"Impact of artificial intelligence using the robotic process automation system on the efficiency of internal audit operations at Jordanian commercial banks"

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NUMBER OF REFERENCES

51

NUMBER OF FIGURES

0

NUMBER OF TABLES

10

BUSINESS PERSPECTIVES

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IMPACT OF ARTIFICIAL INTELLIGENCE USING THE ROBOTIC PROCESS AUTOMATION SYSTEM ON THE EFFICIENCY OF INTERNAL AUDIT OPERATIONS AT JORDANIAN COMMERCIAL BANKS

Abstract

This study aims to examine the impact of artificial intelligence through robotic process automation systems on internal audit operation efficiency in Jordanian commercial banks. The study uses a descriptive methodology to evaluate how robotic process automation systems enhance the different dimensions of internal audit efficiency: planning, management, execution, and communication. The study designed a structured questionnaire for data collection. The sample consisted of 12 commercial bank employees whose working processes are directly affected by robotic process automation system procedures which puts them in a unique position to comment on the practical applicability of this technology and its implications for internal audit. In this study, 480 electronic questionnaires were distributed via Google Forms, and 390 completed forms were collected for further analysis. The study employs descriptive statistics and advanced statistical techniques, such as linear regression analysis, for data analysis. The findings indicate that robotic process automation systems enhance the internal audit process by reducing the cost of operations, eliminating human errors, and smoothing work processes. The robotic process automation system will allow continuous auditing, real-time risk management, and proper reporting; hence, it will change the role of internal auditors and, in the end, improve organizational compliance and performance. This study asserts that the banking industry must integrate AI-driven automation to maintain its competitiveness in the constantly changing financial landscape.

Keywords	artificial intelligence, robotic process automation system, internal audit operations, banks
JEL Classification	G21, M42, M15, O31

INTRODUCTION

Given the global advancements in information technology, recent discussions frequently use the term "artificial intelligence" in reference to robotic process automation systems. It is considered a modern field by all societies and is continuously changing, with a promising future that will determine the fate of humanity (Abousweilem et al., 2023). In the modern era, artificial intelligence and information technology systems will be indispensable for the efficient and effective completion of audit work. Robotic process automation systems (RPAS) have significantly transformed the way banks interact with their customers in the past few years. Thus, using automated RPAS puts banks at the forefront of customer service and ensures high-class security. In fact, the integration of artificial intelligence and RPAS into banking has transformed the industry, enabling banks to provide innovative, efficient, and customer-oriented services. RPAS in banking refers to

sophisticated programs designed to facilitate human interaction through voice commands, text conversations, or both; these streamline customer interactions and enhance the overall service experience (Verma & Sehgal, 2023). These AI-enabled tools have enhanced the quality of services that banks can offer to their customers and opened up new avenues of technology that the banking industry can take, moving away from traditional ways of working. This transformation has helped banks save time, money, and labor while improving their efficiency and customer satisfaction.

AI-powered RPAS holds particular significance in the accounting profession, enabling process automation, minimizing human errors, and optimizing workflows. RPAS provides an ideal environment for embracing state-of-the-art information technologies and thus offers opportunities for banks to enhance internal auditing processes and increase compliance with regulatory requirements. However, many challenges impede the successful integration of RPAS into Jordanian commercial banks, including complex infrastructure requirements, the lack of qualified personnel, and the need for updating and maintenance access, all of which demand substantial investment and carry significant risks (Ahmad et al., 2024). Similarly, determining the success of internal auditing necessitates a thorough understanding of the value AI-driven RPAS creates in enhancing its efficiency. Banks must overcome all these challenges to fully apply RPAS in internal auditing, achieving efficiency and risk reduction that will maintain their competitiveness in the dynamic financial world.

1. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

New technology is changing the nature of the global economy, and companies must respond rapidly to new demands from their business partners and clients. Organizations, in turn, are also trying by all means to reduce costs and enhance their overall efficiency in light of increasing financial and regulatory burdens (Hofmann et al., 2020). One of the emerging business and accounting technologies in relation to the field is business process automation. It refers to the automation of multiple processes and functions beyond the capabilities of traditional data processing and record keeping, sometimes using algorithms. Organizations have been investing heavily in information technology for years (Al-Kasasbeh et al., 2023), aiming to reduce the complexity and time-consuming procedures associated with processing business transactions. This shift is a result of various technological tools that have emerged to speed up the business process cycle (Griffiths & Pretorius, 2021).

Automation is the process of programming machines to perform tasks automatically instead of requiring human intervention. For instance, machines can automatically transfer data between databases rather than requiring human intervention (Romney et al., 2021). Robotic process automation technology uses software robots to automate tasks typically performed by humans. Automation procedures are based on applications that use computer programs and logic to arrange data inside the specified digital workflow (Plattfaut & Borghoff, 2022). Because of its contemporary uses, RPA technology has gained attention in the accounting community in both academic and practical contexts, especially for activities like financial management and bank reconciliations (Bellinga et al., 2022). Accounting businesses have made significant progress in reducing RPA operating costs, and they plan to leverage this development in other areas of their business (Cooper et al., 2019).

Since auditing procedures follow a particular set of steps to identify the type and caliber of information present in financial data, the accounting industry stands out as one of the best places to deploy RPAS technology (Perdana et al., 2023). Because the auditing process involves managing numerous repetitive tasks, RPA technology can assist by executing orders quickly, completing time-consuming tasks, and ultimately revamping procedures to enhance effectiveness and efficiency. RPA technology can carry out auditing tasks like reconciling cash transactions, sales, purchases, journal entries, inventories, wages, and other expenses (Harrast, 2020), and it can monitor risk thresholds and issue notifications when they exceed them (Liu, 2022). It

also discusses additional procedures that are repetitive and time-consuming but call for little human judgment (Doguc, 2021).

Most earlier studies have focused on the advantages of using RPAS technology and the challenges it faces in the accounting industry generally and auditing specifically. Lacurezeanu et al. (2020) have accomplished this by creating suggested frameworks for utilizing this technology and testing it through experiments. RPAS can enhance the value of audit processes by facilitating the testing of a complete set (the entire population) of all operations in general and revenue-related operations in particular (Harrast, 2020). It enables auditors to analyze the risks of material misstatement in revenues, as revenues are a high-risk area subject to frequent audits (Hsiung & Wang, 2022). Revenue is constantly subject to audit flaws, as the Public Company Accounting Oversight Board has pointed out. This suggests that RPA technology holds significant importance for the auditing profession by addressing these deficiencies and assessing potential material errors or uncertainties (Fotoh & Lorentzon, 2023).

Developments in data, artificial intelligence, and related domains have constantly motivated researchers and practitioners to review these topics (Ribeiro et al., 2021). One recent innovation that has shown promise for automating some processes, such as continuous auditing, is RPA (Farinha et al., 2024). Ayinla et al. (2024) describe RPAS as "a pre-configured software that employs business rules and pre-designed activities to independently execute a set of processes, activities, and transactions, either within one or more relevant software systems managed as a service." RPA is a general name for digital tools that communicate with other computer software's user interfaces (Karaki et al., 2023; Syed & Wynn, 2024). RPA also entails automatically retrieving data from one system and transferring it to another or initiating a process in a different system (Lin et al., 2024).

Auditing has utilized automation technology for more than three decades. They came up with the idea of continuous auditing (CA), which, according to CICA/AICPA, means, "*the ability to release audit reports concurrently with or soon after relevant events take place*" (Tiron-Tudor et al., 2024)

because of the cost of labor and the size of decision structures. Subsequently, they emphasized the importance of formalizing internal audit procedures for computer-based execution and identifying processes suitable for automation. Research has shown that automating many internal audit departments, including IT audits, can result in cost savings, enable more parallel audits, and free up audit staff for tasks that require human judgment (Eulerich et al., 2024). By using RPA technology to automate repetitive and normal tasks, accounting firms can improve their skills at every level. Instead of depending on the conventional sampling method, RPA enables auditors to perform tests on the complete collection of accounting data (the population), greatly lowering the possibility of sampling errors (Zareen et al., 2024).

When used with analytics, RPA can improve the detection of mistakes, anomalies, and even fraud (Ayinla et al., 2024). Additionally, it allows verification that cost-related data complies with regulatory standards by comparing it with source data. This enhances efficiency through continuous monitoring and the issuance of alerts when needed (Broek, 2024). Global economic stagnation and changes in work practices, such as the remote performance of accounting and auditing tasks from home, have compelled the adoption of new methods to enhance operations (Alkasasbeh et al., 2022). One of the key technologies adopted by auditing firms to address these challenges is robotics and intelligent process automation (Saatchi et al., 2024). This automation can help small businesses remain competitive in the market, as it performs better than traditional corporate systems. These technologies are more flexible and faster than building new IT systems, enabling auditors to apply robotic process automation across all stages of auditing that involve rule-based, repetitive, and time-consuming tasks (Perdana et al., 2023).

Significant advantages of intelligent process automation for auditing include improved audit quality, more time for activities requiring professional judgment, and improved decision-making by auditors with the aid of artificial intelligence and cognitive computing (Salah & Alzghoul, 2024). Furthermore, compared to conventional sampling techniques, intelligent automation enables auditors to do comprehensive population testing as

opposed to sample testing, offering more impartial support for audit opinions (Zhang et al., 2023). Automation can also virtually eliminate human errors in repetitive tasks. If implemented correctly, these technologies can result in immediate and substantial time and cost savings for the most repetitive, standardized, and rule-based tasks (Hong et al., 2023). However, intelligent process automation cannot fully replace human workers (Alzghoul et al., 2024). Although it incorporates AI and cognitive technologies, the intention is not to eliminate humans from the workflow (Candratio et al., 2023). Instead, its goal is to reduce the time employees spend on manual, repetitive tasks, helping them focus on creative, high-value activities and make better decisions (Ng, 2023). Ultimately, the role of accountants and auditors could shift professionally from data entry tasks to becoming decision-makers—or at least significantly supporting decision-makers with more analytical and in-depth insights. Intelligent robotic applications have delegated previously time-consuming repetitive tasks to them, making this transformation possible (Cooper et al., 2019).

Information technology has witnessed significant developments in recent decades, with artificial intelligence technologies now being used across various sectors to simplify complex processes and analyze large datasets (Alawaqleh, 2021). Because of this development, computers can now carry out activities that formerly required human intelligence. These technologies have also been adopted in accounting and auditing to enhance the accuracy of financial operations and strengthen controls, helping companies efficiently detect errors and identify potential risks (Almaliki, 2021). Examining accounting procedures and financial transactions is the main responsibility of internal auditing, making it one of the most important roles in organizations., in addition to evaluating the internal control system and risk management. It is directly connected to senior management or audit committees (Krichene & Baklouti, 2020). The French Institute of Audit and Internal Control (IFACI) defines it as an independent internal activity specialized in examining and monitoring all operations within the institution, as well as assessing risk management and the internal control system to assist management in fulfilling its duties by providing recommendations and necessary statements (Kotb et al., 2020).

By taking a methodical and structured approach to assessing the internal control system, enhancing risk management, and establishing corporate governance principles, internal auditing is defined by the international professional practice framework as an independent and objective activity that assists organizations in achieving their objectives (Hazaea et al., 2021). Betti and Sarens (2021) defined internal auditing as an independent activity carried out by an internal employee responsible for examining financial operations, with the intention of enhancing the company's worth by offering a series of statements and suggestions that help management make the right choices. Amid technological advancements and digitalization, the internal audit department, as a key oversight function within the organization, successfully masters many modern and innovative technologies that enable it to analyze large datasets and audit processes in a short time with high accuracy (Turetken et al., 2020). Artificial intelligence technologies are among the most widely used in accounting and auditing, serving as tools to enhance and streamline auditing processes by reorganizing and upgrading the skills of the auditors performing these tasks (Kutbidinovich, 2022).

The International Standards for the Professional Practice of Internal Auditing outline various factors that impact the quality of internal auditing, aiming to enhance the efficiency and effectiveness of audit operations. Compared to the Institute of Internal Auditors' (IIA) Standard 2000, the chief audit executive (CAE) is in charge of making sure that the internal audit activity adds value to the organization by carrying out its tasks in a smart and effective way. This responsibility is based on the following concepts of internal auditing: Highly competent professionals perform this self-governing activity, and the authorities responsible for internal auditing recognize and assign clear objectives and duties in the internal audit charter. Internal auditing follows and complies with international standards; internal auditing adheres to ethical and professional principles. It takes into account possible emerging issues and trends that might affect the authorities of the organization (Alqudah et al., 2023). When combined, these factors enable internal auditing to provide valuable insights and solutions that can benefit the organization.

Standard 2200 outlines the planning process for internal audit engagements, requiring the chief audit officer to develop a detailed plan based on risk assessments to prioritize internal audit operations in line with the company's objectives. Clarifying the organization's strategy, outlining important business goals, and identifying related risks all require collaboration with the board of directors and top management. The mission planning process includes defining the mission's objectives and scope, providing the necessary resources for its execution, developing implementation programs, and ensuring the quality of the process. ground the plan in the following principles: The internal audit activity includes the responsibility of conducting recorded risk assessments at least annually, with input from the board of directors and senior management. Next, when an internal audit provides insights and findings, it establishes unambiguous expectations for the board of directors, senior management, and other relevant stakeholders. Finally, incorporating approved advisory tasks into the audit plan is one way to think about ways to enhance risk management and the organization's operations.

The standards indicate that the internal auditor identifies, analyzes, evaluates, and documents sufficient information necessary to achieve the audit engagement objectives. These processes include the following steps: First, Standard 2400 addresses the task of communicating results, requiring the internal auditor to deliver the audit engagement results in a timely and appropriate manner (Alrabei, 2021). Communicating results involves conveying and reporting them, covering communication rules, the quality of communication, and errors resulting from non-compliance with standards, events, disclosures, and the publication of results (Alsabti & Khalid, 2022). These results include objective recommendations that motivate management to take action when senior management deems it necessary to adopt the recommendations outlined in the internal audit report. Management will then implement changes in planning processes, policies, systems, or methods to correct deviations and address problems identified by internal auditors during the audit engagement (Alsabti & Khalid, 2021).

To guarantee the effectiveness of communication, it must be objective, accurate, clear, concise, constructive, complete, and delivered on time. Communications are considered accurate when they are devoid of distortions and firmly grounded in pertinent facts and evidence. They are objective when they are neutral, unbiased, and derived from fair evaluations of all facts and evidence. Communications are clear when they are logical and simple to understand. They are concise when they remain focused on the subject matter and avoid unnecessary elaboration. Communications are constructive when they assist the engaged client and facilitate necessary improvements. Lastly, they are considered complete when they do not lack any essential or critical elements (Napitupulu, 2023).

The purpose of this study is to evaluate the impact of implementing AI using RPAS on the efficiency of internal audit services in Jordanian commercial banks. The study aims to fill this gap by examining the role of AI-driven RPAS in improving audit processes and operational effectiveness from the Jordanian perspective, drawing empirical evidence from Jordanian commercial banks. Thus, the following hypotheses are proposed:

H0: *There is no effect of artificial intelligence using the Robotic process automation system RPAS on the efficiency of internal audit operations at Jordanian commercial banks.*

H0.1: *There is no effect of artificial intelligence using the Robotic process automation system RPAS on the Quality of Internal Audit Activity Management dimension at Jordanian commercial banks.*

H0.2: *There is no effect of artificial intelligence using the Robotic process automation system RPAS on the Quality of Audit Planning Dimension at Jordanian commercial banks.*

H0.3: *There is no effect of artificial intelligence using the Robotic process automation system RPAS on the Quality of Audit Engagement Execution Dimension at Jordanian commercial banks.*

H0.4: *There is no effect of artificial intelligence using the Robotic process automation system RPAS on the Quality of Results Communication dimension at Jordanian commercial banks.*

2. METHODOLOGY

In fact, according to the report of the Association of Banks in Jordan, there are 12 commercially representative banks (with Jordanian nationality) that currently serve as the backbone of Jordan's financial sector, offering a wide range of services and maintaining robust internal audit functions, particularly when it comes to examining the influence of RPASs. The target population was 13,921 employees from various managerial and operational levels within these banks. The study adopted a stratified proportional random sample to minimize selection bias and increase the generalizability of findings, aiming to make the sample representative of diversity in the banking sector and internal auditing environment. The respondents targeted included employees from internal audit departments, risk management teams, and IT audit divisions because their jobs are in direct contact with RPAS implementation and thus can provide valuable insights into its practical applications and the effect on audit efficiency. The study electronically forwarded 480 questionnaires using Google Forms and received 390 valid responses.

The structured questionnaire was the primary instrument for data collection, divided into two major sections. The first section covers demographic data such as age group, educational background, and professional experience, taking into account potential variations among different profiles related to these factors. The second part talked about the main factors of the study, which were RPAS adoption, and evaluated four aspects of internal audit efficiency: the quality of planning, the communication of results, the management of activities, and finally, the execution of an audit engagement. A five-point Likert scale ranging from "strongly disagree" to "strongly agree" extracted the level of agreement of the respondents to statements. The study first did a pilot study among a small group of employees and then refined it based on their feedback to ensure its validity and reliability. With the aid of SPSS, the study computed descriptive statistics highlighting the demographic characteristics of respondents and conducted trend analysis. Therefore, the study employed advanced data analysis techniques, including linear regression analysis, to investigate the impact of RPAS on the effectiveness of internal auditing.

Table 1. Sample distribution

Variable	Category	Frequency	Percent
Age	Less than 25	80	20.5
	25 and more but less than 35	169	43.3
	35 and more but less 45	56	14.4
	45 until Less than 55	60	15.4
	55 and more	25	6.4
Educational qualification	Bachelor's	179	45.9
	Higher Diploma	48	12.3
	Master's	113	29.0
	Ph. D	41	10.5
	Any other educational qualification	9	2.3
Job experience in years	Less than 5	96	24.6
	5 and more – less than 10	135	34.6
	10 and more – less than 15	104	26.7
	15 and more – less than 20	24	6.2
	20 and more – less than 25	31	7.9
	Total	390	100.0

2.1. Reliability test

The study evaluated the sample measure's internal reliability and its ability to capture the variables before distributing it to the participants. The study applied internal reliability and used Cronbach's alpha value as the primary reliability parameter. Multiple interpretations exist for the various confidence coefficients, ranging from 0 to 1. Typically, bigger coefficient values indicate better reliability (Bruton et al., 2000). Moreover, Hair et al. (2010) established a lowest acceptable value of 0.70 or higher for this test, with a Cronbach's alpha value of 0.6 or higher indicating excellent reliability (Taber, 2018). Table 2 presents the results of the internal consistency test, which show that every measure used in this research satisfied the reliability standards.

Table 2. Reliability test

Variable	domain		Cronbach alpha
Independent variable	Artificial intelligence using the Robotic process automation system RPAS		0.88
Dependent variable	1	Quality of Internal Audit Activity Management	0.81
	2	Quality of Planning	0.74
	3	Quality of Audit Engagement Execution	0.76
	4	Quality of Results Communication	0.81
	Efficiency of internal audit operations (Overall)		0.90

3. RESULTS

3.1. Descriptive statistic

The independent variable: Artificial intelligence using the Robotic process automation system RPAS.

With a mean score of 3.62, Item 12 (RPAS speeds up task completion by automating routine processes, improving overall productivity, and reducing the need for human intervention) was ranked last. Items 3 and 10 ("RPAS reduces operational costs by minimizing the need for manual labor, allowing resources to be redirected towards growth initiatives" and "RPAS reduces human errors, ensuring higher precision, especially in internal audits requiring meticulous calculations") got the lowest scores (4.17). Table 3 also shows that the mean for artificial intelligence using the Robotic Process Automation System (RPAS) as a whole is 3.98, indicating a high degree of agreement.

Table 4 shows that "Quality of Planning" acquires the highest mean (3.96), while "quality of communication results" was ranked last with a mean of

Table 3. Means and standard deviations of artificial intelligence using the RPAS items, descending ranked order

Rank	N	Item	Mean	Std. Deviation	Degree of agreement
1	3	Automated processes through RPAS reduce human errors, ensuring higher precision, especially in internal audits requiring meticulous calculations	4.17	0.823	High
1	10	RPAS reduces operational costs by minimizing the need for manual labor, allowing resources to be redirected toward growth initiatives	4.17	0.893	High
3	1	RPAS integrates AI algorithms to automate repetitive tasks, enabling efficient, error-free operations across industries, especially in finance and auditing	4.09	0.966	High
4	4	RPAS can quickly analyze large datasets, offering insights for better decision-making in real-time audits and financial assessments	4.07	1.081	High
5	7	RPAS generates real-time reports, improving transparency in internal audits and fostering trust in the audit process	4.06	0.869	High
6	2	RPAS accelerates task completion by automating routine processes, improving overall productivity and minimizing manual intervention	4.00	0.884	High
7	5	RPAS systems adjust automatically to new regulations, ensuring continuous compliance and reducing operational risks	3.98	0.897	High
8	9	With RPAS, auditors can perform real-time monitoring, providing immediate alerts when irregularities occur	3.93	0.903	High
9	6	By automating routine work, RPAS allows staff to focus on value-added activities like strategic planning and analysis	3.91	0.923	High
10	13	Automated processes through RPAS reduce human errors, ensuring higher precision, especially in internal audits requiring meticulous calculations	3.91	0.931	High
11	8	RPAS helps identify unusual patterns or anomalies early, enhancing the ability to manage risks effectively	3.89	0.899	High
11	11	RPAS integrates AI algorithms to automate repetitive tasks, enabling efficient, error-free operations across industries, especially in finance and auditing	3.89	0.927	High
13	12	RPAS accelerates task completion by automating routine processes, improving overall productivity, and minimizing manual intervention	3.62	1.070	Moderate
		Artificial intelligence using the robotic process automation system RPAS (over all)	3.98	0.592	High

Table 4. Means and standard deviations for the efficiency of internal audit operations, in descending ranked order

Rank	N	Domain	Mean	Std. Deviation	Level
1	2	Quality of Planning	3.96	0.639	High
2	1	Quality of Internal Audit Activity Management	3.86	0.711	High
2	3	Quality of Audit Engagement Execution	3.86	0.617	High
4	4	Quality of Communication Results	3.75	0.551	High
		Efficiency of internal audit operations (overall)	3.86	0.552	High

Table 5. Means and standard deviations for the efficiency of internal audit operations

N	Item	Mean	Std. Deviation
14	A framework was available that defines the objectives of internal auditing at the university	3.83	0.949
15	Clear guidelines were provided for managing internal auditing activities	3.81	0.953
16	The university offers training to develop the skills of the internal audit team	3.95	0.929
17	The internal audit management activities include mechanisms to monitor the performance of the internal audit team	3.75	1.019
18	The internal audit management activities include mechanisms to review internal audit processes.	3.97	0.878
19	Risk analysis was conducted adequately to determine the objectives of internal auditing	4.05	0.850
20	Internal audit objectives were defined clearly and measurably	4.13	0.887
21	Risk assessments were conducted periodically to ensure the efficiency of internal audit operations	4.01	0.877
22	Clear guidelines were provided on how to plan tasks and allocate responsibilities	3.86	0.980
23	The planning process was documented adequately	3.74	0.944
24	Internal audit operations were conducted in accordance with international auditing standards	3.81	1.036
25	Sufficient evidence was collected to assess risks and compliance	4.11	0.774
26	Evidence was analyzed objectively and impartially.	3.90	0.907
27	Internal audit reports were prepared clearly within the specified time frame	3.79	1.053
28	Effective communication with the university management was carried out to facilitate the efficient execution of internal audit tasks	3.71	0.994
29	The internal audit report was submitted to relevant stakeholders in a timely manner	3.64	0.946
30	Audit results were presented clearly and comprehensibly	3.68	0.928
31	Corrective actions were taken periodically	3.72	0.942
32	Internal audit recommendations are effectively followed up	3.88	0.935
33	Internal audit results were used to improve processes, procedures, and systems	3.81	1.068

3.75. This table also shows that the efficiency of internal audit operations total mean is (3.86), with a high degree of agreement.

Table 5 demonstrates substantial agreement among participants regarding the significance of creating measurable objectives for internal audits, with Item 20 ("Internal audit objectives are defined clearly and measurably") receiving the highest mean score of 4.13. Item 19 ("Risk analysis is conducted adequately to determine the objectives of internal auditing") also attained a high mean of 4.05, indicating trust in the function of risk analysis in guiding audit objectives. However, with the lowest mean score of 3.64, Item 29 ("The internal audit report is submitted to relevant stakeholders in a timely manner") indicated that there was still space for improvement in terms of timely audit report submission. Furthermore, Item 30 ("Audit results are presented clearly and comprehensibly") received a low mean score of 3.68, suggesting that more work may need to be done to improve the clarity of the audit result presentation. There is a fair amount of agreement among respondents regarding the efficacy of internal auditing procedures, as seen by the overall mean of 3.88 for all items relating to the efficiency of internal audit operations. To improve audit performance completely, it may be necessary to pay more attention to some aspects, such as report timeliness and result presentation, as indicated by the variation in mean ratings among items.

3.2. Hypothesis testing

H0:   *There is no effect of artificial intelligence using the Robotic process automation system RPAS on the efficiency of internal audit operations at Jordanian commercial banks.*

Table 6 shows the coefficient table for the simple regression analysis for *H0*. The study model explained, according to the simple regression test results, 71.4% of the variance in the efficiency of internal audit operations at Jordanian commercial banks can be explained by artificial intelligence using the robotic process automation system RPAS (Coefficient of determination R^2 = 0.714).

H0.$_1$: *There is no effect of artificial intelligence using the Robotic process automation*

Table 6. Simple regression analysis for the impact of artificial intelligence using the RPAS in the efficiency of internal audit operations

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.722	0.102	–	7.096	0.000
	Artificial intelligence using the Robotic process automation system RPAS	0.788	0.025	0.845	31.130	0.000
R = 0.845	R² = 0.714			F = 969.082	P = 0.000	

Table 7. Simple regression analysis for the impact of artificial intelligence using the RPAS on the quality of internal audit activity management

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.181	0.157	–	1.158	0.247
	Artificial intelligence using the Robotic process automation system RPAS	0.926	0.039	0.770	23.773	0.000
R = 0.770	R² = 0.593			F = 565.172	P = 0.000	

Table 8. Simple regression analysis for the impact of artificial intelligence using the RPAS on the quality of planning dimension

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.594	0.137	–	4.335	0.000
	Artificial intelligence using the Robotic process automation system RPAS	0.846	0.034	0.783	24.817	0.000
R = 0.783	R² = 0.614			F = 615.891	P = 0.000	

system RPAS on the Quality of Internal Audit Activity Management dimension at Jordanian commercial banks.

Table 7 shows the coefficient table for the simple regression analysis for $H0._1$. According to the simple regression test results, the study model explained that 59.3% of the variance in the quality of internal audit activity management dimension at Jordanian commercial banks can be explained by artificial intelligence using the Robotic process automation system RPAS (coefficient of determination $R^2 = 0.593$).

$H0._2$: There is no effect of artificial intelligence using the Robotic process automation system RPAS on the Quality of Planning dimension at Jordanian commercial banks.

Table 8 shows the coefficient table for the simple regression analysis for $H0._2$. The study model explained, according to the simple regression test results, 61.4% of the variance in the quality of planning dimension at Jordanian commercial

banks can be explained by artificial intelligence using the robotic process automation system RPAS (coefficient of determination $R^2 = 0.614$).

$H0._3$: There is no effect of artificial intelligence using the Robotic process automation system RPAS on the Quality of Audit Engagement Execution dimension at Jordanian commercial banks.

Table 9 shows the coefficient table for the simple regression analysis for $H0._3$. The study model explained, according to the simple regression test results, 50.5% of the variance in the quality of audit engagement execution dimension at Jordanian commercial banks can be explained by artificial intelligence using the Robotic process automation system RPAS (Coefficient of determination R2 = 0.505).

$H0._4$: There is no effect of artificial intelligence using the Robotic process automation system RPAS on the Quality of Results Communication dimension at Jordanian commercial banks.

Table 9. Simple regression analysis results for the impact of artificial intelligence using the RPAS on the quality of audit engagement execution

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.919	0.150	–	6.143	0.000
	Artificial intelligence using the Robotic process automation system RPAS	0.740	0.037	0.711	19.901	0.000
	R = 0.711　　　　R^2 = 0.505			F = 396.055　　　P = 0.000		

Table 10. Simple regression analysis for the impact of artificial intelligence using the RPAS on the quality of results communication

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.195	0.138	–	8.671	0.000
	Artificial intelligence using the Robotic process automation system RPAS	0.641	0.034	0.689	18.701	0.000
	R = 0.689　　　　R^2 = 0.474			F = 349.713　　　P = 0.000		

Table 10 shows the coefficient table for the simple regression analysis for $H0._4$. The study model explained, according to the simple regression test results, that 47.4% of the variance in the quality of the communication results dimension at Jordanian commercial banks can be explained by artificial intelligence using the robotic process automation system RPAS (coefficient of determination R^2 = 0.474).

4. DISCUSSION

This research work primarily aims to evaluate the impact of AI through RPAS on the efficiency and quality of internal audit processes at Jordanian commercial banks, specifically examining the impact of RPAS on key dimensions such as activity management, planning, execution, and communication. In response to this, the study aimed to bridge a research gap by exploring practical applications of AI-powered tools in internal auditing processes within the banking sector, particularly in the Jordanian context. The findings indicate that AI using RPAS has a statistically significant positive impact on the efficiency of internal audit operations. This supports other works such as Harrast (2020), which reveal that RPA reduces the time and effort used in executing repetitive and rule-based tasks. In this way, RPAS frees up auditors to work on more important and strategic tasks by automating tasks like cash reconciliation, payroll review, and journal entry testing. This is in line with Ng's observation from 2023 that auditors'

jobs have changed from entering data to making decisions since automation. This study validates the findings of Zareen et al. (2024), who conducted a similar study, asserting that RPAS significantly reduces human errors and boosts efficiency in settings that demand greater speed and accuracy.

The study also discloses the strong positive impact of RPAS on the management dimension of internal auditing. Such a finding is also supported by insights from Tiron-Tudor et al. (2024), who note that this improvement in audit oversight owes to the fact that the automation technologies ensure international standards are upheld and provide full-time monitoring of audit activity. These findings also support the work of Lacurezeanu et al. (2020), who provided frameworks for integrating RPA in auditing to optimize management practices and increase organizational compliance. In a Jordanian banking context, these findings underline the relevance of RPAS in the ability of internal audit teams to manage such complex processes with efficiency. On the planning dimension, the study indicates affirmatively that RPAS enhances the quality of planning in auditing, automating risk-based audit assessments to prioritize audit work. Indeed, this supports the views of regarding the role of an AI-driven tool in aligning auditing priorities with organizational needs. As opposed to traditional manual techniques in auditing, RPAS will make it faster for auditors to work through large volumes of information, thereby underlining more accurately those areas that bear high risks. These are of particular relevance in a

dynamic environment, such as the banking industry, where proper planning helps minimize financial and operational risks.

The fact that RPAS can change the way things are done really shows how powerful it is. It lets auditors test large amounts of data on whole populations instead of just a few samples, which makes their findings more reliable and in-depth. This fact sustains that automation reduces sampling errors as concluded by Ribeiro et al. (2021) and Zareen et al. (2024) and is effective at catching anomalies and fraud. Moreover, RPAS automates routine rule-based tasks, freeing auditors to focus on judgment-intensive activities, which further validates their inclusion in modern auditing practices. RPAS improves clarity, timeliness, and accuracy in audit reporting, as revealed by the findings on the communication dimension. Therefore, this study reinforces Napitupulu's (2023) emphasis on the need for effective communication to foster insight and transparency within organizations. RPAS automates the generation of audit reports, ensuring the timely delivery of findings in a comprehensive and accessible format to stakeholders. Besides fostering positive communication, these improvements above would further help achieve the greater good of enhancing accountability in internal auditing. This study focuses on the impact of RPAS on Jordanian banking, thereby contributing to new knowledge and enabling it to surpass previous limits. While Ribeiro et al. (2021) and Lacurezeanu et al. (2020) pioneered its usage in auditing practices around the world, this study adds a regional perspective by testing its applicability in Jordanian commercial banks. It also builds on the work of Ayinla et al. (2024) regarding how RPAS integrates with AI in pursuit of better audit outcomes and presents some empirical evidence of its effectiveness in a number of dimensions of internal auditing.

Although it may contribute to various aspects, the study also has some limitations. First, the current research, being mainly quantitative in nature, does not delve into the different experiences and challenges auditors may face in implementing RPAS. Furthermore, the study investigates only the short-run implications of RPAS adoption and does not consider longer-run implications, such as technology obsolescence, integration of systems, and changing roles of human auditors. An in-depth cost-benefit analysis with regard to the implementation of RPAS was beyond the scope of this study; it would, however, be a very valuable contribution to financial decision-making. Possible future research directions might overcome these limitations by studying the impacts of RPAS in various industries and across different geographical regions. A comparison of various developed and developing economies' financial institutions may present insights on how regional factors affect RPAS adoption and its outcomes. Qualitative research could also shed light on the challenges and management changes associated with the integration of RPAS in internal auditing. Future studies sld alshouo examine the enhancement of internal auditing practices through the integration of enabling technologies like blockchain, advanced analytics, and artificial intelligence into RPAS. Cost-benefit analyses and return-on-investment evaluations should also generate practical guidelines that can assist an organization in considering the implementation of RPAS.

CONCLUSION

The study focused on analyzing the effect of artificial intelligence using the robotic process automation system RPAS on the efficiency of internal audit operations at Jordanian commercial banks. The findings confirm that robotic process automation systems enhance the internal audit process and play an important beneficial role in increasing the efficiency of internal audit in all dimensions: management dimension, quality of planning dimension, quality of audit engagement execution dimension, and quality of results communication dimension, by saving cost of operations, eliminating human errors, and smoothing work processes. Hence, the technological shift has transformed internal auditors from mundane, process-oriented tasks to high-value roles focused on strategic oversight and value creation.

The study's results imply that the robotic process automation system can lead to better conditions for the banks in terms of the efficiency of internal audit, IT innovations, and, thereby, banks' efficiency

and performance. By these means, Jordanian commercial banks as one of the most crucial sectors in the national economy needed to develop and adopt the robotic process automation system to improve their efficiency and serve customers in a much proper way. This paper has provided additional evidence on the link between robotic process automation systems and the efficiency of internal auditing in the Jordanian context. Therefore, the study recommends that further research on this topic be conducted in different regions and cultures.

AUTHOR CONTRIBUTIONS

Conceptualization: Abdalla Alassuli.
Data curation: Abdalla Alassuli.
Formal analysis: Abdalla Alassuli.
Investigation: Abdalla Alassuli.
Methodology: Abdalla Alassuli.
Software: Abdalla Alassuli.
Supervision: Abdalla Alassuli.
Writing – original draft: Abdalla Alassuli.
Writing – reviewing & editing: Abdalla Alassuli.

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