2021) argue that AI adoption in audit firms is primarily influenced by the type of clients served and the complexity of audits. For instance, firms dealing with large multinational clients are more inclined to adopt AI-driven audit tools to manage vast amounts of data and address complex

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accounting structures. This point is especially relevant in the context of Saudi Arabia, where audit firms serve clients across diverse sectors, from oil and gas to banking, each with unique data challenges and compliance requirements.

Impact of AI on Operational Efficiency in Auditing

Operational efficiency is one of the primary reasons for adopting AI in auditing, as automation of repetitive tasks allows auditors to focus on higher-level analysis and judgment-based tasks. Research by (Chirra, 2021) emphasizes that AI-driven tools in auditing help reduce the time spent on data entry, data validation, and compliance checks, which traditionally require significant human resources. By automating these processes, firms can increase productivity, cut down on operational costs, and allocate resources to areas that add more value to their clients. Another research by (Othman, 2012) revealed that there is significant positive effect of using AI expert systems on efficiency and effectiveness of various auditing activities, such as risk assessment, assessing clients internal control systems, audit planning, preparing audit programs and writing auditing reports.

Similarly, (Chowdhury et al., 2023) argue that AI technologies can transform operational efficiency by augmenting human capabilities. Their study suggests that while AI may not fully replace human auditors, it significantly enhances their productivity by enabling quicker data processing, pattern recognition, and anomaly detection. This view is supported by (Alles & Gray, 2020), who describe AI as a tool for enhancing, rather than replacing, human auditors, noting that operational efficiency is maximized when AI and human expertise work in tandem.

In the Saudi Arabian context, research by (Abdullah & Almaqtari, 2023) highlights the operational efficiencies gained by audit firms that have adopted AI tools. According to their study, AI has enabled Saudi firms to enhance their auditing processes by reducing manual workload, thereby freeing up resources to focus on client-specific risk analysis and recommendations. This efficiency is critical for Saudi firms aiming to align with Vision 2030, as increased efficiency supports competitiveness in a global market. The researchers note that Saudi firms, particularly those working with international clients, are increasingly reliant on AI to maintain high standards of operational performance and meet the expectations of global stakeholders.

Impact of AI on Audit Quality

One of the most significant promises of AI in auditing is its potential to enhance audit quality by improving accuracy, consistency, and reliability. The use of AI tools in audit processes has been shown to increase the quality of audits by reducing the likelihood of errors and enhancing the auditor's ability to detect anomalies and fraud (Fedyk et al., 2022). (Peng et al., 2023) argue that AI-powered tools enable auditors to perform deeper analyses of financial data, providing insights that might be overlooked in traditional audits. The authors emphasize that AI enhances an auditor's capacity to analyze large datasets, identify red flags, and ensure compliance with regulatory standards, thereby improving audit quality.

In addition, (Munoko et al., 2020) highlights that AI enhances audit quality by enabling real-time data analysis and continuous monitoring, which are not feasible with manual audits. Continuous auditing, enabled by AI, allows firms to provide ongoing assurance rather than relying solely on periodic reviews. This real-time approach is especially valuable in sectors with high transaction volumes, as it enables auditors to identify issues as they occur and advise clients on corrective actions, thereby reducing the risk of material misstatements.

(Murikah et al., 2024) provide a comprehensive framework for understanding how AI impacts audit quality, proposing that AI improves not only accuracy but also the consistency of audit outcomes. The authors argue that AI reduces auditor bias by standardizing audit procedures, making it easier to replicate audit processes across clients and industries. This standardization is particularly relevant for audit firms in Saudi Arabia, where consistency in quality is essential for maintaining the trust of both local and international clients.

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(Musa, 2024) examine the impact of AI on audit quality within Saudi firms, focusing on its role in risk assessment and fraud detection. Their findings indicate that AI adoption has enabled Saudi audit firms to improve the accuracy of their audits, particularly in high-risk areas. The authors highlight that AI-powered analytics tools allow auditors to analyse vast amounts of data for patterns indicative of fraud, making it easier to detect irregularities that may otherwise go unnoticed. This enhanced quality aligns with the objectives of Saudi Vision 2030, which calls for greater transparency and accountability in financial practices.

AI in Auditing and Saudi Vision 2030

The alignment of AI adoption in auditing with Saudi Vision 2030 is an emerging area of interest among researchers. (Mgammal, 2024) discuss how AI adoption in Saudi audit firms supports Vision 2030's objectives of economic diversification, transparency, and efficiency. They argue that by adopting AI, audit firms contribute to a more transparent financial sector, which is crucial for attracting foreign investment and fostering a diversified economy.

Moreover, (Bendary & Rajadurai, 2024) suggest that AI in auditing can strengthen Saudi Arabia's global competitiveness, a central goal of Vision 2030. Their study highlights how the enhanced audit quality and operational efficiency provided by AI allow Saudi firms to meet international standards, making them more attractive to multinational clients. The researchers conclude that AI adoption in auditing is not only beneficial for the firms themselves but also for the broader Saudi economy as it moves towards a diversified, knowledge-based model.

Research Gap and Hypothesis Development

Based on the current literature, a research gap exists regarding the specific extent of AI adoption in Saudi Arabian audit firms and its measurable impact on operational efficiency and audit quality, particularly within the unique regulatory and economic environment shaped by Saudi Vision 2030. This study addresses these gaps through the following hypotheses:

H_1: There is a variation in the level of AI adoption in Saudi Arabian audit firms.

H_2: AI applications positively impact the operational efficiency of audit firms in Saudi Arabia.

H_3: AI applications positively enhance the audit quality of firms in Saudi Arabia.

The conceptual model shown in Figure 1 was built considering the hypotheses developed.

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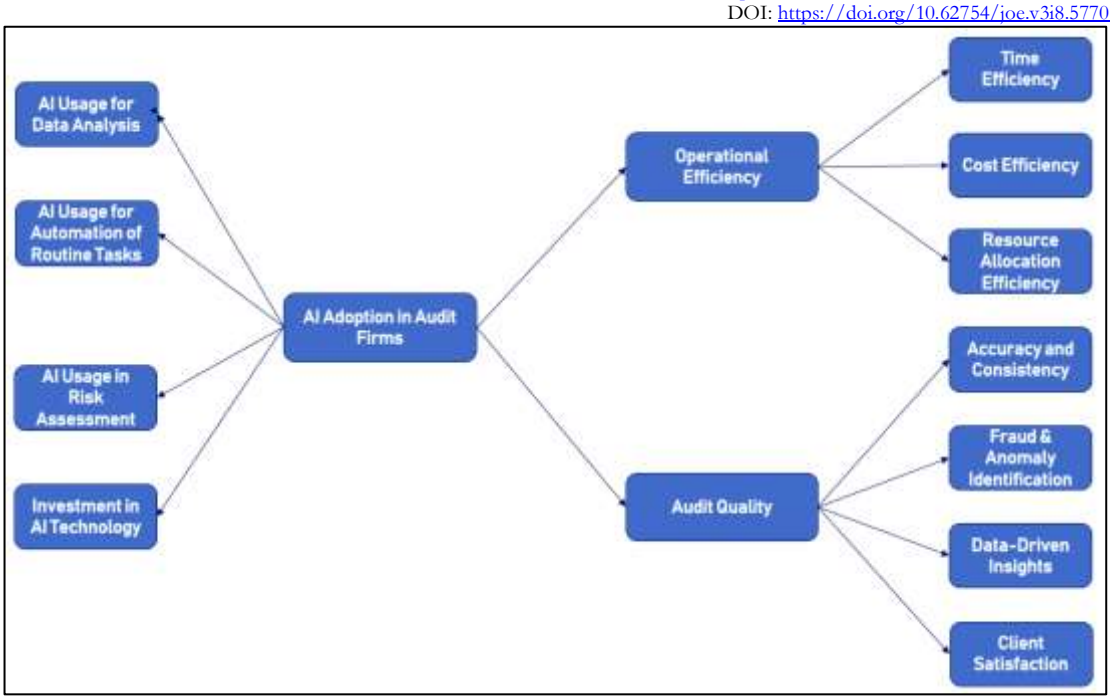

Figure 1. Conceptual Framework (Author Designed)

Research Methodology

Participants and Data Collection

The study population comprises 38 audit firms (Figure 2- The Approved Audit Firms By LCGPA (Local Content & Government Procurement Authority)) in Saudi Arabia. Using Slovin's formula with a 5% margin of error, the minimum required sample size was determined to be 35 audit firms. This quantitative data collection strategy involves a two-part questionnaire utilizing a 5-point Likert-type scale (1 = strongly disagree; 5 = strongly agree). The first part captures respondents' demographic information, including gender, years of experience, firm size, and location. The second part focuses on gathering information related to the research variables, specifically AI adoption, operational efficiency, and audit quality.

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Figure 2. The Approved Audit Firms By LCGPA

(Retrieved from https://www.lcgpa.gov.sa/en/LocalContent/Documents/Data%20of%20Approved%20audit%20offices.pdf)

Data were collected through online surveys targeting senior auditors and managers within these audit firms, given their critical role in implementing and overseeing AI applications within their organizations. The study adopts the audit firm as its unit of analysis, recognizing its significance as a primary implementer of technology-driven innovation in the auditing industry. Consequently, senior auditors and managers serve as the observation unit, reflecting their pivotal role in evaluating and integrating AI technologies at the firm level. This approach aligns with practices in audit research. For instance, studies by (Kamaludin & / , 2020) focused on firm-level managers to explore technology adoption, while (Afshan et al., 2023) examined leadership within auditing firms regarding digital transformation. Similarly, (Al-Shari & Lokhande, 2023) utilized senior management as a data source to study fintech adoption's impact on firm performance. By collecting primary data directly from senior auditors and managers, this study ensures data authenticity and relevance to the unit of analysis, providing valuable insights into AI adoption and its effects on audit firm performance in Saudi Arabia.

Data Analysis

For this study, data analysis involves addressing three specific objectives using a structured approach. Initially, reliability testing will be conducted on the survey instrument to ensure internal consistency of the variables through Cronbach's Alpha using SPSS. This will validate the dependability of the data collected for further analysis.

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For the first objective, assessing the level of AI adoption in Saudi Arabian audit firms, descriptive statistics will be employed using SPSS. Measures such as means, standard deviations, and frequency distributions will be analysed to provide a clear understanding of adoption levels and variations based on firm-specific factors.

To address the second objective, exploring the impact of AI applications on operational efficiency, and the third objective, examining their influence on audit quality, regression analysis will be conducted using Smart PLS. The tool's ability to handle complex models makes it ideal for testing relationships and analyzing the structural paths between AI adoption, operational efficiency, and audit quality. This integrated methodology ensures a comprehensive examination of AI's role in Saudi Arabian audit firms.

Measurement of Variables

This research employs a comprehensive model encompassing three variables, operationalized through 11 dimensions and 33 indicators. This research employs a comprehensive model encompassing three key variables operationalized through a systematic framework of dimensions and indicators derived from established literature. The variable AI Adoption Level in Audit Firms is measured using dimensions and indicators informed by (Pandey & Rai, 2020), Rahman et al. (2024), Yang et al. (2021), (Seethamraju & Hecimovic, 2023), (Yang, 2022) and (Fedyk et al., 2022), providing a robust basis for evaluating firm-level adoption. Similarly, the variable Impact of AI on Operational Efficiency draws upon dimensions and indicators developed by (Rahman et al, 2024; Almaqtari et al., 2024; Almaqatri, 2024), emphasizing AI's role in enhancing efficiency through predictive upkeep and operational optimization.

For Impact of AI on Audit Quality, dimensions and indicators are adapted from (Rahman et al, 2024; Albawwat & Frijat, 2021; Qatawneh, 2024; Chen & Yang, 2024; Svanberg & Ohman, 2015), focusing on AI's ability to improve accuracy, decision-making, and compliance in audits. This meticulous approach to variable selection and operationalization ensures the study's validity, reliability, and alignment with prior research, contributing to a replicable and impactful analysis.

Analysis and Results

The data collected from all the firms was entered to excel and analysis was run on MS-Excel, SPSS and Smart PLS to achieve the objectives mentioned in the previous section. Each of the detailed analysis and interpretation has been described in the upcoming sub sections.

Descriptive Statistics

The data was collected from 38 audit firms through a structured questionnaire which was categorised into different sub sections. Section A consisted of demographic profile of the respondents. The analysis of the demographic profile is shown in the upcoming table, Table 1.

Age			
		Frequency	Percent
Valid	2.0	16	42.1
	3.0	21	55.3
	4.0	1	2.6
	Total	38	100.0
Gender			
		Frequency	Percent
Valid	1.0	10	26.3
	2.0	22	57.9
	3.0	6	15.8
	Total	38	100.0

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Experience			Position			
		Frequency			Frequency	Percent
Valid	1.0	9	Valid	1.0	6	15.8
	2.0	6		2.0	11	28.9
	3.0	8		3.0	8	21.1
	4.0	15		4.0	13	34.2
	Total	38		Total	38	100.0

Size			
		Frequency	Percent
Valid	1.0	11	28.9
	2.0	16	42.1
	3.0	11	28.9
	Total	38	100.0

Table 1. Demographic Profile of the Respondents

The demographic profile of the respondents provides key insights into their background. Regarding gender, the majority (57.9%) of respondents identified as female, while male respondents accounted for 26.3%. A smaller group (15.8%) preferred not to disclose their gender.

In terms of age, the largest group (55.3%) fell within the 31-40 years category, followed by 42.1% in the 20-30 years age group. Only 2.6% of respondents were aged 41-50 years, with no respondents above 50 years.

For years of experience in the auditing field, 39.5% of respondents reported having more than 15 years of experience, making them the most experienced group. This was followed by 23.7% with less than 5 years, 21.1% with 11-15 years, and 15.8% with 5-10 years of experience.

Regarding position in the firm, the largest group (34.2%) comprised Partners/Directors, followed by 28.9% who were Senior Auditors, 21.1% in Managerial roles, and 15.8% as Junior Auditors.

Finally, for the size of the audit firm, medium-sized firms (11-50 employees) represented 42.1% of respondents. Small firms (1-10 employees) and large firms (51+ employees) both accounted for 28.9% each.

This analysis reflects a diverse distribution across gender, age, experience, position, and firm size, providing a balanced perspective for the study.

Objective 1: To Find the Variation Level of AI Adoption in Saudi Arabian Audit Firms.

To achieve the stated objective, the technology adoption scale proposed by Pandey and Rai (2020) was utilized. The analysis was conducted in MS-Excel to calculate the mean scores for each of the 38 firms. Mean scores of 1 and 2 indicated that companies are at the acceptance level of AI adoption. Mean scores of 3 and 4 signified that companies have reached the full-scale usage level of AI adoption. Finally, a mean score of 5 represented that companies are at the embracement level, demonstrating complete integration of AI into their operations.

Audit Firm	**Mean Score**	**Level of AI Adoption**
Audit Firm 1	4	Full Scale Usage
Audit Firm 2	2	Acceptance Level

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Audit Firm 3	5	Embracement
Audit Firm 4	2	Acceptance Level
Audit Firm 5	1	Acceptance Level
Audit Firm 6	2	Acceptance Level
Audit Firm 7	1	Acceptance Level
Audit Firm 8	4	Full Scale Usage
Audit Firm 9	4	Full Scale Usage
Audit Firm 10	2	Acceptance Level
Audit Firm 11	2	Acceptance Level
Audit Firm 12	4	Full Scale Usage
Audit Firm 13	3	Full Scale Usage
Audit Firm 14	2	Acceptance Level
Audit Firm 15	5	Embracement
Audit Firm 16	4	Full Scale Usage
Audit Firm 17	5	Embracement
Audit Firm 18	3	Full Scale Usage
Audit Firm 19	2	Acceptance Level
Audit Firm 20	2	Acceptance Level
Audit Firm 21	4	Full Scale Usage
Audit Firm 22	4	Full Scale Usage
Audit Firm 23	2	Acceptance Level
Audit Firm 24	4	Full Scale Usage
Audit Firm 25	2	Acceptance Level
Audit Firm 26	4	Full Scale Usage
Audit Firm 27	3	Full Scale Usage
Audit Firm 28	2	Acceptance Level
Audit Firm 29	4	Full Scale Usage
Audit Firm 30	5	Embracement
Audit Firm 31	4	Full Scale Usage
Audit Firm 32	2	Acceptance Level
Audit Firm 33	3	Full Scale Usage
Audit Firm 34	5	Embracement
Audit Firm 35	5	Embracement
Audit Firm 36	5	Embracement
Audit Firm 37	4	Full Scale Usage
Audit Firm 38	4	Full Scale Usage

Table 2. Individual Audit Firm AI Adoption Level

From the data presented in *Table 2*, it is clear that AI adoption levels vary across different audit firms in Saudi Arabia. The table highlights a mix of firms with varying degrees of AI integration, ranging from minimal use to advanced implementations. To provide a more concise and structured view, the data has been consolidated into a summary representation in *Table 3*, categorizing firms based on their AI usage

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levels and operational emphasis. This consolidated format enables a clearer understanding of the AI adoption trends within the audit sector in Saudi Arabia.

AI Adoption Level	**Number of Firms**
Acceptance Level	14
Embracement	7
Full Scale Usage	17

Table 3. AI Adoption Level

From the above table, it is evident that the majority of audit firms, approximately 14, have reached the acceptance level of AI usage within their operations. Additionally, 17 firms have progressed to the full-scale usage of AI, integrating it extensively into their audit processes. However, only a limited number, around 7 firms, have fully embraced AI adoption, leveraging it comprehensively across all facets of their auditing practices. This distribution highlights the varying degrees of AI adoption among audit firms in Saudi Arabia, reflecting the sector's gradual transition toward advanced technological integration.

Objective 2: To evaluate the impact of AI applications on operational efficiency of audit firms in Saudi Arabia.

To achieve the above objective, scale was adopted from the study of (Fedyk et al., 2022; Munoko et al, 2020; Oluyombo et al., 2024; Law & Shen, 2024) for AI adoption level and (Rahman et al, 2024; Almaqtari et al., 2024; Almaqatri, 2024) for impact of AI on operational efficiency.

To evaluate the impact of AI applications on operational efficiency of audit firms, regression analysis was applied on Smart PLS software and the results obtained are discussed in the following part. The regression analysis evaluates the influence of AI applications on the operational efficiency of audit firms in Saudi Arabia. The results highlight distinct patterns of significance and impact across different AI dimensions.

	Unstandardized coefficients	**Standardized coefficients**	**SE**	**T value**	**P value**	**2.50%**	**97.50%**
Investment in AI Technology	-0.154	-0.153	0.148	1.04	0.306	-0.455	0.147
AI Usage in Risk Assessment	0.502	0.563	0.12	4.194	0	0.259	0.745
AI Usage for Data Analysis	0.018	0.02	0.163	0.109	0.914	-0.313	0.348
AI Usage for Automation of Routine Tasks	0.465	0.509	0.177	2.626	0.013	0.105	0.825

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Intercept	0.503	0	0.272	1.854	0.072	-0.048	1.055

Table 4. Summary Coefficients

The Summary coefficients table (Table 4) highlights important observations from the data collected. Investment in AI Technology shows a negative unstandardized coefficient (-0.154), indicating a potential inverse relationship with operational efficiency. However, the high p-value (0.306) demonstrates that this effect is statistically insignificant. This suggests that merely investing in AI technology may not translate into efficiency gains unless accompanied by effective implementation strategies or organizational readiness. AI Usage in Risk Assessment has a positive and statistically significant impact on operational efficiency (Wong et al., 2024), with an unstandardized coefficient of 0.502 and a p-value of 0.000. The standardized coefficient (0.563) further highlights its strong relative importance. This underscores the critical role of AI in enhancing risk assessment processes by identifying potential issues with greater accuracy and speed, thereby significantly improving operational outcomes.

AI Usage for Data Analysis yields an unstandardized coefficient of 0.018, indicating a negligible positive impact. However, its high p-value (0.914) suggests statistical insignificance. This implies that, while data analysis is essential, AI's contribution in this area may not yet be fully optimized or sufficiently integrated into audit processes to drive measurable efficiency improvements. AI Usage for Automation of Routine Tasks demonstrates a positive and statistically significant influence (Wamba-Taguimdje et al., 2020), with an unstandardized coefficient of 0.465 and a p-value of 0.013. This result highlights the substantial efficiency gains achieved through automating repetitive tasks, reducing human error, and saving time for higher-value activities.

In conclusion, AI usage in risk assessment and automation of routine tasks emerge as critical drivers of efficiency, while investments and data analysis require further exploration for optimization.

	Sum square	**df**	**Mean square**	**F**	**P value**
Total	35.492	37	0.000	0.000	0.000
Error	6.530	33	0.198	0.000	0.000
Regression	28.962	4	7.241	36.591	0.000

Table 5. Summary ANOVA

The ANOVA results presented in Table 5 provide an overview of the overall model fit and the significance of the regression analysis used to evaluate the impact of AI applications on operational efficiency in audit firms in Saudi Arabia.

The total sum of squares (35.492) represents the total variability in operational efficiency explained by both the regression model and the residuals (error). The regression sum of squares (28.962) indicates the portion of variability explained by the predictors (investment in AI, AI usage in risk assessment, data analysis, and automation). The error sum of squares (6.530) accounts for the unexplained variability in the model, attributed to factors not included as predictors. The mean square for regression (7.241) and the mean square for error (0.198) are used to calculate the F-statistic (36.591). This high F-value indicates that the model explains a significant portion of the variance in operational efficiency compared to the unexplained variance. The associated p-value (0.000) confirms the statistical significance of the model, suggesting that the predictors collectively have a substantial impact on operational efficiency.

ANOVA results validate the overall model, emphasizing that the selected AI applications significantly influence operational efficiency (Al-Surmi et al., 2022). However, individual predictors' contributions vary, as highlighted in the coefficients table. This underscores the importance of focusing on specific impactful applications, such as risk assessment and automation.

	Operational Efficiency

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Investment in AI Technology	-0.154
AI Usage in Risk Assessment	0.502
AI Usage for Data Analysis	0.018
AI Usage for Automation of Routine Tasks	0.465
Intercept	0.503

Table 6. Unstandardized Coefficient

Table 6 presents the unstandardized coefficients that quantify the direct impact of various AI applications on the operational efficiency of audit firms in Saudi Arabia. These coefficients measure the expected change in operational efficiency for a one-unit change in each independent variable, holding others constant.

Investment in AI Technology has a negative coefficient (-0.154), indicating that an increase in investment is associated with a slight decrease in operational efficiency (Dong et al., 2024). However, this counterintuitive result suggests that investments alone, without effective deployment or strategic alignment, may not yield efficiency gains. AI Usage in Risk Assessment has a positive coefficient (0.502), signifying a significant positive impact. This highlights that employing AI for risk assessment substantially improves efficiency by enhancing predictive capabilities and enabling more precise decision-making processes (Javaid, 2024). AI Usage for Data Analysis shows a minimal positive coefficient (0.018), suggesting a negligible impact on efficiency. This implies that while data analysis is essential, its current AI integration may not significantly enhance operational performance, potentially due to underutilization or immature implementations. AI Usage for Automation of Routine Tasks also exhibits a strong positive impact with a coefficient of 0.465. Automating repetitive tasks reduces time and human error, leading to considerable efficiency improvements. Overall, AI usage in risk assessment and automation of routine tasks emerge as the most impactful factors, while investments and data analysis have limited or negligible effects.

	Operational Efficiency
R-square	0.816
R-square adjusted	0.794
Durbin-Watson test	2.292

Table 7. R square

Table 7 provides key metrics assessing the overall fit and reliability of the regression model examining the impact of AI applications on operational efficiency. The R-square value (0.816) indicates that 81.6% of the variability in operational efficiency is explained by the predictors included in the model. This high value suggests a strong explanatory power of the independent variables. The adjusted R-square (0.794) accounts for the number of predictors and sample size, confirming that 79.4% of the variation is reliably explained, even after adjusting for potential overfitting. This emphasizes the robustness of the model. The Durbin-Watson test value (2.292) lies close to the ideal value of 2, indicating minimal autocorrelation in the residuals. This suggests the model's assumptions about the independence of errors are met, reinforcing its validity.

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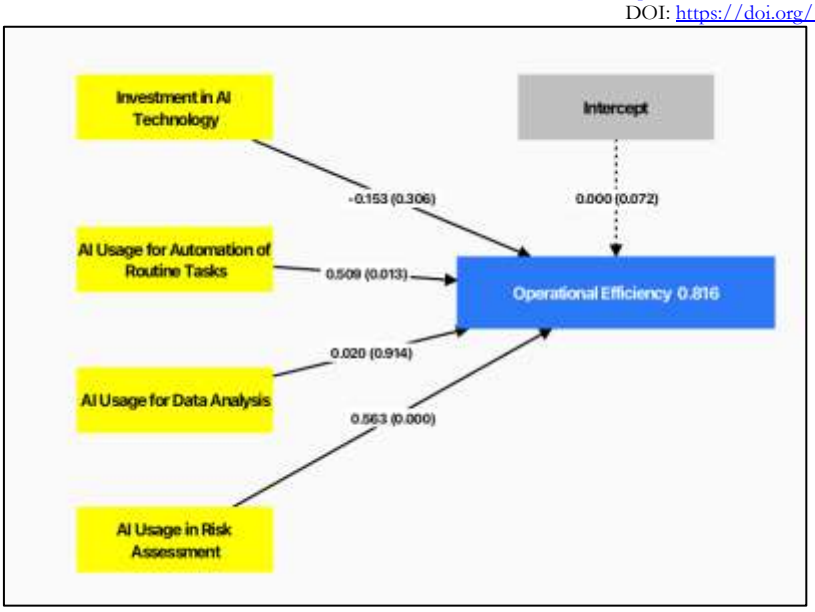

Figure 3. Regression Model (Smartpls) for Evaluating the Impact of AI Applications on Operational Efficiency of Audit Firms In Saudi Arabia

Figure 3 illustrates the regression model developed through the analysis of data collected from 38 respondents, focusing on the relationship between AI usage and operational efficiency using SmartPLS. The analysis highlights that AI applications significantly impact operational efficiency in audit firms. AI usage in risk assessment and automation of routine tasks are the strongest positive contributors, while investments and data analysis show negligible effects. The model demonstrates strong predictive power (R^2 = 0.816), with reliable path coefficients and minimal autocorrelation, affirming its robustness and validity.

Objective 3: To evaluate the impact of AI applications on audit quality of audit firms in Saudi Arabia.

To achieve the above objective, scale was adopted from the study of (Fedyk et al., 2022; Munoko et al, 2020; Oluyombo et al., 2024; Law & Shen, 2024) for AI adoption level and (Rahman et al, 2024; Albawwat & Frijat, 2021; Qatawneh, 2024; Chen & Yang, 2024; Svanberg & Ohman, 2015) for impact of AI on audit quality.

To evaluate the impact of AI applications on audit quality of audit firms, regression analysis was applied on Smart PLS software and the results obtained are discussed in the following part. The regression analysis evaluates the influence of AI applications on the audit quality of audit firms in Saudi Arabia. The results highlight distinct patterns of significance and impact across different AI dimensions.

	Unstandardized coefficients	Standardized coefficients	SE	T value	P value	2.5 %	97.5 %
AI Usage for Data Analysis	-0.181	-0.176	0.322	0.561	0.578	-0.835	0.473
AI Usage for Automation of Routine Tasks	0.894	0.866	0.350	2.552	0.015	0.182	1.606
AI Usage in Risk Assessment	0.288	0.286	0.237	1.217	0.232	-0.193	0.770
Investment in AI Technology	-0.416	-0.366	0.293	1.420	0.165	-1.012	0.180
Intercept	1.218	0.000	0.537	2.267	0.030	0.126	2.310

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Table 8. Summary Coefficients

The results in Table 8 provide insights into the impact of AI applications on the audit quality of audit firms in Saudi Arabia. The unstandardized coefficients indicate the direction and magnitude of the relationship, while the standardized coefficients highlight the relative importance of each predictor (Yeatts et al., 2017).

AI Usage for Data Analysis shows a negative unstandardized coefficient (-0.181), suggesting a slight inverse relationship with audit quality. However, its high p-value (0.578) indicates that this relationship is statistically insignificant. This implies that, at present, leveraging AI for data analysis does not have a meaningful impact on enhancing audit quality, potentially due to suboptimal implementation or lack of advanced analytical integration (Han et al., 2024). AI Usage for Automation of Routine Tasks demonstrates a positive and statistically significant impact on audit quality, with an unstandardized coefficient of 0.894 and a p-value of 0.015. The high standardized coefficient (0.866) underscores its substantial contribution, indicating that automating routine tasks improves audit processes by minimizing human error, increasing efficiency, and allowing auditors to focus on critical areas. AI Usage in Risk Assessment has a positive unstandardized coefficient (0.288), but its p-value (0.232) suggests the relationship is not statistically significant. While AI in risk assessment has potential, its current adoption or execution might not yet be robust enough to yield substantial improvements in audit quality. Investment in AI Technology shows a negative coefficient (-0.416), indicating a potential inverse effect on audit quality. However, the p-value (0.165) suggests this relationship is also insignificant. This may reflect the challenges in translating AI investments into tangible audit quality improvements. Overall, automation of routine tasks emerges as the most impactful AI application, while other dimensions show limited or insignificant contributions.

	Sum square	df	Mean square	F	P value
Total	45.315	37	0.000	0.000	0.000
Error	25.571	33	0.775	0.000	0.000
Regression	19.744	4	4.936	6.370	0.000

Table 9. Summary ANOVA

Table 9 presents the ANOVA results, assessing the overall fit of the regression model analyzing the impact of AI applications on audit quality in Saudi Arabia. The total sum of squares (45.315) represents the total variability in audit quality, encompassing both the variability explained by the regression model and the unexplained variance (error).

The regression sum of squares (19.744) reflects the portion of variability in audit quality that is explained by the predictors (AI usage in data analysis, risk assessment, automation of routine tasks, and investment in AI technology). This indicates that a substantial part of the variability in audit quality is attributed to these AI-related factors (Fedyk et al., 2024). Conversely, the error sum of squares (25.571) captures the unexplained variability, representing influences not accounted for by the model. The mean square for regression (4.936) compared to the mean square for error (0.775) results in an F-statistic of 6.370. This relatively high F-value, coupled with a significant p-value (0.000), confirms that the overall model is statistically significant. This means that the predictors, when considered collectively, have a meaningful impact on audit quality.

The ANOVA results validate the model's ability to explain variations in audit quality, emphasizing the importance of AI applications, particularly automation, in improving audit processes. However, the error term suggests there may be additional factors influencing audit quality outside the scope of the current model.

	Audit Quality
AI Usage for Data Analysis	-0.181
AI Usage for Automation of Routine Tasks	0.894
AI Usage in Risk Assessment	0.288

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Investment in AI Technology	-0.416
Intercept	1.218

Table 10. Unstandardized Coefficient

Table 10 presents the unstandardized coefficients for the regression model examining the impact of AI applications on audit quality. These coefficients indicate the direction and magnitude of the relationships between each AI-related factor and audit quality. AI Usage for Data Analysis has a negative unstandardized coefficient of -0.181, suggesting a slight inverse relationship with audit quality. However, the relatively small coefficient and its statistical insignificance (as indicated by the p-value in earlier results) imply that AI's role in data analysis, at least in its current implementation, may not be strongly impacting audit quality. AI Usage for Automation of Routine Tasks stands out with a positive unstandardized coefficient of 0.894, which is the highest among all variables. This indicates a strong positive relationship with audit quality, implying that automating routine tasks enhances audit efficiency, reduces human error, and contributes to overall higher audit quality (Nazareno & Schiff, 2021). AI Usage in Risk Assessment shows a positive unstandardized coefficient of 0.288, suggesting a beneficial effect, although its statistical insignificance (based on earlier analysis) indicates that its impact on audit quality may not be as significant or immediate. Investment in AI Technology has a negative coefficient of -0.416, but again, the lack of statistical significance implies that AI investments alone do not directly contribute to improvements in audit quality.

	Audit Quality
R-square	0.436
R-square adjusted	0.367
Durbin-Watson test	1.700

Table 11. R square

Table 11 presents the R-square and adjusted R-square values for the regression model evaluating the impact of AI applications on audit quality. The R-square value of 0.436 indicates that approximately 43.6% of the variability in audit quality can be explained by the AI-related factors in the model, which suggests a moderate level of explanatory power. The adjusted R-square value of 0.367 accounts for the number of predictors in the model, slightly reducing the explanatory power but still indicating a reasonable fit. The Durbin-Watson value of 1.700 suggests that there is no significant autocorrelation in the residuals, indicating that the model's assumptions are largely met.

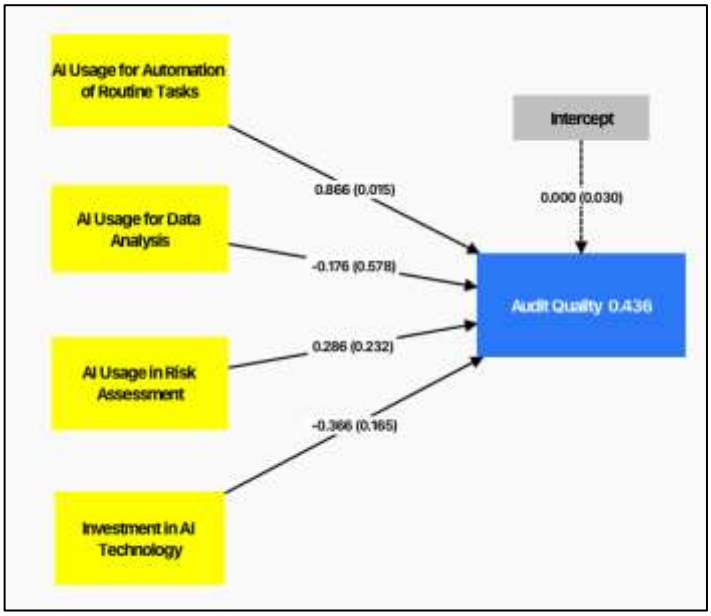

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Figure 4. Regression Model (Smartpls) For Evaluating the Impact of AI Applications on Audit Quality of Audit Firms in Saudi Arabia

Figure 4 illustrates the regression model developed through the analysis of data collected from 38 respondents, focusing on the relationship between AI usage and audit quality using SmartPLS. The analysis highlights that AI applications significantly impact audit quality in audit firms

Discussions

The increasing application of Artificial Intelligence (AI) across various industries has significantly reshaped operational landscapes, and the auditing profession is no exception (Munoko et al., 2020). The results from analyzing the impact of AI on operational efficiency and audit quality in audit firms in Saudi Arabia provide valuable insights into how AI tools are currently being utilized and their potential future implications. In this discussion, an attempt to explore the findings from both objectives: the impact of AI applications on operational efficiency and audit quality, highlighting their relevance in the present context and projecting their future significance has been made.

Objective 1: AI Applications and Operational Efficiency

AI has revolutionized operational practices in audit firms by improving efficiency, accuracy, and reducing human errors (Eziefule et al., 2022). The analysis conducted to evaluate the impact of AI on the operational efficiency of audit firms in Saudi Arabia reveals mixed results, offering insights into areas where AI is currently delivering value, and where further improvements are needed.

Key Findings and Present Relevance

The results show that AI Usage for Automation of Routine Tasks has a significant positive effect on operational efficiency, with a standardized coefficient of 0.509 and a p-value of 0.013. This indicates that automating routine and repetitive tasks, such as data entry, report generation, and initial document reviews, contributes substantially to improving operational efficiency (Ng et al., 2021). In practice, the automation of these tasks allows auditors to focus on more complex, value-added activities, which enhances overall productivity and reduces the chances of human error. This is particularly relevant in today's audit environment, where firms are under increasing pressure to reduce costs, improve turnaround times, and enhance accuracy in their reporting.

AI Usage in Risk Assessment, with a coefficient of 0.563 and a p-value of 0.000, also demonstrates a positive relationship with operational efficiency, but with more emphasis on enhancing decision-making rather than just process automation (Wong et al., 2024). Risk assessment tools powered by AI, such as predictive analytics, help auditors identify potential risks and areas of concern early in the process, improving audit outcomes. The ability to conduct real-time assessments and anticipate issues can significantly reduce the time and effort auditors need to spend on troubleshooting, which in turn boosts operational efficiency (Belfo & Trigo, 2013).

On the other hand, Investment in AI Technology shows a negative, albeit statistically insignificant, relationship with operational efficiency, with a coefficient of -0.154 and a p-value of 0.306. This finding may suggest that merely investing in AI without a clear strategy, effective implementation, or sufficient training for auditors may not result in significant operational improvements. It reflects the challenges that audit firms face in integrating new technologies into existing systems and processes, especially when there is a lack of comprehensive support or understanding of the technology's full potential (Feliciano & Quick, 2022).

Finally, AI Usage for Data Analysis, with a coefficient of 0.02 and a p-value of 0.914, has a minimal and statistically insignificant impact on operational efficiency. This may be due to the early stages of AI adoption for data analysis in audit firms, where data analysis tools might still be underutilized or not fully optimized

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for the auditing process. However, as AI continues to advance, it is likely that data analysis capabilities will improve, providing more actionable insights that can further streamline operations.

Future Relevance

Looking to the future, the impact of AI on operational efficiency in audit firms is expected to grow significantly. As AI tools become more sophisticated, the ability to automate not just routine tasks but also more complex audit functions—such as risk modelling, compliance checks, and financial analysis—will likely reduce the reliance on manual interventions. Predictive analytics and machine learning will allow auditors to proactively identify issues and flag discrepancies before they become major problems, streamlining workflows and improving audit quality.

Moreover, AI-driven insights could lead to faster decision-making, enhancing the speed at which audits are conducted without compromising accuracy. This would result in both time and cost savings for audit firms, making them more competitive in a market that demands quick, reliable, and cost-effective audits. For firms that continue to innovate and adopt AI-driven solutions, these advancements will provide a sustainable competitive advantage in an increasingly technology-driven world.

Objective 2: AI Applications and Audit Quality

AI's potential to improve audit quality is particularly relevant in the current environment where regulatory pressure, the demand for greater transparency, and the need for more accurate financial reporting are at the forefront (Samiolo et al., 2024). The second objective, examining the impact of AI on audit quality, shows that while AI has the potential to enhance the quality of audits, the current results indicate some challenges and areas for improvement.

Key Findings and Present Relevance

The strongest impact on audit quality comes from AI Usage for Automation of Routine Tasks, with a significant positive coefficient of 0.866 and a p-value of 0.015. As mentioned earlier, automating routine audit processes frees up auditors' time to focus on higher-level tasks, such as judgment-based decision-making and risk evaluation (Arkhipova et al., 2024). This not only improves efficiency but also enhances the reliability and accuracy of audit outcomes, which is essential for audit quality. This finding is consistent with current trends in the industry, where firms are leveraging AI to automate repetitive processes, reduce human error, and improve the consistency of audits (Fedyk et al., 2022).

However, AI Usage for Data Analysis shows a negative coefficient of -0.176 and a p-value of 0.578, indicating that it has a negligible and statistically insignificant impact on audit quality at this stage. This result could be attributed to the fact that AI-based data analysis tools are still in the early stages of adoption in the auditing profession. While AI has significant potential to improve data analysis capabilities, such as detecting patterns and anomalies in large datasets, the tools may not yet be fully integrated or optimized for the specific needs of auditors. Over time, as AI tools become more advanced and are tailored to auditing needs, their ability to identify and flag potential audit risks will enhance the overall quality of audits.

AI Usage in Risk Assessment demonstrates a positive but statistically insignificant relationship with audit quality (coefficient of 0.286, p-value of 0.232). Although AI-based risk assessment tools have the potential to enhance audit quality by identifying emerging risks and prioritizing areas requiring more detailed investigation (Murikah et al., 2024), the results suggest that the current tools might not be fully integrated into audit practices or sophisticated enough to make a consistent impact on audit quality.

Lastly, Investment in AI Technology has a negative relationship with audit quality (coefficient of -0.416, p-value of 0.165), although this result is not statistically significant. This could suggest that simply investing in AI without ensuring that it is effectively implemented, well-integrated with audit processes, and supported by adequate training might not yield the desired improvements in audit quality. It highlights the

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need for a holistic approach to AI adoption in audit firms, where technology investments are paired with strategies for training, process integration, and continuous improvement.

Future Relevance

Looking to the future, the impact of AI on audit quality is expected to increase substantially. As AI applications mature, particularly in data analysis and risk assessment, the potential for significantly improving audit quality will be realized. For example, AI-powered tools that can analyze large volumes of financial data and identify anomalies or discrepancies in real time will enhance auditors' ability to detect fraud and errors with greater accuracy. As machine learning algorithms become more sophisticated, they will be able to predict potential risks and provide auditors with actionable insights to guide their decision-making process.

Moreover, predictive analytics could allow auditors to assess risks and financial health more proactively, resulting in a more reliable audit process. With the increasing complexity of financial markets and the growing volume of data, AI's role in auditing will only become more vital in ensuring accurate, timely, and comprehensive audits.

Conclusion

This study aimed to evaluate the impact of AI applications on operational efficiency and audit quality in audit firms in Saudi Arabia. The findings provide a comprehensive understanding of how AI is currently being utilized within these firms and the areas where it shows the greatest potential for improvement. The analysis not only offers insights into the current state of AI adoption in the auditing profession but also highlights the future directions in which AI can significantly enhance audit processes.

For operational efficiency, the study found that AI applications, particularly in automation of routine tasks and risk assessment, have a substantial positive impact. Automating repetitive tasks frees up valuable time for auditors, allowing them to focus on more complex activities, which ultimately enhances productivity and reduces human error. The use of AI in risk assessment also improves operational efficiency by providing auditors with predictive insights, enabling them to identify risks early and focus resources on areas requiring attention. However, investment in AI technology alone did not demonstrate a statistically significant improvement in operational efficiency, highlighting the importance of not only investing in AI but also ensuring its strategic integration and effective implementation within the firm's processes.

Regarding audit quality, AI applications again showed significant promise in improving the accuracy, consistency, and reliability of audits. The use of AI for automating routine tasks significantly enhances audit quality by reducing errors and ensuring consistency across audits. While AI's role in data analysis and risk assessment showed some promise, the results indicate that these applications are still in the early stages of adoption and need further development to fully realize their potential. Additionally, the findings suggest that while investment in AI technology is crucial, its impact on audit quality is contingent upon proper implementation, training, and integration into existing audit practices.

Overall, the study underscores the transformative potential of AI in the auditing profession. AI has the capacity to streamline processes, enhance audit quality, and reduce human error. However, to achieve these benefits, audit firms must adopt a holistic approach to AI implementation that includes adequate training, infrastructure development, and strategic integration of AI tools into auditing processes.

Looking ahead, the role of AI in audit firms will only become more critical, with the growing complexity of financial data and regulatory demands. AI's capabilities in predictive analytics, fraud detection, and data analysis will increasingly shape the future of auditing, enabling firms to deliver faster, more reliable, and higher-quality audits. The future of audit firms lies in their ability to continuously innovate and integrate AI tools to stay competitive and meet the evolving needs of the industry.

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