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Blockchain and its role in narrowing the banking sector Efficiency and effectiveness of banking services

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Abstract

This research examines how Jordan's banking industry uses BC to enhance the effectiveness and efficiency of banking services. A quantitative approach is applied in this study. 300 participants from five leading Amman banks that have integrated BC into their operations provided data for analysis using PLS-SEM. The direct relationship between implementing BC and banking efficiency and effectiveness is investigated in this study, together with the intermediary effects of operating costs and transparency. The results verified that incorporating BC into banking procedures enhances efficiency and effectiveness. Transparency and operational expenses are also important factors in this connection. The research offers helpful suggestions for financial organizations considering implementing BC. Banks can invest in technological innovations that improve their internal procedures, save costs, and boost customer satisfaction more wisely if they know how BC might promote efficiency and effectiveness. To successfully integrate it into operations, continuous training of human resources is necessary to meet the challenges of managing business by adhering to rules and regulations and data privacy requirements.

Keywords: Banking efficiency and effectiveness, Blockchain technology, Operating costs, Transparency.

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1. Introduction

In the modern banking industry, new technologies must be implemented to provide security, efficiency, and transparency in banking operations due to the constantly changing banking environment [1]. BC with the secure distributed

ledger is a contemporary innovation that promises to provide transparency, improve security, and focus on decentralization. The use of cryptographic techniques to make data immutable makes it difficult to alter recorded data for fraudulent activities [2]. In emerging economies like Jordan, the implications of BC are still not fully accepted, despite its huge potential. BC is highly appreciated because of its excellent features to improve the efficiency of supply chains, reduce fraud, and enhance transparency in financial transactions [3]. BC provides several potential advantages for the banking sector because of its novel and fascinating technologies. This active penetration of technology brings new outcomes in the banking sector. To satisfy customer demands and optimize resource-driven business operations through researching, creating, and deploying technology has always been the priority for the banking industry. The banking industry is now focusing on examining how BC may revolutionize the economy [4]. Because of the tamper-proof nature of BC and its transparency factor, BC can help in tackling issues like operational hazards and administrative expenses through a strong framework. With the increase in productivity, BC can generate new avenues for revenue and new sources for expansion [5]. The adoption of BC can completely transform the banking sector by providing democratic, transparent, safe, and effective transactions. Through its different components like data storage, consensus procedures, line-by-line communication, and encryption technologies, it can provide a complete solution. As its database is accessible to the public, this makes it more significant as it can record individuals' transactions effectively [6]. To survive in the modern and innovative world of today, BC provides banks with a chance to redesign their offerings and delivery systems. A secure, tamper-proof, transparent, trustworthy, and irreversible record of ownership is also established, and this enables the tracking of assets and transactions without the need for a centralized trusted authority. It can also offer solutions to some urgent problems such as trade financing, KYC procedures, deposit and loan insurance, cross-border payments, and transfers [7].

Banks will need to collaborate to create the necessary infrastructure for global payments and to connect BC to extract the promised benefits. In Jordan, there is still an experimental and testing phase of BC. The Jordanian banks face tremendous pressure to modernize their working services. In order to stay ahead of the competition, Jordan’s banks are constantly in search of new ideas. The adoption of BC can protect banks in Jordan from these challenges by reducing bank operating fees, enhancing data transparency, and improving the efficiency and effectiveness of bank services. The CBJ sought to make the required changes at the level of statutory mechanisms and regulatory processes in order to permit the use of contemporary BC and digital transactions and to enhance the risk management of BC by banks and financial institutions [8].

In developing economies, where financial institutions need to be reliable, secure, and transparent, the potential of BC to accelerate change assumes great significance. This study helps fill a critical gap by investigating how BC applications would impact financial services or influence the efficacy and efficiency of banks in Jordan. Understanding such a link permits strategic decisions to be made in a situation where financial systems are constantly changing. The objective of the research is to offer practical recommendations to government officials, economic institutions, and technology managers on how to use BC to enhance banking service efficiency and overall bank performance.

This work aims to explore how the adoption of BC in banks in Jordan improves the efficiency and effectiveness of the financial services provided by the banks and how the implementation of BC can minimize operational challenges in the banking sector of Jordan. The study also focuses on the effects of the adoption of BC on customer satisfaction, cost reduction, and the speed of transactions. It also explores the mediating function of transparency and operating costs in improving overall banking performance. These relationships are necessary to understand not only for strategy planners in the banking industry but also for policymakers and regulatory authorities who are focusing on the implementation of BC in the national financial structure.

This study is organized to provide a theoretical framework that directs our comprehension of the possible effects of BC. After that, we outline our study approach and results, go over the significance of these discoveries, and wrap up with a synopsis of our contributions to the field and recommendations for further research directions. Users will have a thorough grasp of the complicated connections between BC and bank performance by the end of this paper, along with accurate guidelines for stakeholders trying to navigate this transformative environment.

2. Literature Review

2.1. BC adoption in the Banking Sector

To elevate the standard of banking transactions, BC helps the banking sector through a decentralized and transparent framework that is suitable for transactions. Due to the costly and time-consuming processing of transactions, the conventional monetary system may face serious problems from fraudulent activities and gross errors. To overcome these issues, BC provides decentralized and secure records of transactions that cannot be changed. The failure of a single point can't pose a risk to the integrity of the entire transaction processing system, as in this system, each transaction is verified by networks of nodes. The decentralized approach of BC lowers operating costs and increases efficiency because of the reduction of intermediaries' costs through advanced security structures, enhanced efficiencies, and reduced transaction costs [9]. BC attracts financial firms as a perfect choice for transaction processing because it makes transactions faster and more streamlined, reducing costs by removing intermediaries from its operations. By serving the underserved population, this approach can increase avenues for financial inclusion for people and businesses. This technology helps the banking sector to compete in the innovative era created by FinTech [10]. BC helps banks to move from conventional banking to digital banking by providing a wide range of financial activities, including payments or money transfers, and offers substitutes that are quicker, secure, and more profitable for transferring money [11]. It has also been proclaimed that the banking sector's

use of BC will result in a complete transformation in financial service delivery to the benefit of its clients. If the global banking industry used BC to enhance efficiency and become more effective, it would save as much as $20 billion [12].

Financial institutions, banks in particular, are considered the backbone of modern society and play an extra significant role in stimulating and catalyzing growth in developing economies such as Jordan. In the interests of following regulations and ensuring the welfare of its clients, the banking system also has to ensure cost-effectiveness and transparency in its operations [13]. Jordanian financial institutions can benefit from BC-based tools such as smart contracts for speedy transactions, increased security, and affordability. BC has transformed wallet-to-wallet transactions significantly by ensuring cross-border remittances are instantaneous, safe, and traceable. Transfers are cost-effective, transparent, efficient, and convenient. In Jordan, through empowering BC adoption to enhance banking security, efficiency, and administrative processes, they further improved their resistance to cyberattacks. It is highly imperative for control, compliance, and resilience against cyberattacks to be improved. BC implementation could drive financial development, transparency, and better financial planning and well-being for customers in Jordan's banking industry [14].

2.2. BC and Transparency

The addition of immutability, decentralization, and real-time updates makes BC an innovative approach to resolving all the existing problems with current accounting and reporting systems [15]. Business organizations can improve the level of regulatory compliance, guarantee accurate reporting, and streamline financial operations through BC features. The framework can look into how BC would be integrated with current financial systems for enhanced stakeholder communication while reducing errors and increasing transparency. Transparency is among BC's most important benefits for financial institutions. BC allows for great transparency in financial exchanges; each network participant has access to the same data. Every transaction has a timestamp and a corresponding cryptographic signature that are publicly visible on the BC [16]. Verifying financial records and tracking the movement of funds across the system is simple for executives, auditors, and other stakeholders. For financial institutions, this transparency reduces the risk of fraud, money laundering, and other financial crimes. Better regulatory compliance is another benefit. BC's openness resolves many of the problems with traditional financial reporting.

Traditional systems often keep financial data in private databases under the control of certain businesses or central authorities. Although it is feasible, auditing these systems is frequently a challenging procedure. On the other hand, BC provides a ledger of every transaction that is open to the public. This offers total transparency. Trust in the reporting process is increased as anybody who has access to the BC network may confirm the accuracy of the financial data [17]. Real-time monitoring and assessment of financial activities are simple for authorities, and this transparency improves regulatory compliance.

2.3. BC and Operating Cost

BC acceptance will always be influenced by cost reduction. We can categorize the operational costs of BC for banks into three groups: transaction costs, energy costs, and storage costs. Banks are increasingly focused on storage costs related to BC. For instance, it is expected that over time, a Bitcoin node's storage costs per gigabyte will exceed USD 22 million [18]. Numerous companies have shown interest in BC because of its power to advance their operations and reduce costs.

Pan et al. [19] observed the effect of BC on the operations of businesses. The findings revealed a positive relationship between BC and transparency, as well as the effectiveness of business operations. Their study provides valuable suggestions for adopting BC into financial operations. However, they failed to cover the operating expenses. Habib et al. [20] investigated the role of BC in reducing the operating costs of the banking industry. They suggested that BC can help in reducing costs, improving efficiency, streamlining transactions, and meeting regulatory compliance. With an emphasis on cost reduction, this study also discussed how a reduction in operating costs influences financial institutions. Bataev and Rodionov [21] examined the use of BC for the verification of customers in banks. The results revealed that the solutions provided by the BC help in the identification process of customers in financial organizations and reduce operational costs. This study provided the facts that BC improves economic efficiency as well as reduces other operational expenses. These studies show that BC can bring innovation in various industries by cost reduction and improved efficiency. Even though other operating costs related to BC implementation haven't been directly measured in the literature, evidence suggests that adopting BC can result in substantial cost savings and operational enhancements that can improve the organization's performance.

2.4. BC and the Banking Efficiency and Effectiveness

Business models might be optimized by BC, which would boost their security and efficiency [22]. Because the banking sector's increasing rivalry is pushing for technical improvements, banks must adapt their operations by incorporating cutting-edge technologies in the domains of approvals, settlements, financial information systems, and client databases with higher efficiency.

Currently, banks face many obstacles in their middle and back-end operations, which make them ineffective with costly reconciliation systems and procedures, complicated trade confirmation procedures, issues with the quality of data in failed trades, complicated legislative, legal compliance, customer reporting, etc., in everyday operations at different levels of banking management. For these banks in the sector, changing the data exchange procedure with the goal of cost minimization is difficult. These banks' reconciliation processes can be transformed with more operational efficiency thanks to BC. Through digital settlements with enhanced connection, BC and transaction platforms provide inter-organization solutions that enable the real-time reconciliation of multiple transactions through a trust-based network and increase the

overall efficiency and effectiveness of the financial services provided by the banks [23]. BC improves operations aimed at reducing expenses, enhancing corporate governance and efficiency, minimizing discrepancies, and providing real-time transactional dashboards and participant entity onboarding through a customized application with instant reconciliation via pre-assembled interfaces for core systems with rapid cloud settlements. Through the use of specialized BC adapters, the entire operating expense of reconciliation can be eliminated [24].

BC is essential to trade finance and extends to financial services by providing an effective and transparent platform for monitoring supply chain transactions. Additionally, it promotes a variety of financial services by enabling creative products priced in cryptocurrencies. BC has the potential to revolutionize trade finance by enhancing the efficiency, security, and transparency of global commerce [25]. Real-time banking solutions provided by the BC help banks to advance their working capital and financial transactions. For international payments, BC is helping leading banks to save both time and money. Through mobile devices, BC helps in minimizing transaction fees during online money transfers. This eliminates the need for geographic location for transfer as well [26]. BC helps in reducing fraudulent activities and boosts cybersecurity, securing sensitive information related to transactions and investments, and managing customer loyalty programs through an immutable ledger. BC makes the trading process smoother by improving effectiveness, security, transparency, and efficiency. The operating costs can be reduced with the help of BC by cutting down the need for third-party approval [27]. The decentralized ledger also serves as the best tool for inspecting financial activities and recordkeeping. Overall transfer process is accelerated by blockchain technology by reducing and eliminating manual operations, which results in cost reduction. It helps in avoiding fraudulent activities, money laundering, mechanizing operations, and streamlining processes. The documentation reconciliation efficiency improves customer satisfaction [28].

To reduce the literature gap, some variables have been selected for testing in this research. BC adoption (BCA) has been selected as the independent variable. Transparency (TRP) and operating costs (OC) serve as mediating variables. Banking efficiency and effectiveness (BEE) are the dependent variables of the study. Banking efficiency is measured by three main items: customer satisfaction, transactional speed, and cost efficiency, but they do not require separate hypotheses.

The following hypotheses are proposed based on the above literature.

H_1: BC adoption positively affects banking efficiency and effectiveness.

H_2: BC adoption positively affects transparency.

H_3: BC adoption negatively affects the operating costs.

H_4: Transparency positively affects banking efficiency and effectiveness.

H_5: Operating costs negatively affect banking efficiency and effectiveness.

H_6: The link between BCA and BEE is mediated by transparency.

H_7: The association between BCA and BEE is mediated by operating costs.

3. Methodology

3.1. Research Design

The quantitative research design is adopted in this study to examine the effect of the adoption of BC on the efficiency and effectiveness of the services provided by banks in Jordan. A cross-sectional survey approach is used in this study to evaluate the role of variables, especially the mediating factors such as transparency and operating costs. PLS-SEM is used to test the hypotheses as it is suitable for complex models.

3.2. Sampling

The middle and senior managers of the selected five banks in Amman, Jordan, have been identified as the study population. Banks that have successfully implemented BC were included in the study. The selected banks are Arab Jordan Investment Bank, Arab Bank, Bank Al Etihad, Islamic Bank, and Ahli Bank of Amman.

To select the sample, a purposive sampling technique is used so that participants who are active in using BC in banking operations are selected.

3.3. Data Collection

A total of 400 questionnaires were distributed electronically to the middle and senior managers of the selected banks. Of the 400 questionnaires distributed, 350 were returned. However, 300 completed questionnaires were considered for further analysis. There were two sections of the survey. Section 1 contains the respondents' demographic information, whereas Section 2 contains questions related to the BC and other variable constructs. Before evaluating the suggested hypotheses, a number of preliminary checks must be performed utilizing the measuring tool and the data gathered in order to conduct additional analysis. First, a pilot test was conducted to ensure the research tool was valid. The top 20 senior managers were selected for the pilot test. To improve the measuring instrument's validity and make the necessary adjustments, a number of meetings and discussions with scholars were held after the results of the pilot test were made available.

4. Results and Discussion

In this study, PLS-SEM was used to evaluate the measurement model and validate the research hypotheses. It is a helpful technique for evaluating complex structural models that link several variables using both indirect and direct connections [29]. Smart PLS version 4.0.7 is used for the tests. Following the estimation of the convergent validity test, the

factor loadings for each item were examined. It is evident from the comparatively high factor values that each construct has a point of convergence. Generally speaking, FL values below 0.6 are unacceptable for evaluating convergent validity.

Observing Table 1, the value of each factor loading is more than 0.5. It shows that all of these are approved and that none were turned down. Furthermore, this table demonstrates that the CR values for each indicator vary from 0.943 to 0.975, all of which are higher than the suggested threshold of 0.70. Convergent validity is also supported because all AVE results are greater than the 0.5 threshold value.

Table 1.
Factor Loadings, composite reliability, and convergent validity.

Constructs	Items	FL	Valid/Invalid	CR	AVE
Blockchain Adoption	BCA1	0.823	V	0.963	0.721
	BCA2	0.816	V		
	BCA3	0.852	V		
	BCA4	0.865	V		
	BCA5	0.872	V		
	BCA6	0.863	V		
	BCA7	0.856	V		
	BCA8	0.869	V		
	BCA9	0.844	V		
	BCA10	0.832	V		
Transparency	TRP1	0.863	V	0.944	0.707
	TRP2	0.841	V		
	TRP3	0.831	V		
	TRP4	0.899	V		
	TRP5	0.829	V		
	TRP6	0.806	V		
	TRP7	0.812	V		
Operating costs	OC1	0.821	V	0.943	0.702
	OC2	0.799	V		
	OC3	0.876	V		
	OC4	0.832	V		
	OC5	0.899	V		
	OC6	0.822	V		
	OC7	0.813	V		
Banking Efficiency and Effectiveness	BEE1	0.822	V	0.975	0.719
	BEE2	0.813	V		
	BEE3	0.875	V		
	BEE4	0.892	V		
	BEE5	0.835	V		
	BEE6	0.812	V		
	BEE7	0.866	V		
	BEE8	0.851	V		
	BEE9	0.871	V		
	BEE10	0.833	V		
	BEE11	0.845	V		
	BEE12	0.895	V		
	BEE13	0.823	V		
	BEE14	0.813	V		
	BEE15	0.869	V		

To verify the differences between latent variables, discriminant validity was assessed. The HTMT ratio was used to illustrate the degree of variation among the latent variables. Since all values in Table 2 fall below the criterion of 0.90, none of them exceed this threshold. Consequently, the discriminant validity of this investigation is supported.

Table 2.
Discriminant validity.

	BCA	TRP	OC	BEE
BCA				
TRP	0.69			
OP	0.68	0.61		
BEE	0.71	0.69	0.65	

The hypotheses are tested using the structural model after the measurement model has been approved. Here, structural equation modeling (SEM) was applied using a bootstrapping technique with 5000 resamples in Smart PLS. The findings indicate a direct relationship between the factors. The variables have a direct link.

With a p-value of 0.001 < 0.01 and a beta value of 0.324, H1 demonstrates a positive and significant connection between BC adoption and banking efficiency and effectiveness. The results fully validate our hypothesis. This proves that banks in Jordan are experiencing improvements in their services and processes. The streamlined processes increase transactional speed and enhance customer satisfaction. Thus, the adoption of BC in banks enhances overall efficiency and effectiveness. The findings align with the previous study by Vittala et al. [30], which indicates that emerging technologies like BC and IoTs improve the service efficiency of banks.

A beta value of 0.218 and a p-value of 0.000<0.01 further corroborate H2, indicating a positive correlation between BCA and transparency. The favorable associations are further supported by H3's beta value of -0.109, which indicates that BCA adoption has a beneficial effect on a bank's operating costs. The adoption of BC helps in reducing operating costs. The results of H2 and H3 reveal that BC adoption in the operations of banks helps in enhancing transparency and reducing operating costs. This result is consistent with the findings of the study conducted by Eyo-Udo et al. [31]. Manual intervention, intermediary fees, and other costs can be reduced by adopting BC. This is supported by the negative association between BCA and OC. Overall, banking efficiency and effectiveness are achieved through the reduction of operating costs.

With a beta value of 0.201 and a p-value of 0.001, along with a beta value of -0.113 and a p-value of 0.001, the results of H4 and H5 indicate that transparency and operating costs influence banking efficiency and effectiveness (Table 3). The beta values and p-values for H6 and H7 suggest that transparency and operating costs mediate the relationship between BC adoption and banking efficiency and effectiveness. The results of H6 and H7 demonstrate that improvements in banking efficiency and effectiveness come not only from the direct effect of BC adoption but also from increasing transparency and lowering costs. Therefore, transparency and operating costs serve as important mediators. Overall, the results show that banks integrating BC into their operations can gain a competitive edge and improve customer satisfaction.

Table 3.
Hypotheses Result.

#	Research Hypothesis	β	S. Dev.	T-stats	P-values	Status
H1	BCA --> BEE	0.324	0.121	2.287	0.001	Accepted
H2	BCA--> TRP	0.218	0.152	2.391	0.000	Accepted
H3	BCA--> OC	-0.109	0.112	1.981	0.003	Accepted
H4	TRP--> BEE	0.201	0.095	2.021	0.000	Accepted
H5	OC--> BEE	-0.113	0.072	1.022	0.001	Accepted
H6	BCA-->TRP--> BEE	0.213	0.056	0.156	0.004	Accepted
H7	BCA-->OC-->BEE	0.298	0.063	0.163	0.000	Accepted

5. Conclusion

Adoption and implementation of BC have become essential for the banking industry to survive in the modern world of digital finance. The integration of BC into the operations of banks helps in achieving customer satisfaction, improving efficiency, and accelerating smart banking solutions. Banks can avoid risks like fraudulent activities, money laundering, and data breaches through this innovative technology. This also helps in streamlining financial transactions and provides transparent and secure services. Furthermore, BC helps in enhancing financial inclusion by serving the underserved population of remote areas through smartphones and digital financial activities. It also encourages digital literacy.

BC also has some challenges. For the successful integration of BC into operations, continuous training for HR is necessary. The requirement to follow rules and regulations, and data privacy needs are also important challenges. BC has opened the path for innovation and growth opportunities for the banks. With these benefits, banks can participate in making a more inclusive financial landscape, generate new growth opportunities for society. The future of the digital financial ecosystem is becoming clearer as the BC is continuously developing. Because of the transparency provided by the BC, it aims to enhance operational efficiency. By adopting BC, banks can minimize their dependence on centralized firms because of the decentralized trust and ensured access to tamper-proof data for regulators, customers, investors, and financial institutions. In conclusion, BC significantly affects the global financial system and boosts banking efficiency and transparency. Although there are some challenges to overcome, this technology streamlines financial transactions, enhances regulatory compliance, and raises trust within banks. As it is continuously developing, it will play an important role in forming the financial landscape with enhanced security and efficiency.

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