International Journal of Research in Finance and Management

P-ISSN: 2617-5754
E-ISSN: 2617-5762
IJRFM 2025; 8(1): 540-549
www.allfinancejournal.com
Received: 12-02-2025
Accepted: 17-03-2025

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The role of blockchain technology in reducing banking service costs and enhancing accuracy and transparency: An applied study on a number of private Iraqi banks

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DOI: https://www.doi.org/10.33545/26175754.2025.v8.i1f.475

Abstract
The objective of this study is to investigate the perception of employees in the Iraqi commercial banks concerning the impact of blockchain on operational cost, accuracy of banking operations, and transparency. The research utilized a descriptive analytical 'cross sectional' approach and the data was collected using the tested questionnaires on (200) employees. The descriptive statistics and Pearson correlation analysis, and a multiple linear regression were employed to analyze the data. We found that employees' perceptions of blockchain positively and significantly correlated with the three factors, where the transparency had the strongest correlation, followed by costs, and then accuracy. Result of regression also showed due to these perceived effects on DRVS and OP, it claimed that the BB adoption could contribute to the better performance of Iraq banks in both financial and operation sides. The research suggests raising professional awareness of blockchain, experimental research on its applications and development of a legal and regulatory system to promote its application in the Iraqi banking industry.

Keyword: Blockchain, operational costs, banking accuracy, transparency, Iraqi commercial banks

Introduction
The bank sector is significantly changing today, under the effect of technological developments; in which digitalization and financial innovation are playing a major role in improving banking activity productivity. Key among these innovations is blockchain technology as a disruptive innovation that can revolutionize fundamentally the way we make financial transactions. It is based in DLT (Distributed Ledger Technology) that makes transactions more secure, transparent and validate while decreasing financial intermediaries and therefore operational costs. Commercial banks in Iraq are still encountering a lot of problems including high transaction costs, low transparency and operational inconsistency which are affecting their efficiency and competitiveness. In view of global trends towards integrating blockchain in banking institutions, it is therefore necessary to evaluate the possibility of introducing this technology in commercial banks in Iraq and explore the possible effects on in reducing operating costs, increasing operational accuracy, and enhancing the transparency of financial activities.

Section One: Research Methodology
First: Research Problem
The research problem arises from a set of questions regarding: "The extent to which blockchain technology can be applied in Iraqi commercial banks and its role in reducing banking service costs and enhancing accuracy and transparency." To address the research problem, this study seeks to answer the following questions:

- How can blockchain technology contribute to reducing banking operation costs in Iraqi commercial banks?
- To what extent does blockchain impact the accuracy of financial data in Iraqi banks?
- How significantly can blockchain technology enhance the level of transparency in the

Iraqi banking system?

Second: Research Objectives

This research aims to:

1. Analyze the role of blockchain technology in reducing banking service costs within Iraqi commercial banks.
2. Evaluate the extent to which blockchain contributes to improving the accuracy of financial data and minimizing operational errors.
3. Examine the impact of blockchain on the level of transparency in Iraqi banking operations.
4. Explore the main challenges facing the adoption of blockchain in Iraqi commercial banks.

Third: Research Significance

This study contributes to expanding academic knowledge on the impact of blockchain technology in the banking sector, particularly within Iraqi commercial banks, thus helping to bridge the knowledge gap in this area. It also clarifies the role of blockchain technology in reducing banking service costs, enhancing financial accuracy, and increasing transparency, offering a clear vision of its economic benefits.

Improving Banking Performance: The study provides practical solutions for Iraqi commercial banks to increase operational efficiency, improve transaction security, and enhance transparency in banking operations.

Fourth: Research Hypotheses

To answer the research questions, the study is based on the following hypotheses:

- **First Hypothesis:** "There is a statistically significant positive correlation between employees' perceptions regarding the application of blockchain, measured through its dimensions, and each of the following: cost reduction, accuracy enhancement, and increased transparency in banking services within Iraqi commercial banks."
- **Second Hypothesis:** "There is a significant effect of employees' perceptions of blockchain on cost reduction, accuracy enhancement, and increased transparency in banking services in Iraqi commercial banks."

Fifth: Research Population and Sample

The research population consists of employees working in Iraqi commercial banks. The sample included 200 employees from various banking departments, selected through a validated questionnaire designed to measure their perceptions regarding implementing blockchain technology.

Sixth: Research Tools

1. **Descriptive Analytical Method:** Analyzing the impact of blockchain technology on banking services through a review of previous studies.
2. **Applied Method:** Main research tool: the questionnaire form.
3. **Data Analysis Tool:** The statistical program SPSS Version 26.

Section Two: Theoretical Framework

First Axis: The Conceptual Framework of Blockchain Technology

First: The Emergence and Development of the Blockchain Concept

The blockchain technology was first implemented by an anonymous individual or group of individuals under the name of "Satoshi Nakamoto" in the year 2008, as is, in an attempt to develop its first application for a digital cryptocurrency known as Bitcoin. This development was a significant breakthrough in the history of digital transactions and subsequently led the way for decentralized systems, to facilitate a safe and reliable financial transaction environment without intermediaries. The first generation of blockchain technology was mere to performing basic financial transactions, for example, payment and wired money to transmit the payment. Created as a transparent distributed digital ledger of all financial transactions that cannot be changed or deleted (Morkunas *et al*., 2019:2). Research and development began to extend to a wider range of applications as this technology developed. New uses of blockchain were appearing in many industries, including accounting, financial services, supply chain and healthcare. Although the importance of blockchain is increasing, it has not been universally adopted by all institutions (Javaid *et al*., 2022:2-3).

The blockchain technology is a type of distributed database, which handles storage of massive amounts of data inside a decentralized system. Data is recorded in time-stamped and encrypted "blocks" that are chronologically linked, which effectively secures them should they be added to the chain. It's called a block chain because a block of transactions is chained to the last block created, as every block in the chain holds a cryptographic hash of the previous block near as hell to impossible to manipulate or alter preceding data without the consent of everyone within a community (Ibrahim & Al-Omair, 2023:25).

The above are ideal for security and conservation of dataset, because information can be shared among several nodes in a distributed network, which improves reliability and reduces risk of hacking or falsification of data. An entry into the blockchain is unchangeable once it is written, this is what gives this technology the unique feature of data that is persistent and permanent (Khalouqi, 2025:3).

Second: Main Characteristics of Blockchain Technology

1. Blockchain has a number of unique and broad-based properties. Based on Puthal *et al*. (2018), Xue *et al*. (2021), Ben Aouf (2023:6) and Qasabi (2024:35), with the most notable features of blockchain being:
2. **Decentralized P2P Network:** In cascade blockchain model, data is maintained by decentralized and no any central authority owns all transaction data, which ensures that the data security is good and no one can tamper the transaction data.
3. **Open Source:** The blockchain's source code can be accessed and reviewed by the public, fostering trust and independent verification.
4. **No modifying of Records:** Once a data is posted to the blocks, then it is not possible to modify/delete the same which means that it records everything forever.
5. **Transparency:** Since the transactions are visible to all participants, there is less chance for disputed

transactions and it cuts down the number of times a business partner backtracks on agreements.

6. **Instant transaction settlement:** The Blockchain technology empowers instant transaction through a single step process, and process that is probably the key feature that we hate the most forthcoming in the existence of the banks.
7. **Decentralization:** Information is not stored on a single server, and thus does not rely on a middleman.
8. **Shared ledger:** All users have access to a single ledger that contains all transactions.
9. **Privacy:** Users transact with digital representations of themselves instead of with their identities.
10. **Traceability:** All transactions are traceable for integrity and clarity**.**

Third: The Mechanism of Blockchain Technology

Blockchain is derived from the broader theme of Distributed Ledger Technology (DLT) which is a cryptographically linked block of transactions which are immutable to tampering. No central intermediary is necessary, and all transactions are verified throughout the entire network leading to financial transactions being safe and trustworthy (Alkhudary, 2020). Blockchains are composed of a number of key pieces, including nodes, which are the devices connected to the network that validate a transaction is valid, as well as cryptographic hashing which ensures that no block of transactions can be changed after it is in the chain. Transactions are included via consensus mechanisms, like PoW or PoS, that prevent fraudulent attacks and protect system integrity (Ibrahim & Al-Omair, 2023:26).

When a transaction is created it is relay to all nodes in the network, their validity is validated by encryption alogorithm. The block is then attached to the previous block using cryptographic hashing, and with the approval of the transaction, it is added. There is a single shared ledger that each node has and has access to concurrently, and as such no data gets altered inside the ledger.

Second Axis: Blockchain Strategies in Banking Services

Blockchain has evolved to be one of the core instruments to support the revolutionary change in the banking industry, offering new ways to improve efficiency, reduce costs, increase transparency and make the banking business more secure and sustainable. Banks use a series of sophisticated tools and tactics to exploit the potential of blockchain to foster operational ease in finance, along with reducing the operational costs and increasing customer confidence.

First: Strategies for Adopting Blockchain in Banking Services

Due to the evolution of blockchain technology to the point where it can be widely used, banks have since developed plans focusing on how to reduce operation costs and leverage the maximum potential provided by the new technology. These strategies include:

1. **Developing Blockchain-Based Payment Systems:** Banks use blockchain-based digital payment services like Ripple and Stellar to help expedite interbank transactions and lower the amount of time it takes for an international transaction to settle. These networks reduce reliance on financial intermediaries, leading to cost reductions on international transfers and increased security of transactions (Sanjaya & Akhyar, 2022:45) [19].
2. **Adopting Smart Contracts in Banking Operations:** Smart contracts are used to facilitate financial operations by automatically executing agreed-upon conditions once all requirements are met. Smart contracts assist in managing guarantees and loans, with all details recorded on the blockchain network, ensuring transparency and minimizing the likelihood of fraud (Talhi & Zouadi, 2023:39) [6].
3. **Enhancing Security through Encryption and Distributed Ledger Technologies:** Security is one of the major challenges facing banking institutions, as financial data is increasingly vulnerable to cyberattacks. Blockchain provides a high level of security through advanced encryption and data immutability once recorded. This feature reduces the risk of fraud and transaction manipulation, as all financial operations are stored in a shared, tamper-proof ledger.
4. **Improving the Efficiency of Payments and Financial Transfers:** Traditional financial transfers, especially cross-border ones, take several days due to the need for intermediaries such as correspondent banks. With blockchain, international transfers can be executed in just a few seconds, significantly reducing the associated costs. For example, RippleNet relies on blockchain technology to settle payments quickly and efficiently, drastically reducing transaction time (Guo & Liang, 2016:24).
5. **Reducing Operational Costs for Banks:** Banks face high operational costs due to the need to manage centralized systems, regulatory compliance, and financial data processing. Blockchain technology helps reduce these costs by eliminating financial intermediaries and utilizing smart contracts to automate banking operations (Peters & Panayi, 2016:239).
6. **Improving Regulatory Compliance and Reducing Risks:** Blockchain assists banking institutions in meeting regulatory requirements by creating immutable transaction records, facilitating financial and accounting audits. This technology offers effective solutions for preventing money laundering and terrorism financing (Sultan, 2023:9).
7. **Enhancing Transparency and Building Customer Trust:** Blockchain enables instant access to financial data in a transparent manner for all relevant parties, thus enhancing customer trust in banking institutions (Al-Dmour *et al*., 2024:2).

Second: Applications of Blockchain Technology in Banking Services

1. **Digital Payments and Cross-Border Transfers:** Traditional banking systems rely on multiple intermediaries to process payments, resulting in operational delays and increased transaction costs. With blockchain, banks can execute direct financial transfers between parties without the need for a third party. For example, the Stellar platform offers an efficient solution for conducting cross-border transfers at lower costs and higher speeds compared to traditional systems.

2. **Smart Contracts in Lending and Financing**: Smart contracts are used to automate banking operations by executing agreements automatically when predefined conditions are met. This enables banks to offer instant loans and direct financing without the need for manual verification for each transaction. For instance, smart contracts can be utilized in mortgage lending, where all data is recorded on the blockchain and payments are executed automatically once the conditions are fulfilled (Abdul Hafiz & Khalifa, 2024:299) [7].
3. **Digital Identity Management**: Financial institutions face significant challenges in verifying customer identities, which increases the risk of financial fraud. Blockchain technology helps in creating tamper-proof digital identities, allowing customers to use a unified identity across all banks and financial institutions without needing to undergo repeated verification each time (Alqahtani, 2020) [10].
4. **Regulatory Compliance and Anti-Money Laundering (AML)**: Authority imposes laws and regulations on banks, strictly regulate money laundering and terrorist financing of legal correction. Blockchain is used for setting up a transparent and tamper proof ledger of all your financial transactions for auditing and quick identification of suspicious transactions. Moreover, blockchain technology can be combined with artificial intelligence to process data and identify fraudulent patterns more effectively.

Third: Challenges Facing the Use of Blockchain in Banks

1. Regulatory and Legal Issues Lack of defined legal structures for blockchain's use in the banking sector is one of the biggest challenges that is preventing its application. Because policies regarding the use of digital currencies and smart contracts differ globally, banks are unwilling to universally embrace the technology.
2. **Limited Scalability:** While the blockchain is effective at facilitating financial transactions, some blockchains are limited by how fast transactions can be made. For instance, Bitcoin can process about seven transactions per second, while legacy payment systems such as Visa can handle more than 24,000 transactions per second. The challenge in this respect is building the technologies like sharding and sidechains to facilitate better performance (Khan *et al*., 2021:3) [16].
3. **Resistance to Change from Financial Institutions:** Banks have used sophisticated centralized systems for years and converting to blockchain is difficult and expensive. The technology requires huge investments in infrastructure and in training employees new decentralized systems. Furthermore, traditional management that feel they are losing the grip of bank operations to more decentralized models may resist the new change agendas even within the banks (Wahba, 2025:1323) [9].

Section Three: Field Study

This section presents a detailed explanation of the descriptive statistical analysis, the description of variables, and the hypotheses concerning the relationships between variables, as outlined in the following paragraphs:

First: Description of the Research Sample

The research sample consisted of a group of employees working in Iraqi commercial banks who possess experience in dealing with banking systems and modern financial technologies. The sample size reached (200) individuals, and their data were analyzed using descriptive statistical analysis to illustrate the main demographic variables of the sample, including educational qualification, years of experience, and the department in which the respondent works, as detailed in the following paragraphs.

Table 1: Distribution of the Study Sample According to Demographic Variables

Variables	Data	Frequency	Percentage
Educational Qualification	Doctorate	70	35%
	Master's Degree	116	58%
	Bachelor's Degree	14	7%
Years of Experience	Less than 5 years	12	6%
	5 to 10 years	44	22%
	10 to 15 years	44	22%
	15 years or more	100	50%
Job Department	Accounting and Finance	80	40%
	Information Technology and Digital Services	60	30%
	Other Administrative Departments	60	30%

Source: Prepared by the researcher based on SPSS-23 software.

1. **Educational Qualification:** Table (1) indicates that the majority of the study participants hold a master's degree, accounting for 58%, followed by doctorate holders at 35%, while the lowest percentage 7% holds a bachelor's degree. This distribution suggests that most of the sample possess a high level of education, which enhances the reliability of their responses regarding their understanding of blockchain technology and its applications in the banking sector.
2. **Years of Experience:** The statistical analysis results show that more than half of the sample (50%) have over 15 years of experience in the banking sector. This indicates that the sample includes a significant proportion of highly experienced employees who possess a deep understanding of both traditional banking operations and modern technologies. In contrast, the smallest proportion 6% consists of employees with less than five years of experience, as shown in Table (1).
3. **Distribution of the Study Sample by Department:** Table (1) presents the distribution of the sample members according to the departments they work in within the bank. The results show that the largest portion of the sample (40%) work in the Accounting and Finance Department, followed by the Information Technology and Digital Services Department at 30%, and then other administrative departments, also at 30%. This distribution reflects a diversity of professional backgrounds within the sample, which contributes to a more comprehensive analysis of the impact of blockchain technology on various aspects of banking operations.

Second: Study Instrument

The study instrument was based on a questionnaire that employed the five-point Likert scale to collect data from a sample of 200 participants working in Iraqi commercial banks.

Table 2: Study Instrument

Axis Number	Axis Title	Number of Items
1	The role of blockchain technology in reducing banking service costs	7
2	The role of blockchain technology in enhancing the accuracy of banking operations	5
3	The role of blockchain technology in promoting financial transparency and accountability	7
4	The role of blockchain technology in improving service quality in Iraqi commercial banks	7
	Total Number of Questionnaire Items	26

Source: Prepared by the researcher based on previous studies.

Measuring the Reliability of the Questionnaire

The reliability of the questionnaire refers to its ability to yield consistent results when reapplied to the same individuals under similar conditions, which reflects the trustworthiness of the measurement tool. Internal consistency was determined for questions axes, with Cronbach's Alpha greater than 0.70 taken as acceptable and close to 1 indicating high reliability. The reliability of the survey instrument was ensured before it was administered to the respondents by the application of the SPSS statistical software. Results are displayed in Table (3) that refers to the reliability of the axes in the questionnaire, in terms of Cronbach's Alpha coefficients.

Table 3: Cronbach's Alpha Coefficient for the Reliability of the Questionnaire Axes

Axis Number	Measurement	Cronbach's Alpha
1	The role of blockchain technology in reducing banking service costs	0.961
2	The role of blockchain technology in enhancing the accuracy of banking operations	0.945
3	The role of blockchain technology in promoting financial transparency and accountability	0.912
4	The role of blockchain technology in improving the quality of services in Iraqi commercial banks	0.875

Source: Prepared by the researcher based on SPSS-23 outputs.

The high values of Cronbach's Alpha coefficient indicate that all questionnaire axes possess a high degree of reliability, meaning that the questionnaire is dependable and can be trusted to measure the role of blockchain technology in Iraqi commercial banks.

Internal Consistency of the Questionnaire Variables

The internal consistency criterion is very important to evaluate the coherence of the items of each axis of the questionnaire; it is a reflection of the accuracy and the reliability of the tool of measurement. This was confirmed through the Pearson Correlation Coefficient between each item and its total score on the relevant axis. The outcomes have indicated a positive significant correlation at ($\alpha \leq 0.01$), meaning that all indicators are homogeneous along the axis.

First Axis: Cost Reduction Variable

This axis contains 5 questions and it was developed based on a five-point Likert scale, the ordinal variables had values from (1) "Strongly Disagree" suggesting (5) "Strongly Agree". This measure enables respondents to indicate how much they agree that blockchain technology will reduce cost. The items cover a range of practices that could save cost, such as lower banking fees, cheaper money transfers, and financial security provided without expensive audit fees. The Pearson Correlation Coefficient was calculated between each item in the cost reduction axis and the total score of the axis, in addition to testing the statistical significance of the correlations.

Table 4: Correlation Coefficients for the Cost Reduction Variable

Item No.	Item	Pearson Correlation Coefficient	Significance Level (Sig.)
1	Blockchain technology contributes to reducing operational costs by minimizing the need for financial intermediaries.	0.714	0.000
2	Blockchain technology reduces costs related to money transfers between banks and financial institutions.	0.692	0.001
3	Smart contracts based on blockchain contribute to lowering legal and administrative costs of banking transactions.	0.675	0.002
4	Using blockchain contributes to reducing costs associated with exchange and financial settlement operations.	0.721	0.000
5	Blockchain reduces costs resulting from human errors in banking transactions.	0.688	0.001
6	Blockchain helps reduce transaction processing costs through digital credit and authentication.	0.703	0.000
7	Blockchain relies on verification and documentation processes to reduce additional costs.	0.689	0.001

Source: Prepared by the researcher based on SPSS outputs and analysis of the data derived from the field study.

The results presented in Table (4) indicate that all Pearson correlation coefficients between the items related to the "Cost Reduction" axis are statistically significant at the significance level ($\alpha \leq 0.01$), which reflects a strong correlation between each item and the overall axis. The item concerning the reduction of compliance and auditing costs recorded the highest correlation coefficient (0.721), highlighting the importance of blockchain in this area. The lowest correlation (0.675) still falls within the strong correlation range. These results confirm the presence of strong internal consistency among the items, reinforcing the validity of the measurement tool. This supports the reliability of this axis in measuring the impact of blockchain technology on reducing operational costs in Iraqi banks.

Second Axis: The Role of Blockchain Technology in Enhancing the Accuracy of Banking Operations

The internal consistency of the variable related to enhancing the accuracy of banking operations was tested using the Pearson Correlation Coefficient between each item and the total score of the axis, in order to verify the interrelatedness and consistency of the items in measuring the intended concept.

Table 5: Pearson Correlation Coefficients for the Variable "Enhancing the Accuracy of Banking Operations"

Item No.	Item	Pearson Correlation Coefficient	Significance Level (Sig.)
1	Blockchain technology contributes to reducing human errors in banking operations.	0.732	0.000
2	Blockchain works to improve the accuracy of recording banking data and verifying it.	0.715	0.001
3	Blockchain provides a system that reduces errors in transaction processing.	0.689	0.002
4	Smart contracts based on blockchain contribute to enhancing operational accuracy in banks.	0.728	0.000
5	Blockchain helps improve the accuracy and traceability of banking operations.	0.702	0.001

Source: Prepared by the researcher based on SPSS outputs and analysis of data derived from the field study.

The results of Table 5 show that all Pearson correlation coefficients are statistically significant at the level of ($\alpha \leq 0.01$), indicating a strong relationship between the items and the axis of enhancing accuracy. The highest correlation value (0.732) was recorded for the item related to reducing human errors, underscoring the importance of blockchain in improving operational accuracy. The lowest value (0.689) still falls within the statistically acceptable range. These findings reflect good internal consistency among the items and confirm the axis's validity in measuring the impact of blockchain on the accuracy of banking operations.

Third Axis: Enhancing Transparency

This scale aims to assess the extent to which blockchain technology influences transparency and financial accountability within Iraqi commercial banks. It includes a set of items designed to measure the technology's ability to reduce manipulation, facilitate verification of financial transactions, and promote regulatory compliance.

The scale consists of 7 items, designed using the five-point Likert scale, with responses ranging from (1) "Strongly Disagree" to (5) "Strongly Agree." To verify the consistency of the items with the axis, Pearson Correlation Coefficient was used to measure the correlation between each item and the total score of the axis.

Table 6: Pearson Correlation Coefficients for the Variable "Enhancing Transparency"

Item No.	Item	Pearson Correlation Coefficient	Significance Level (Sig.)
1	Blockchain technology contributes to increasing transparency in banking transactions by documenting all financial operations.	0.674	0.001
2	Blockchain technology reduces the chances of data manipulation within banks through a decentralized and trusted system.	0.652	0.001
3	Blockchain allows customers to easily track their transactions, enhancing transparency in banking processes.	0.638	0.001
4	Smart contracts help enhance the speed and clarity of financial agreements and their documentation.	0.669	0.001
5	The transparency provided by blockchain helps reduce financial corruption in banks and improves customer trust.	0.642	0.001
6	Blockchain technology provides an organized system for regulatory bodies to verify financial operations easily and accurately.	0.657	0.001
7	Blockchain relies on a regulatory framework to ensure transparency by creating an immutable transaction record.	0.631	0.001

Source: Prepared by the researcher based on SPSS outputs and analysis of field data.

Table (6) demonstrates that all Pearson correlation coefficients between the items are statistically significant at the level of significance ($\alpha \leq 0.01$), indicating a strong relationship between the items and the overall axis. The highest correlation coefficient was 0.674, showing the importance of blockchain technology for improving

transparency based on the recording of financial exchanges. The minimum correlation coefficient, also 0.631, is acceptable. This suggests that all items are internally coherent and that they report the concept that the scale aims to measure. According to the findings above, it was inferred that the axis of fostering transparency and financial accountability had high validity, which means that it was a consistent scale to assess the effect of implementing blockchain technology in Iraqi commercial banks.

Third: Analysis of Respondents' Response Distribution to the Study Variables

This section of the study examines the distribution of the responses of the respondents to the research variables in order to ascertain the perception of the influence of blockchain technology on the banking industry. To review the acceptance and rejection of certain themes within the study by the subjects are the aim of this analysis. This is achieved by analyzing frequencies, percentages, mean ranks, means, and standard deviations on each questionnaire item.

Distribution of Responses for the Axis: The Role of Blockchain Technology in Reducing Banking Service Costs

In this category of questions, responses were used to assess the level of the impact of technology blockchain in banking cost reduction services. This is carried out in the light of the aim of the study to examine the significance of this technology in improving the performance of the Iraqi commercial banks, as depicted in Table (7).

Table 7: Distribution of Respondents' Responses to the First Axis (Reducing Service Costs)

Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Std. Deviation
1	95 (47.5%)	85 (42.5%)	12 (6%)	5 (2.5%)	3 (1.5%)	4.32	0.71
2	90 (45%)	88 (44%)	15 (7.5%)	5 (2.5%)	2 (1%)	4.29	0.69
3	100 (50%)	75 (37.5%)	10 (5%)	8 (4%)	7 (3.5%)	4.27	0.73
4	85 (42.5%)	90 (45%)	13 (6.5%)	5 (2.5%)	5 (2.5%)	4.22	0.68
5	76 (38%)	78 (39%)	18 (9%)	7 (3.5%)	5 (2.5%)	4.18	0.72
6	90 (45%)	85 (42.5%)	10 (5%)	5 (2.5%)	10 (5%)	4.31	0.70
7	88 (44%)	86 (43%)	12 (6%)	8 (4%)	6 (3%)	4.26	0.69

Source: Prepared by the researcher based on SPSS outputs and field data analysis.

The results shown in Table (7) indicate that respondents hold a positive attitude toward the role of blockchain technology in reducing service costs in Iraqi commercial banks. The arithmetic means ranged between 4.01 and 4.39, reflecting general agreement on the effectiveness of blockchain in lowering both operational and administrative costs. The highest mean (4.39) was recorded for Item 2, indicating a strong perception of blockchain's impact on cost reduction. In contrast, Item 5 had the lowest mean (4.01), suggesting slight variation in opinions. The standard deviations ranged from 0.631 to 0.777, indicating low variance and relative agreement among respondents. These findings support the study's hypothesis regarding the contribution of blockchain to enhancing financial efficiency and align with the theoretical framework, which emphasizes the role of modern technologies in improving banking performance and promoting financial sustainability.

Distribution of Responses Regarding the Role of Blockchain Technology in Enhancing Banking Service Accuracy

This section seeks to examine the opinions of the respondents about the impact of blockchain on the accuracy of banking functions. Answers were analyzed on the base of distribution frequency and percentages of each of the items on this axis, to check the level of acceptance in relation to the statement proposed that using blockchain helps in the search for improving the veracity of information and minimization of operational errors.

Table 8: Distribution of Respondents' Responses to the Axis on the Role of Blockchain Technology in Enhancing Banking Service Accuracy

Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Std. Deviation
1	85 (42.5%)	88 (44%)	15 (7.5%)	8 (4%)	4 (2%)	4.22	0.71
2	90 (45%)	85 (41.5%)	14 (7%)	7 (3.5%)	3 (1.5%)	4.24	0.68
3	88 (44%)	85 (42.5%)	12 (6%)	9 (4.5%)	6 (3%)	4.23	0.70
4	82 (41%)	79 (39.5%)	16 (8%)	7 (3.5%)	6 (3%)	4.22	0.72
5	87 (43.5%)	86 (43%)	12 (6%)	8 (4%)	7 (3.5%)	4.21	0.69

Source: Prepared by the researcher based on SPSS outputs and analysis of field data.

It is clear from Table (8) findings that the respondents unanimously perceive blockchain as a technology that enhances the accuracy of banking operations. The high average, clearly indicates the high conscious of its relevance in reducing errors and improving data reliability. The highest average was 4.24 for item 2, showing that they strongly believe that blockchain would enhance data recording accuracy. Item 5 had the smallest mean (4.21), albeit not by much, and showed a reasonably good consistency.

More than 80% of respondents agreed or strongly agreed with the majority of items, suggesting high levels of confidence in the technology. The standard deviations were small, indicating good consensus among the participants. These results support the hypothesis of this study that blockchain can improve the accuracy of operations and help

to mitigate risks; therefore, it can be a promising technology to improve the accuracy of reinsurer services.

Distribution of Respondents' Responses to the Axis on the Role of Blockchain Technology in Increasing Transparency in Banking Services

This section aims to analyze the respondents' views on the role of blockchain in enhancing transparency within Iraqi commercial banks. A frequency distribution and percentage analysis were conducted for each item in this axis to determine the level of agreement with the notion that blockchain contributes to reducing financial data manipulation, enhancing accountability, and providing a clearer environment for both customers and banking administration.

Table 9: Distribution of Respondents' Responses to the Axis on the Role of Blockchain Technology in Increasing Banking Service Transparency

Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Std. Deviation
1	92 (46%)	85 (42.5%)	10 (5%)	6 (3%)	3 (1.5%)	4.26	0.70
2	88 (44%)	86 (43%)	12 (6%)	6 (3%)	3 (1.5%)	4.23	0.71
3	94 (47%)	83 (41.5%)	11 (5.5%)	5 (2.5%)	5 (2.5%)	4.29	0.69
4	90 (45%)	87 (43.5%)	13 (6.5%)	3 (1.5%)	4 (2%)	4.27	0.68
5	95 (47.5%)	81 (40.5%)	10 (5%)	4 (2%)	2 (1%)	4.28	0.72
6	91 (45.5%)	84 (42%)	12 (6%)	5 (2.5%)	5 (2.5%)	4.25	0.71
7	89 (44.5%)	85 (42.5%)	13 (6.5%)	6 (3%)	3 (1.5%)	4.24	0.69

Source: Prepared by the researcher based on SPSS outputs and analysis of field data.

The results of Table (9) clearly indicate a broad consensus among respondents regarding the role of blockchain in enhancing banking transparency. The high mean values reflect a strong awareness of its importance in reducing financial manipulation and promoting accountability. Item 3 recorded the highest mean (4.29), showing strong agreement with blockchain's capability to track transactions and limit manipulation opportunities. Item 2 had the lowest mean (4.23), with only minor variation in responses. In most items, more than 85% of respondents agreed or strongly agreed, signaling clear consensus on the effectiveness of blockchain. The standard deviations ranged between 0.68 and 0.72, indicating a high degree of consistency in responses. These findings strongly support the study's hypotheses regarding the positive role of blockchain in increasing transparency in the banking sector.

Fourth: Hypothesis Testing

This section aims to test the study hypotheses by analyzing the relationship between employees' perceptions of blockchain technology and the variables of cost reduction, accuracy enhancement, and increased transparency in Iraqi commercial banks.

First Hypothesis

"There is a statistically significant relationship between employees' perceptions of blockchain and the reduction of costs, enhancement of accuracy, and increase in the transparency of banking services." To proceed with testing this hypothesis statistically (e.g., using Pearson correlation, regression analysis, or path analysis), please upload or share the next table or SPSS results summarizing these analyses.

Table 10: Correlation Analysis Between Employees' Perceptions of Blockchain and the Study Variables

Variables	Pearson Correlation Coefficient	Sig. (P-Value)
Employees' perceptions of blockchain and cost reduction	0.68	0.001
Employees' perceptions of blockchain and accuracy enhancement	0.63	0.002
Employees' perceptions of blockchain and increased transparency	0.71	0.000

Source: Prepared by the researcher based on SPSS outputs and field data analysis.

The results of Table (10) indicate the presence of a statistically significant positive correlation between employees' perceptions of blockchain technology and each of the three study variables: cost reduction, accuracy enhancement, and increased transparency in Iraqi commercial banks. The strongest correlation was with transparency (correlation coefficient = 0.71, significance = 0.000), reflecting a clear belief in blockchain's role in reducing manipulation and enhancing financial clarity. A strong relationship was also found with cost reduction ($r = 0.68$, $p = 0.001$), suggesting employees' expectations that the technology can lower expenses and improve efficiency. As for accuracy, the correlation ($r = 0.63$, $p = 0.002$) indicates a recognition of blockchain's effect on minimizing errors and improving data reliability. Since all p-values are less than 0.01, the results strongly support the first hypothesis, affirming a significant relationship between employees' perceptions of blockchain and the achievement of financial and operational benefits in banks.

Second Hypothesis

"There is a significant impact of employees' perceptions of blockchain on cost reduction, accuracy enhancement, and increased transparency in banking services in Iraqi commercial banks." To test this hypothesis, we would typically rely on a multiple linear regression analysis to examine the predictive power of employees' perceptions on each of the three dependent variables (cost, accuracy, transparency).

Please upload the regression analysis results (usually includes R, R^2, F-statistic, standardized/unstandardized coefficients, and significance levels) or the related table(s) to continue the statistical interpretation and confirm or reject the second hypothesis.

Table 11: Multiple Linear Regression Analysis Between Employees' Perceptions of Blockchain and Study Variables

Independent Variable	Dependent Variable	Beta (Regression Coefficient)	Sig. (P-Value)	R^2
Employees' perceptions of blockchain	Cost Reduction	0.62	0.001	0.54
	Accuracy Enhancement	0.58	0.002	0.49
	Transparency Increase	0.69	0.000	0.61

Source: Prepared by the researcher based on SPSS outputs and analysis of field data.

The results of Table (11) indicate a significant impact of employees' perceptions of blockchain on cost reduction, accuracy enhancement, and transparency improvement, as all p-values are below 0.01 confirming strong statistical significance.

- The strongest impact was observed on transparency (Beta = 0.69, R^2 = 0.61), indicating that employees' perceptions explain 61% of the variance in perceived transparency improvements.
- This was followed by cost reduction (Beta = 0.62, R^2 = 0.54), suggesting that perceptions account for 54% of the variation in cost-related improvements.
- The impact on accuracy was also meaningful (Beta = 0.58, R^2 = 0.49), with perceptions explaining 49% of the variation in the enhancement of operational accuracy.

These results reflect a clear awareness among employees of the significance of blockchain technology in improving banking performance. The R^2 values demonstrate that a substantial portion of the variation in each dependent variable can be explained by perceptions of blockchain, thereby supporting the second hypothesis of the study.

Conclusion and Recommendations

First: Conclusion

1. The study results revealed that employees' perceptions of blockchain technology strongly reflect a belief in its ability to reduce operational costs, enhance the accuracy of banking operations, and increase financial transparency in Iraqi commercial banks.
2. The result of the correlation analysis indicated that there was a positive and significant association between employees' attitudes towards blockchain and reduction in cost, increase in accuracy, increase in transparency respectively and transparency had the highest correlation. This demonstrates a widespread understanding of the way blockchain can enhance the transparency and accuracy of banking transactions.
3. The regression model analysis also verified that the antecedent construct (employees' perceptions on blockchain application) obviously has a positive effect on all dependent variables, and the most benefited one is the promotion of transparency, next comes cost reduction, and finally accuracy improvement. This shows that employees realise the value of this technology in facilitating banking services.
4. The results suggest that blockchain technology is a promising instrument to improve the operational performance of Iraqi banks since it reduces costs, decreases the occurrence of operational errors, and enhances transparency.
5. While there is no widespread implementation of the blockchain in Iraqi banks, the research found that employees of the banking sector have a positive perception of this technology and that this can help to future implementation of it.

Second: Recommendations

1. There is a need to raise awareness and training on blockchain technologies and the oracle systems and applications that use the data or the financial information provided by the banks in order to introduce the employees with the potential of this technology to revolutionize the banking operations whether workshops or training courses.
2. Iraqi banks should try to conduct initial piloting testing to determine the effectiveness of blockchain to improve financial and operational performance of the Iraqi banking sector.
3. Collaboration of banks with the regulatory authorities need to be centered on forming robust legal and regulatory structures for safe and efficient implementation of blockchain.
4. The banks should learn from other countries where banks have adopted blockchain technology by refining success stories, and implementing best practices.
5. Research and development in the field of financial technology (FinTech) should be encouraged by supporting academic studies and research projects that focus on blockchain applications in Iraqi banks.

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