

An Empirical Study on the Impacts of the Fourth Industrial Revolution Technologies on Internal Audit in Jordanian Banks

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Abstract. This study aimed to study and impact of the techniques of the Fourth Industrial Revolution on internal auditing processes in Jordanian banks, especially in light of the expansion of their use and application during the Corona pandemic crisis. As its use contributed to the development of accounting systems and changes in the concepts and methods of processing transactions, accounting data, internal control, and greater attention to cyber security, and it contributed to improving the quality of financial reports, which led to the need to develop an internal audit process. The inductive method was used in the study by referring to the theoretical literature to identify the impact of the use of digital technologies on the problem of auditing, designing a questionnaire that deals with the subjects of the study and analyzing data in the SPSS program. As for the study population and the study sample, it was the internal audit departments and members of the audit committee of the Jordanian commercial and Islamic banks, where the valid questionnaires for analysis were 64 questionnaires. The study concluded that the techniques used in the Fourth Industrial Revolution (4IR) achieved many advantages for internal auditing (improving the quality of completion speed, increasing work efficiency, achieving independence, and making the audit process more accurate and effective), and contributed to the development of knowledge and practical skills of the auditor As for its impact on the audit process, there was a high degree of influence between the use of technology (Internet Things, Blockchain) and a medium degree between technology (Big Data, Robot) internal audits. study recommends the need to update the legislative environment regulating digital transactions, especially those related to the rights and duties of the auditor, update professional standards to suit the development of digital technologies, and work on developing audit evidence and guidelines for the auditor to help him identify audit risks and evaluate internal control systems, especially information security (cyber) in The use and application of digital technologies. This study dealt with a new topic, which is the auditing processes under the tools of digital technologies. One of the new and unexplored topics is considered a modest beginning and encourages researchers to study each technology separately. It is considered the basis for the preparation of the next studies.

Key words: Digital technologies, Fourth Industrial Revolution(4IR), internal auditing, Jordanian banks, evidence audit

1. Introduction

Today, the banks witness a remarkable development of the role played by modern financial technologies in all economic and social life sectors of the countries. and principle focusing on information technologies and digital applications as one of the basic factors of progress and development has become a recognized matter. The fourth industrial revolution refers to a set of integrated technologies that automate processes and introduce new forms of interaction between humans and machines.

Using the Technologies of the fourth industrial revolution (4IR) in the banks has resulted in an increase of data volume as well as emergence of new scientific concepts and practical practices which have not been previously available in addition to advanced analytics and smart processors. Internet of things(*), blockcahin, robotics, (*)big data are among the most important 4IR technologies affecting accounting and auditing; 4IR technologies have obviously changed the concepts of planning, analysing and designing the information systems in general and the principles of designing banking accounting information systems in particular; in addition, some elements such as robotics and blockchains have been added to accounting systems. Consequently, other details have been added to the life cycle of accounting information system; and manual traditional tasks performed by the accountant and internal auditor have largely been reduced and replaced by analytical and consultative tasks. And the roles played by human and robots in conducting many accounting processing and internal audit procedures have been exchanged. 4IR technologies have improved the quality of financial reports because they have increased the levels of characteristics of reliability and relevance have increased and the quality of the accounting information systems; in addition, a high level of integration among 4IR technologies has made the relationships between the management, accounting, and audit intertwined.

4IR technologies reduce the personal judgments and estimates issued by the auditor due to the increase of a percentage of accuracy and confidence; furthermore, these technologies require an update of some international audit standards, and internal audit standards; or they may need an issuance of new standards.

Due to the use of 4IR technologies, evidence collection means and tools using in audit process have be changed; as a result, evidence forms and an organization and planning of audit process as well as risk assessment and analytical audit procedures have fundamentally changed; moreover, new concepts such as auditing by exception, real time accounting, real time and automatic audit, financial analysis of big data, The corona virus pandemic has greatly contributed to a rapid shift toward the used digital technologies in performing banking and financial transactions as well as buy/sell processes.

This study aims to clarify the most important digital technologies used at the present time by banks, which were covered by the study ((Internet of Things, Big Data, Blockchain, Robots) and their impact on audit planning processes and audit procedures and collecting evidence and their impact on the audit report in the most important sectors that use digital technologies In Jordan, which are banks, and a statement of the most important challenges facing the auditor in light of the use of digital technologies (Internet of Things, big data, block chain, robots) in carrying out banking transactions in Jordanian banks.

Therefore, this study is important because it is the first study - as far as the researcher knows - to study the impact of using this modern digital environment on the performance of banking transactions and internal audit procedures; This modern banking environment. It affected the audit processes (planning, evidence collection, evaluation of the internal audit system, expressing opinions and issuing reports). Thus, the study seeks to answer the question

What is the impact of digital technologies used in banking transactions in Jordanian banks on internal audit operations?

Topics of study can be represented by the following form:

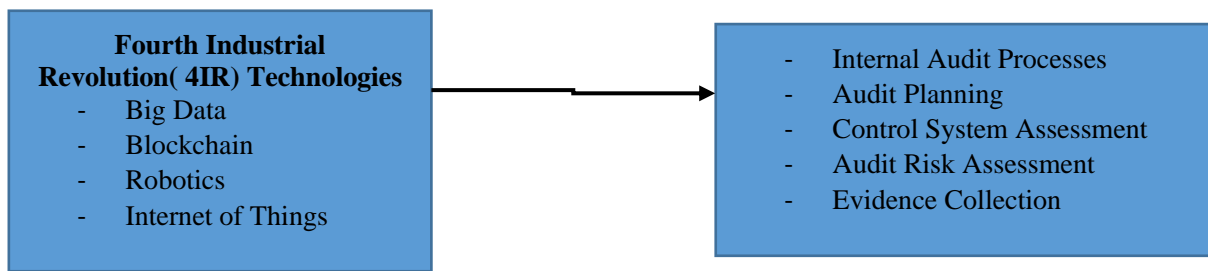


Fig. 1: Model of Study

2. Literature Review and Theoretical Framework

2.1 Literature Review;-CPA and AICPA's study (2017)

touched upon the potential impacts of digital blockchain technology on account auditing, financial reports and additional assurance services performed by the auditor in the light of this modern technology. The study reached that digital blockchain has affected all stages of accounting cycle, starting with the occurrence of financial transactions, their processing and authorizing and closing with their registering. Consequently, current audit model has been affected by blockchain technology; accordingly, methods and procedures of audit processes must be modified in order to be compatible with the 4IR technologies. In addition, blockchain technology provides a greater amount of data as well as greater possibilities for analysing the data, thereby creating additional assurance services performed by the auditor. Accordingly, he/she shall improve his/her technological knowledge in response to these additional services. Abreu et al s' study (2018) analyzed the concept of the digital blockchain and how it has transformed from a mere concept to applicable thing; various companies such as Vardy, Libra and Factom have applied this technology. Furthermore, this study touched upon the advantages which blockchain technology can add to the auditor profession. For example, this technology has decreased the workload of the auditor since it has provided the data; in addition, it reduces the chances of fraud to a minimum degree. Furthermore, this study illustrated that audit profession shall be developed in a manner that is consistent with this modern technology. Cae et al. s' study (2018) touched upon the applications resulting from the use of the blockchain technology in financial reports and audit processes; the study analyzed the competition between the auditors, audit quality, fundamental errors of audit client, and the organization policy through using one framework. Accordingly, the study illustrated that collaborative audit in which the digital blockchain is used, may improve the audit efficiency of the transactions registered in a database and transactions performed between the auditors through zero-knowledge protocols, maintaining data privacy. Thus, the study found that the blockchain technology will change the audit process's pricing strategy ; instead of relying client size, the auditors participating in the blockchain and transaction size will be taken into account. In addition, the study illustrated that using the digital blockchain will decrease the errors of auditors' reports and will reduce the costs of the samples since the errors are at their lowest level. Chedrawi and Howayeck's study (2018) focused on the properties of the digital blockchain and the impact of these properties on the audit profession; the study also illustrated the method which the auditors shall use in order develop themselves for facing this technology. In addition, the study indicated that the cost of development, which the profession bear, automatically decrease while the digital blockchain is being applied due to the reduction of the risks and information uniformity. Furthermore, the study recommended that the professional bodies shall develop the audit model which is consistent with the environment of the digital blockchain technology. Bonson and Bednarova's study (2019) provided a general view of accounting and auditing systems in which the digital blockchain technology has been inserted, through analysing the relevant previous studies. In addition, it indicated that this modern technology shall be integrated with the accounting information system in order to take advantage of this technology. Furthermore, the study identified the impacts of the blockchain

technology on the audit profession such as adding the reliability and control over the transactions performed via the network. Finally, the study recommended that audit profession shall necessarily keep pace with this modern technology. Brender et al's study (2019), conducted in Switzerland, examined the potential impacts of the digital blockchain technology on the auditor's tasks and activities in Switzerland; the sample was consisted of 34 auditors. The results concluded that there are three categories of the auditor; the first category of the auditor indicated that there is no a substantial impact on the auditor's tasks and activities; the second category indicated that there will be a qualitative shift of audit profession due to this modern technology; and the third indicated that this technology will completely change the audit profession .Liu et at.'s study (2019) identified the impacts of using the blockchain technology on the accounting and auditing processes; the study examined two types of digital blockchain: permission blockchain (private blockchain) and permission less blockchain (public blockchain). Furthermore, the study concluded that the auditors shall necessarily adapt to the modern technology because they are strategic partners in this technology. Nakhal's study (2020) was to identify the impact of the blockchain technology on auditor's legal responsibility divided into: (1) responsibility towards the customer, (2) responsibility towards the primary user,(3) responsibility towards the expected user, and (4) and responsibility towards the predictable user. In this study, a stratified random sample was used; it consisted of 74 respondents; the study found that using the blockchain technology increase the responsibility of the auditor towards the customer or the primary user, and the expected user or the predictable user. The study (Muhammad Zarlis. Marcel2023). showed that digital transformation has a positive impact on business performance and organizations may fail to understand their true nature as being about business. Current signals of digital transformation do not clearly distinguish this Digitization or adoption of technology, and current paradigms and frameworks are often abstract, making them It is difficult for organizations to find practical application guidelines. This paper reached the conclusion Three key characteristics of successful digital transformation are transforming business capabilities, Transforming data management capabilities, transforming IT roles. And study Hai (2023) showed that banks spend money to develop mobile banking applications, and aimed to explore the main factors that affected the adoption of mobile banking services for customers and those with low incomes in particular. Including the purpose of using mobile banking services. and User acceptance of Mobile Banking Services. Abdulrahman Hashem. (2023 study aimed to explore the impact of big data analysis on the relationship between blockchain technology (decentralization, improving security and transparency, smart contracts and tokens) and financial services In the financial brokerage firms in the Amman Stock Exchange. A questionnaire was distributed to a sample of (84) managersInside the brokerage firms. The study concluded that the existence of an integration between big data and the block chain technology creates a great value for financial services. Al-Khasawneh, R.O(2023) The study aimed to explain the internal control procedures when using digital banking technologies in light of the Corona pandemic. Internal control. And that digital banking applications and systems, which are used by Jordanian banks, have informational characteristics that make the internal control system more effective and efficient during the Corona pandemic. The study showed that general administrative or regulatory oversight measures have achieved the effectiveness of digital banking applications and services used by Jordanian banks in light of the Corona pandemic. Data security and safety procedures and systems have greatly affected the effectiveness of digital banking applications.

The previous studies dealt with various topics related to the study, but not directly, and because the subject of the study is one of the modern topics, and it is comprehensive of the types of dysfunctional digital technologies. Digital :From the theoretical literature review, the researcher can summarize the impact of the tools of the Fourth Industrial Revolution on the audits of the following topics:

2.2 The Impact of Fourth Industrial Revolution(4IR) Technologies On Internal Audit Processes

Internet Of Things and Its Impact on Internal Audit

Internet of things technology advanced sensors and chips embedded in the items, products and devices surrounding the people; these digital sensors transmit valuable real –time data illustrating the method used by the people in order to interact with their surroundings and make decisions. Furthermore, the data collected is used in order to enhance the design and production of tools, devices and techniques improving all aspects of life. Internet of things provides a common language as well as an integration of the data, software and applications which help the scientists and inventors conduct the analyses required for developing a particular field.

Internet of things technology will positively affect the internal audit process; it will change the method in which audit process of all banking activity is conducted; in addition, it will change audit methods and practices, for example, the auditor will quickly and remotely collect real-time data, thereby contributing to a quick completion of audit works. Accordingly, all audit tasks can quickly and continuously be performed; and problem, if any, can directly be addressed without a delay.

Big Data and Its Impact on Internal Audit

In audit field, some studies have concluded that big data broadens the framework and scope of audit processes, timing and procedures as well as costing of audit process. In addition, a nature of audit evidence differs from paper and electric evidence to digital evidence which can be obtained from the digital technologies such as Radio-frequency identification (RFID) and global position system (GPS) and internet of things (IOT). As a result, company management, control system, and continuous audit tasks are overlapped through multiple layers (layer upon layer) graded in terms of a level of data complexity, analytical procedures as one of the evidence, the difference of risk nature and types due to the changes of many cases such as risk types and fraud through the digital systems.

Blockchain Technology and Its Impact on Internal Audit

Blockchain technology will drastically change the accounting books because they are considered unchangeable and encrypted central ledgers which provide a more transparent framework; this technology provides unchangeable records where the accounting policies and estimates can permanently be included, thereby reducing the manipulation cases. This technology intervene deliberately in internal control systems and profit management systems, so that audit risks will reduce; in addition, blockchain technology simplifies and improves auditor works; for example, the auditor can perform audit tasks immediately after the transaction is completed and accounting entries are established; furthermore, by using the blockchain technology, internal audit work can be implemented immediately after preparing financial statements, so that audit period and cost will reduce. But, auditor skills shall be developed in order to be consistent with this technology. Furthermore, other studies indicated that audit process will be more complicated as it will expand to include the software and code auditing, and the instruction written in one of programming language and codes used in blockchain in order to ensure that they are safe and process correctly the data.

Robotics Technology and Its Impact on Internal Audit

When robotics technology is used, the auditor will be required to verify the governance of robots, and distinguish between the processes that can be automated and the processes that cannot be automated in accordance with the following factors: the risk related to the process, the degree of its complexity, the degree of variation of results of the decision resulting from the process. By identifying these factors, the company will achieve various benefits related to the cost and efficiency. Furthermore, the auditor shall take into account the following: the robots may not always do what we need and they do not think like a human. In addition, he/she shall check and update software of these robots in order to be compatible with the changes, requirements and nature of environment of banking works and services. Al-Khasawneh, (2021)

The following hypotheses shall be tested by a study:

H1 -The use of the 4IR technologies in the banking transactions in Jordanian banks contributes to the achievement of various advantages of the internal audit processes;

H2-There an impact relationship between the use of the 4IR technologies in performing the banking

transactions and the internal audit processes performed in Jordanian banks;

H3- Various challenges which face the internal audit processes due to the use of the 4IR technologies in Jordanian banks.

3. Results

3.1 methodology and population of Study and Sample

Use the inductive method to collect and analyze relevant data. The deductive method was used to design an appropriate questionnaire focusing on the impact of the technologies of the fourth industrial revolution on the internal audit operations in Jordanian banks. The statistical package (SPSS) was used to analyze the responses of the respondents. The study population is banks in Jordan. The study sample consisted of 16 Jordanian Islamic and commercial banks. In order to achieve the purposes of the study, the branches of foreign commercial and Islamic banks operating in Jordan were not included, due to the various regulations and instructions issued by the main center, and the internal audit department comes outside Jordan, and the researcher could not reach and visit them. It distributed to a member of the Audit Committee for its responsibility for the audits and the internal auditor affected by the use of digital technologies operations. Four questionnaires were distributed to each bank. All 64 questionnaires were retrieved

3.2 Data Collection and Analysis

For answering questionnaire's questions and testing study hypotheses, Five-likert scale has been used. A numerical values of the five responses are as follows: 1 – strongly disagree, 2– disagree, 3- neutral, 4- agree and 5- strongly agree. And have been using the ranges as follows: 1.00 – 2.33 means that a little impact; 2.34-3.67 means that there is a moderate impact; 3.68 – 5.00 means that there is a high impact. . And the scale is calculated by the equation $\frac{\text{Upper limit (5)} - \text{Lower limit (1)}}{\text{Number of required categories (3)}} = \frac{5-1}{3} = 1.33$ Then , the answer (1.33) is added to the end of each category.

3.3 Reliability of Study Tool

For ensuring study tool's reliability, the following table presents Cronbach's alpha and the calculated ratios are acceptable and suitable for the purposes of the study

Table 1. Cronbach's alpha Coefficients of study

the axes	Internal Consistency
The impact of using the 4IR technologies on the internal audit processes	0.83
The advantages achieved by the use of the 4IR technology to the internal audit in Jordanian banks	0.77
The challenges face the auditor while auditing banking transactions in the digital technology environment	0.81

3.4 Hypotheses Testing and Result Analysis

3.4.1 Testing First Hypothesis

The first hypothesis states that using the 4IR technologies in banking transactions achieves various advantages to the internal audit processes. For testing the validity of this hypothesis, relevant arithmetic means and standard deviations of statements, stated in table 2 have been extracted.

Table 2. Standard deviations and Arithmetic means related to the first hypothesis

Paragraph	A member of audit committee			Internal auditor		
	Arithmetic mean	Standard deviation	Response orientation	Arithmetic mean	Standard deviation	Response orientation
Using the digital technologies in Jordanian banks has contributed to a quick implementation of internal audit works	3.72	.729	High	4.25	.803	High
Using the digital technologies in Jordanian banks has contributed to an improvement of level of internal audit quality	3.56	.619	Moderate	4.84	.369	High
Using the digital technologies in Jordanian banks has contributed to an increase of the efficiency of internal audit workflow	3.88	.751	High	4.22	1.039	High
Using the digital technologies in Jordanian banks has contributed to an achievement of internal auditor's independence	3.56	.619	Moderate	4.82	.369	High
Using the digital technologies in Jordanian banks has contributed to an increase of accuracy and effectiveness of internal audit process	3.69	.738	High	4.19	.471	High
Using the digital technologies in Jordanian banks has contributed to a development of auditor's knowledge skills and keeping pace with these developments.	3.52	1.047	Moderate	3.72	.924	High
Using the digital technologies in Jordanian banks has contributed to a development of auditor's practical skills and keeping pace with these developments.	3.53	.842	Moderate	3.94	1.134	High
Total	3.64	.479	Moderate	4.29	.406	High

Table 2 shows as follows

audit committee members' responses Arithmetic means of have ranged between 3.8 – 3.52; accordingly, response orientation is moderate; paragraph (3) has occupied the first rank; the arithmetic mean of responses' respondents has reached 3.88. in addition, paragraph 6 has occupied the last rank; and the arithmetic mean of responses from respondents has reached 3.52. Total arithmetic means of the advantages of using the 4IR technologies has reached 3.64.

Arithmetic means of responses of internal auditors have ranged between 3.72 – 4.84; and response orientation has been high; paragraph 2 has occupied the first rank; the arithmetic mean of responses' respondents has reached 4.84. Paragraph 6 has occupied the last rank; and the arithmetic mean of responses' respondents has reached 3.72. and total arithmetic mean of the advantages of using the 4IR technologies has reached 4.29

For testing the hypothesis, arithmetic mean of responses of audit committee members, internal auditors has been compared with standard mark (3) - hypothesis acceptance standard- by using t-test as stated in table 3.

Table 3. T-test of one sample in comparison with the hypothetical mean (70%)

First Hypothesis	Arit. Mean	Stand Deviation	T- Value	Freedom degrees	Statistical Significance
From the point of view of internal auditor	4.29	.406	17.928	31	.000
From the point of view of audit committee	3.64	.479	7.545	31	.000

Table 3 illustrates the following results:

There are statistical differences at ($\alpha = 0.05$) between the performance and hypothetical mean of the advantages of using the digital technologies based on the responses of audit committee members; and t- value has reached 7.545 and the statistical significance has reached (0.000) which is statistically accepted.

Based on the responses of internal auditors, there are statistical differences at ($\alpha = 0.05$) between the performance and hypothetical mean of the advantages of using the digital technologies; t-value has reached 17.928 and the statistical significance has reached (0.000) which is statistically accepted.

The presence of statistically significant differences ($\alpha = 0.05$) between the arithmetic mean. and the standard mark (3) of the respondents of audit committee members and internal auditors indicates that the first hypothesis is accepted.

3.4.2 Testing Second Hypothesis

Second hypothesis states that there is an impact relationship between the use of the 4IR technologies' in performing the banking transactions and the internal audit processes in Jordanian banks.

Analyzing the impact of 4IR technologies on the internal audit process from the audit committee's point of view

To test hypothesis' validity, standard deviations and arithmetic means of the field of the impact of the 4IR technologies on the internal audit process have been extracted as stated in table 4.

Table 4. Arithmetic means and standard deviations of the the impact of the 4IR technologies on the internal audit process the audit committee's point of view

No	Field	Arit. mean	Stand deviation
1	The impact Internet of Things on the internal audit process	3.70	.529
2	The impact Blockchain on the internal audit process	3.69	.489
3	The impact Robotics on the internal audit process	3.66	.430
4	The impact Big data and its impact on the internal audit process	3.63	.488
	Total impact of the 4IR technologies on the internal audit process audit committee's point of view	3.67	.432

Table 4 illustrates that the arithmetic means have ranged between 3.63 – 3.70; and the field of the impact of the internet of things technology on the internal audit process has occupied the first rank; and it has reached the highest arithmetic mean, 3.70. Whereas the field of big data and its impact on the internal audit process has occupied the last rank; its arithmetic mean has been has reached 3.63. And total arithmetic mean of the impact of the digital technologies has reached 3.67. Arithmetic means and standard deviations of estimates of respondents of study sample related to each paragraph of each field have been separately calculated as follows:

Table 5. Arithmetic means, standard deviations of the paragraphs related to the second hypothesis from the point of view of audit committee members

The impact of the 4IR technologies on the internal audit process in Jordanian banks based on the responses of the audit committee members											
the4IR technologies	Plannin g	Control system assessment	Contro l risk estimat e	Developi ng audit program	Identifyi ng audit strategy	Evidence collection methods	Proof evidence amount	Proof eviden ce quality	Audit report preparatio n	Control system report	Total
Internet of Things	3.56	3.57	3.81	3.81	3.81	3.88	3.63	3.66	3.66	3.63	3.70
Blockchain	3.50	3.72	3.94	3.72	3.66	3.94	3.56	3.72	3.47	3.72	3.69
Robotics	3.47	3.94	3.72	3.56	3.46	3.69	3.63	3.69	3.66	3.75	3.66
Big Data	3.72	3.72	3.66	3.47	3.43	3.53	3.63	3.75	3.73	3.66	3.63
Total											3.67

Table 5 shows the following results:

The arithmetic means of internet of things technology have ranged between 3.56 – 3.88; and the paragraph stating that internet of things technology used in the banking transactions has affected the nature of the evidence, has occupied the first rank; and its arithmetic mean has been 3.88; whereas the paragraph stating that internet of things technology used in the banking transactions has affected audit process planning, has occupied the last rank and its arithmetic mean has been has reached 3.56. Total arithmetic mean of the impact of the field of internet of things has reached 3.70. According to the responses of audit committee members, response orientation has been high.

The arithmetic means of blockchain technology have ranged between 3.94 – 3.47; and the paragraph stating that blockchain technology has affected control risk estimate and the nature of evidence, has occupied the first rank; and its arithmetic mean has been 3.94; whereas the paragraph stating that the use of blockchain technology in the banking transactions has affected the audit report, has occupied the last rank and its arithmetic mean has been has reached 3.47. Total arithmetic mean of the impact of the field of blockchain technology has reached 3.69. according to the responses of audit committee members, response orientation has been moderate.

The arithmetic means of robotics technology have ranged between 3.46 – 3.94; and the paragraph stating that the use of robotics technology in the banking transactions has affected audit risk assessment, has occupied the first rank; and its arithmetic mean has been 3.94; whereas the paragraph stating that the use of robotics technology in the banking transactions has affected the process of developing the audit program, has occupied the last rank and its arithmetic mean has been has reached 3.46. Total arithmetic mean of the impact of the field of robotics technology has reached 3.66. From the point of view of audit committee members, response orientation has been moderate.

The arithmetic means of big data technology have ranged between 3.43 – 3.75; and the paragraph stating that the use of big data technology in the banking transactions has affected proof evidence collection methods, has occupied the first rank; and its arithmetic mean has been 3.75; whereas the paragraph stating that the use of big data in the banking transactions has affected the process of developing the audit program, has occupied the last rank and its arithmetic mean has been has reached 3.43. Total arithmetic mean of the impact of the field of big data technology has reached 3.63.

Analyzing 4IR technologies' impact on the internal audit process based on the responses of the internal auditors

Table 6. shows the 4IR technologies' impact on the audit process based on the responses of the internal auditors.

Table 6. Arithmetic mean, a standard deviation of the field 4IR technologies' impact from the point of view of internal auditors

Field	Arith mean	Stand deviation
1 The impact Internet of Things on the internal audit process	4.21	.405
2 The impact Blockchain on the internal audit process	4.01	.527
3 The impact Robotics on the internal audit process	3.87	.405
4 The impact Big data and its impact on the internal audit process	3.91	.737
Total impact of the 4IR technologies' on the internal audit process internal auditors point of view	4.00	.469

Table 6 showed that the have ranged arithmetic means between 3.91 – 4.21; and the field of the impact of the internet of things technology on the internal audit process has occupied the first rank; and it has reached the highest arithmetic mean, 4.21. Whereas the field of big data technology and its impact on the internal audit process has occupied the last rank and its arithmetic mean has been has reached 3.91. Total arithmetic mean of the impact of the 4IR technologies has reached 4.00.

Table 7 shows Arithmetic means and standard deviations of estimates of respondents of study sample related to each paragraph of each field have been separately calculated as follows:

Table 7. Arithmetic means, standard deviations of the paragraphs related to the second hypothesis based on the responses of the internal auditors

the 4IR technologies impact on the process of performing an internal audit in Jordanian banks according to the responses of the internal auditor											
4IR technologies'	Planni ng	Control system assessment	Contr ol risk estim ate	Developi ng audit program	Identifi ying audit strate gy	Evidence collection methods	Proof eviden ce amount	Proof evide nce qualiti y	Audit report preparati on	Control system report	Total
Internet of thing technology	4.84	4.34	4.13	4.13	4.47	4.22	4.19	3.94	3.66	4.19	4.21
Blockchain technology	3.97	3.78	4.13	3.81	3.84	3.75	3.84	4.25	4.13	3.63	4.01
Robotics technology	4.18	3.78	3.78	3.75	3.84	4.19	3.72	4.13	3.56	3.78	3.87
Big data technology	3.84	3.81	3.94	4.00	4.00	3.94	4.19	3.84	3.78	3.75	3.91
Total											4.00

Table 7 shows the following results:

The arithmetic means have ranged between 3.66 – 4.84; and the paragraph, the internet of things stating that technology used in banking transactions has affected the audit process planning, has occupied the first rank; and its arithmetic mean has been 4.84; whereas the paragraph, stating that internet of things technology used in the banking transactions has affected the audit report, has occupied the last rank and its arithmetic mean has been has reached 3.66. Total arithmetic mean of the impact of the field of internet of things has reached 4.21.

The arithmetic means of blockchain technology have ranged between 3.63 – 4.84; and the paragraph stating that blockchain technology has affected the proof evidence amount, has occupied the first rank; and its arithmetic mean has been 4.84; whereas the paragraph stating that the use of blockchain technology in the banking transactions has affected the internal control system report, has occupied the last rank and its arithmetic mean has been has reached 3.63. Total arithmetic mean of the impact of the field of blockchain technology has reached 4.01.

The arithmetic means of robotics technology have ranged between 3.56 -4.19; and the response orientation has been high. In addition, the paragraph stating that the use of robotics technology in the

banking transactions has affected the nature of the proof evidence, has occupied the first rank; and its arithmetic mean has been 4.19; whereas the paragraph stating that the use of robotics technology in the banking transactions has affected the audit report, has occupied the last rank and its arithmetic mean has been has reached 3.56. Total arithmetic mean of the impact of the field of robotics technology has reached 3.87.

The arithmetic means of big data technology have ranged between 3.75 – 4.19; and the paragraph stating that the use of big data technology in the banking transactions has affected proof evidence amount, has occupied the first rank; and its arithmetic mean has been 4.19; whereas the paragraph stating that the use of big data in the banking transactions has affected the internal control system report, has occupied the last rank and its arithmetic mean has been has reached 3.75. Total arithmetic mean of the impact of the field of big data technology has reached 3.91. Based on the responses of the internal auditor, response orientation has been high.

For testing the hypothesis, arithmetic mean of responses of internal auditors and audit committee members has been compared with standard mark 3- hypothesis acceptance standard- by using t-test as stated in table 8.

Table 8. T-test of one sample in comparison with the hypothetical mean (70%)

Second Hypothesis	Arithmetic Mean	Standard Deviation	T-Value	Freedom degrees	Statistical Significance
Based on the responses of internal auditor	4.00	.469	12.076	31	.000
Based on the responses of audit committee members	3.67	.432	8.776	31	.000

Table 8 shows the results:

There are statistical differences at ($\alpha = 0.05$) between the performance and hypothetical mean of the impact of the digital technologies; t-value has reached 8.776 and the statistical significance has reached (0.000) which is statistically accepted.

There are statistical differences at ($\alpha = 0.05$) between the performance and hypothetical mean of the impact of the digital technologies; t-value has reached 12.076 and the statistical significance has reached (0.000) which is statistically accepted.

The presence of statistically significant differences at ($\alpha = 0.05$) between the arithmetic mean and the standard mark 3 of the respondents of audit committee members and internal auditors indicates that the second hypothesis has been accepted.

3.4.3 Third Hypothesis

Third hypothesis Testing stipulates that there are various challenges which face the internal audit processes due to the 4IR technologies used in Jordanian banks. To test the hypothesis' validity, arithmetic means and standard deviations of paragraphs regarding third hypothesis have been extracted as stated in table 9.

Table 9. Standard deviations and Arithmetic means of the challenges which face the internal audit processes due to the use of the 4IR technologies

Paragraph	A member of audit committee			Internal Auditor		
The internal auditor faces various challenges due to the 4IR technologies used in Jordanian banks as follows:						
	Arithmetic mean	Standard deviation	Response orientation	Arithmetic mean	Standard deviation	Response orientation
A lack scientific knowledge of the field of the digital technologies	3.50	.718	moderate	3.97	.782	High

A lack of practical knowledge of the field of the 4IR technologies	3.47	1.047	moderate	3.84	1.221	High
A lack of legislations consistent with the digital applications	3.72	.888	Moderate	3.63	.976	High
A lack of professional standards for the auditing in the light of the digital applications	3.56	.619	moderate	4.84	.369	High
A diversity of the risks in the light of the digital applications	3.88	.751	Moderate	4.22	1.039	High
A lack of suitable auditing software	3.81	.780	moderate	4.47	.567	High
Diversity and development of the digital devices	3.44	.878	Moderate	3.88	1.238	High
Total	3.63	.461	Moderate	4.12	.565	High

Table 9 shows the results:

Based on the responses of the audit committee members, the arithmetic means have ranged between 3.44 – 3.88; and the responses orientation has been moderate; the paragraph -the challenge of the diversity of risks- has occupied the first rank; and its arithmetic mean has been 3.88. Whereas the paragraph - the challenge of the diversity and development of the digital devices-has occupied the last rank and its arithmetic mean has reached 3.44. Total arithmetic mean has reached 3.63.

Based on the responses of the internal auditors, the arithmetic means have ranged between 3.63 – 4.84; and the responses orientation has been high; paragraph 1 - the challenge of a lack of standards- has occupied the first rank; and its arithmetic mean has been 4.84. Whereas paragraph 4 - the challenge of a lack of suitable legislations - has occupied the last rank and its arithmetic mean has reached 3.63. Total arithmetic mean of the challenges has reached 4.12.

For testing third hypothesis, arithmetic mean of internal auditors and audit committee members' responses has been compared with standard mark 3 - hypothesis acceptance standard- by using t-test as stated in table 10.

Table 10. T-test of one sample in comparison with the hypothetical mean (70%)

Third Hypothesis	Arithmetic Mean	Standard Deviation	T-Value	Freedom degrees	Statistical Significance
Based on the responses of the internal auditors	4.12	.565	11.227	31	.000
Based on the responses of the audit committee members	3.63	.461	7.661	31	.000

Table 10 shows the following results:

Based on the responses of audit committee members, it has been shown that there are statistical differences at ($\alpha = 0.05$) between the performance and hypothetical mean of the challenges; t-value has reached 11.227 and the statistical significance has reached (0.000) which is statistically accepted.

Based on the responses of the internal auditors, it has been shown that there are statistical differences at ($\alpha = 0.05$) between the performance and hypothetical mean of the challenges; t-value has reached 11.227 and the statistical significance has reached (0.000) which is statistically accepted.

The presence of statistically significant differences at ($\alpha = 0.05$) between the arithmetic mean and the standard mark 3 of the respondents of audit committee members and internal auditors indicates that hypothesis third has been accepted,

4. Discussion

The study aimed to demonstrate the most important advantages achieved by the technologies of the Fourth Industrial Revolution and their impact (Big Data, Block chain, Robotics, Internet of Things) on (Audit Planning, Control System Assessment. Audit Risk Assessment, Evidence Collection). By distributing 64 questionnaires to (internal audit departments - those affected by the use of industrial

revolution technologies on their tasks and work and members of the audit committee because they are the category that organizes audit procedures and defines their tasks) in Jordanian banks. The study clarified the challenges facing the internal auditor while performing internal audit tasks and the results can be discussed as follows.

The use of the digital technology has achieved various advantages to the internal audit. For example; it increases the levels of internal audit process' quality , rapidness and efficiency; in addition, it provides the auditor with the independence; and it makes the audit process more accurate and efficient; it also develops the knowledge and practical skills of the internal auditor; according to the responses of the audit committee members, the impact of using the 4IR technologies is moderate, whereas according to the responses of the internal auditors, the impact of using the digital technologies is high;

There is a high degree of impact relationship between the use of Internet of Things technology in banking transactions and the internal auditing processes that take place in Jordanian banks. According to the responses of the internal auditor,;

There is a high degree of impact relationship between the use of big data technology in banking transactions and internal audits based on the responses of internal auditors;

There is an impact relationship between the use of blockchain technology in banking transactions and the internal audit processes performed by Jordanian banks is high; based on the responses of audit committee members and the internal auditor;

There is an impact relationship between robotics technology in the banking transactions and the internal audit processes performed by Jordanian banks; according to the responses of the impact of using robotics technology is moderate whereas the impact of using robotics technology is high according to the responses of the internal auditor,

There is a moderate degree of impact relationship between the use of the 4ir technologies (internet of things, big data, blockchain and robotics) in implementing the banking transactions and the internal audit processes performed by Jordanian banks; according to the responses of the audit committee members, whereas the impact of using the digital technologies is high according to the responses of the internal auditor;

face internal auditors many challenges due to the use of the 4ir technologies as a whole (internet of things, big data, blockchain, and robotics) in Jordanian banks; these challenges are as follows: a weakness of scientific and practical knowledge of the auditor in the field of electronic technologies, diversity of relevant risks, a lack of the professional organized standards, and a lack of suitable audit software. Based on the responses of the audit committee members, these challenges are moderate, whereas, these challenges are high according to the responses of the internal auditors.

5. Conclusion

The use of the tools of the industrial revolution in providing banking services has achieved many advantages such as accuracy and speed in completing banking services and reducing costs, but this modern environment has affected the processing and storage of data. In addition to the need to update professional standards to comply with developments in 4IR techniques related to planning and evaluating the internal control system, audit risks and the nature and amount of evidence, internal auditors must participate in the creation and development of digital means .However, this current study was limited to the following:

Jordanian banking sector (internal auditor, members of the audit committee)

Tools of Fourth Industrial Revolution (4IR) Technologies under study (Big Data, Blockchain,Robotics ,Internet of things)

Fiscal year 2022-2023

Based on the previously presented results, discussions, and conclusions, the current study

recommends following:

Developing legislation, professional standards, and guidelines that regulate the audit process to suit the development in the use of digital tools.

Holding training courses for the internal auditor specialized in digital tools and the use of experts who have knowledge of digital tools in the internal audit departments and to be part of the audit teams

Supporting the internal audit departments with hardware and software that can be used in auditing processes and are compatible with the development in the use of the tools of the Fourth Industrial Revolution.

Conducting studies on topics related to the risks of the tools of the industrial revolution, internal control and external auditing.

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