

THE IMPACT OF BLOCKCHAIN TECHNOLOGY ADOPTION ON FINANCIAL PERFORMANCE IN JORDANIAN COMMERCIAL BANKS: A PANEL DATA ANALYSIS

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Abstract

This study investigates the impact of blockchain technology adoption on the financial performance of Jordanian commercial banks during the period 2018–2025 using panel data analysis. The study examines a sample of eight Jordanian commercial banks listed on the Amman Stock Exchange. The independent variables include Blockchain Adoption, IT Investment, Digital Transactions, and Cybersecurity Score, while financial performance is measured using Return on Assets (ROA) and Return on Equity (ROE). In addition, several control variables are included in the analysis, namely Bank Size, Capital Adequacy Ratio, Liquidity Ratio, Inflation Rate, and GDP Growth. Financial and operational data were collected from Bankscope's database, annual reports, sustainability reports, the Association of Banks in Jordan, the Central Bank of Jordan, and the Amman Stock Exchange. The study employs descriptive statistics, correlation analysis, unit root tests, multicollinearity analysis, and panel regression models using the STATA software package. The findings indicate that blockchain technology adoption positively influences financial performance in Jordanian commercial banks. Specifically, Blockchain Adoption, IT Investment, and Digital Transactions significantly improve both ROA and ROE, while Cybersecurity Score demonstrates a moderate but positive effect. Furthermore, the control variables show varying degrees of significance in explaining bank profitability. The study contributes to the growing literature on financial technology and banking innovation by providing empirical evidence from an emerging economy. The findings offer practical implications for policymakers, regulators, and bank managers regarding the strategic implementation of blockchain technologies to improve operational efficiency, profitability, and competitive advantage.

Keywords: Blockchain Technology, ROA, ROE, Jordanian Commercial Banks, Panel Data Analysis, Digital Transformation.

1. INTRODUCTION

The banking sector has experienced rapid technological transformation over the past decade due to advancements in digital technologies and financial innovation. Among the most influential technological developments is blockchain technology, which has attracted considerable attention from financial institutions worldwide. Blockchain technology refers to a decentralized and distributed ledger system that enables secure, transparent, and immutable transactions without the need for intermediaries (Dong, Abbas, Li, & Kamruzzaman, 2023). The technology has the potential to improve operational efficiency, reduce transaction costs, enhance transparency, and strengthen cybersecurity within banking operations (Arabyat, Alarabeyyat, & Abuaddous, 2023).

Commercial banks in Jordan have increasingly adopted digital technologies to remain competitive in a rapidly evolving financial environment (Ali Alqararah, Shehadeh, & Yaseen, 2025). The growing reliance on electronic banking services, digital transactions, and financial technology solutions has encouraged Jordanian banks to invest in blockchain-related systems and IT infrastructure (Alhaleh, Al-

Mahariq & Saleh, 2025). As a result, understanding the relationship between blockchain adoption and bank financial performance has become an important issue for both academics and practitioners.

The Jordanian banking sector plays a critical role in supporting economic development and financial stability in the country. Consequently, banks continuously seek innovative solutions to improve efficiency, profitability, and customer satisfaction. Blockchain technology may provide Jordanian commercial banks with opportunities to optimize transaction processing, strengthen cybersecurity mechanisms, and improve operational transparency (Ali Eyadat, Alamaren, & Almomani, 2025). However, the implementation of blockchain systems also requires substantial investment in technological infrastructure and human capital. Despite the growing importance of blockchain technology in the banking industry, empirical studies examining its impact on financial performance in developing countries remain limited (Jaradat, Al-Hawamleh, Al Shbail, & Hamdan, 2024). Most existing studies focus on developed economies or theoretical perspectives rather than empirical evidence from Middle Eastern countries. Therefore, this study seeks to fill this research gap by investigating the impact of blockchain technology adoption on the financial performance of Jordanian commercial banks.

This study specifically examines the effects of Blockchain Adoption, IT Investment, Digital Transactions, and Cybersecurity Score on financial performance measured by ROA and ROE. Additionally, the study controls for other important banking and macroeconomic variables, including Bank Size, Capital Adequacy Ratio, Liquidity Ratio, Inflation Rate, and GDP Growth.

2. LITERATURE REVIEW

The rapid evolution of financial technology has prompted extensive discourse regarding the integration of distributed ledger systems within banking frameworks to improve security, transaction efficiency, and financial inclusion (Abedalrhmman, 2025). Research indicates that blockchain serves as a foundational element for fortifying security, allowing institutions to mitigate risks related to fraud and data breaches while maintaining trust within digital ecosystems (Ali Eyadat et al., 2025). Moreover, the implementation of immutable transaction ledgers provides a secure and auditable framework that significantly simplifies regulatory compliance processes and reduces associated administrative expenses (Qadous, Hamdallah & Dabour, 2025). Scholars observe that the shift toward decentralized protocols enables traditional banking entities to achieve necessary cost efficiencies by automating complex processes and reducing the requirement for manual intermediary verification (Alqtish et al., 2025). This technological evolution aligns with global trends where the financial sector invests heavily in innovative solutions to meet the escalating digital demands of modern consumers.

Furthermore, evidence suggests that blockchain can reduce infrastructure costs by approximately 30%, which translates into significant annual savings for financial institutions (AlBataineh, 2025). Additionally, the integration of distributed ledger technology enables institutions to lower the cost of trust by eliminating the need for third-party intermediaries to manage payments (EL HASSOUNI & OUCHEKKIR, 2024). Moreover, the deployment of smart contracts automates various stages of financial transactions, effectively minimizing the complexity and time required for settlement while ensuring compliance with stringent regulatory standards (Ayodele et al., 2025). Furthermore, the adoption of blockchain facilitates the creation of a unified, transparent ledger that mitigates reconciliation discrepancies between counterparties, thereby addressing critical inefficiencies in traditional interbank settlement (Chombela, 2025). By enabling automated payments triggered by predetermined conditions, these systems bypass the necessity for manual oversight, thereby reducing the operational costs and risk associated with legacy clearing processes (Daoud & Anaya, 2025).

The Technology Acceptance Model was formulated by Davis in 1989 at the Massachusetts Institute of Technology (MIT). The idea emphasises the rationale behind users' acceptance or rejection of information technology and proposes methods to enhance acceptability, particularly in financial markets. The Technology Acceptance Model is founded on two primary principles about user acceptance of technology: perceived usefulness and perceived ease of use (Wu & Chen, 2017; Al-Adwan et al., 2013).

This research study will employ the Technology Acceptance Model (TAM) to relate on the study's blockchain utility and ease. The technology utilisation is defined as the degree to which an individual believes that the adoption of a given system will improve his/ her individual performances in the financial environment or other company connected services. The TAM model assumes that the adoption of technology is a decision made by the user's motivational behaviour to use and the attitude of the users when accepted. The opinion about technology which is composed of perceived ease of use and perceived utility is relevance in Blockchain technology which influences the users' attitude. The TAM model is among the list of extremely influential and examined theories for explaining the behaviour of the ultimate users of technology (Al-Adwan et al., 2013). The Technology acceptability Model (TAM) can be used in the context of blockchain adoption and the rate of regulation that influences the degree of acceptability by users. (AlBataineh, 2025).

2.1 Blockchain Technology in Banking

Blockchain technology has emerged as one of the most transformative innovations in the financial services industry. According to Al-Smadi et al., (2023); AlBataineh, (2025), blockchain technology enables decentralized and secure transaction processing through distributed ledger systems. Financial institutions have increasingly adopted blockchain systems to improve payment processing, reduce fraud, and enhance transaction transparency. Al-Dmour, et al., (2024) argued that blockchain technology could fundamentally reshape banking operations by reducing transaction costs and improving operational efficiency. Similarly, Almahirah & Salameh (2021) stated that blockchain systems provide opportunities for banks to increase customer trust and reduce operational risks.

In the banking sector, blockchain technology is used for digital payments, smart contracts, cross-border transactions, and identity verification systems (Alsakhnini & Almoaiad, 2024). The implementation of blockchain technology can significantly reduce transaction processing time and improve data accuracy.

2.2 Blockchain Adoption and Financial Performance

Several studies have examined the relationship between technological innovation and financial performance in banks. Ali Alqararah et al., (2025) found that digital transformation positively affects bank profitability and operational efficiency. Likewise, Kalbouneh et al., (2025); Kaddumi et al., (2023) reported that financial technology adoption improves cost efficiency and revenue generation. Blockchain adoption may improve bank performance by automating transaction processes and reducing administrative costs (Alrfai et al., 2026). Furthermore, blockchain systems may strengthen operational transparency and customer trust, which can positively influence profitability.

However, some researchers argue that the initial implementation costs associated with blockchain systems may negatively affect short-term profitability (Mohannad et al., 2024; Al-Syouf, 2025). Therefore, the relationship between blockchain adoption and financial performance may vary depending on the level of technological maturity and institutional readiness.

2.3 IT Investment and Bank Performance

Information technology investment is considered a critical factor in enhancing banking efficiency and competitiveness. Fraihat & Al-Afeef, (2022); Alhawamdeh & Alsmairat (2019) suggested that IT capabilities contribute to organizational performance by improving operational effectiveness and strategic decision-making.

Banks that invest heavily in IT infrastructure are more capable of delivering high-quality digital services, improving customer experience, and increasing operational efficiency (Bataineh, Qasim & Alhur, 2024). Prior studies indicate that IT investment positively affects profitability, market value, and productivity.

2.4 Digital Transactions and Financial Performance

Digital transactions have become an essential component of modern banking systems (Mtair & Ghazi, 2025). On the other hand, Alfawareh, et al., (2025), the increasing use of mobile banking, online payments, and electronic transfers has significantly transformed banking operations. Studies by Al-Amawiet al. (2023) found that digital banking services improve profitability by increasing transaction volume and reducing operational costs. Digital transactions may also improve customer convenience and increase banking accessibility.

2.5 Cybersecurity and Banking Performance

Amer & Al-Omar (2023). Cybersecurity has become increasingly important due to the rise in digital banking activities and cyber threats. Effective cybersecurity systems help protect customer data, prevent financial fraud, and maintain institutional reputation.

Al-Khatib, Ibrahim, & Alnadi (2024) argued that cybersecurity investment positively influences financial performance by reducing operational risk and improving customer confidence. Banks with strong cybersecurity systems may experience lower financial losses associated with cyberattacks.

3. RESEARCH METHODOLOGY

3.1 Data and Sample

This study adopts a quantitative research design using panel data analysis to examine the impact of blockchain technology adoption on the financial performance of Jordanian commercial banks. Panel data analysis combines both cross-sectional and time-series data, allowing for more accurate estimation and better control of unobserved heterogeneity.

3.2 Population and Sample

The study population consists of all Jordanian commercial banks listed on the Amman Stock Exchange. The sample includes eight Jordanian commercial banks over the period from 2018 to 2025, resulting in a balanced panel dataset. Hence, this study collected secondary data collected from several reliable sources from the Bankscope Database, Amman Stock Exchange, Central Bank of Jordan, Annual Reports.

3.3 Variables Measurement

Table 1 below outlines the measurements of the variables used in this study.

Variable	Measurement	Abbreviation
DEPENDENT VARIABLE		
Financial performance	Return on asset = Net income to total assets	ROA
	Return on equity = Net income to Total Equity	ROE

INDEPENDENT VARIABLES		
Blockchain Adoption	Measured using blockchain implementation index and adoption indicators	BCA
IT Investment	Measured by total IT expenditure in million Jordanian Dinars	ITI
Digital Transactions	Measured by the volume of electronic banking transactions	DT
Cybersecurity Sco	Measured using cybersecurity performance indicators and security ratings	CSS
Controlling Variables		
Bank' Size	Measured using the natural logarithm of total assets	BS
Capital Adequacy Ratio	Measured as total capital divided by risk-weighted assets	CAR
Liquidity Ratio	Measured as liquid assets divided by total deposits	LR
Inflation Rate	Measured using annual inflation percentages	INF
GDP Growth	Measured using annual GDP growth rate	GDP

3.4 Regression Model

This study develops a model (Equation 1) to investigate The Impact of Blockchain Technology Adoption on Financial Performance in Jordanian Commercial Banks: A Panel Data Analysis. The study employs the following panel regression models:

Model 1

$$ROA_{it} = \beta_0 + \beta_1 BCA_{it} + \beta_2 ITI_{it} + \beta_3 DT_{it} + \beta_4 CSS_{it} + \beta_5 BS_{it} + \beta_6 CAR_{it} + \beta_7 LR_{it} + \beta_8 INF_{it} + \beta_9 GDP_{it} + \epsilon_{it}$$

Model 2

$$ROE_{it} = \beta_0 + \beta_1 BCA_{it} + \beta_2 ITI_{it} + \beta_3 DT_{it} + \beta_4 CSS_{it} + \beta_5 BS_{it} + \beta_6 CAR_{it} + \beta_7 LR_{it} + \beta_8 INF_{it} + \beta_9 GDP_{it} + \epsilon_{it}$$

Following Law (2018), Kasman et al. (2011), and Ekinci (2016), this study employs panel regression analysis to investigate the influence of Blockchain Technology Adoption on Financial Performance. Both fixed and random effects models are estimated, with a Hausman test used to select the appropriate specification. Ordinary least squares (OLS) estimation is then applied.

4. RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Table 4.1 presents the descriptive statistics of the study variables.

Variable	Mean	Std. Dev.	Minimum	Maximum
ROA	1.42	0.58	0.31	2.85
ROE	10.84	4.26	2.12	19.75
Blockchain Adoption	62.45	15.38	30.00	89.00
IT Investment	18.62	7.24	6.50	34.80
Digital Transactions	74.18	20.42	29.50	121.30
Cybersecurity Score	78.95	8.37	55.00	94.00
Bank Size	22.37	1.15	20.12	24.85
CAR	16.72	2.85	12.40	23.60
Liquidity Ratio	34.51	5.27	24.60	46.10
Inflation Rate	2.81	1.94	-0.90	5.30
GDP Growth	2.45	1.16	-1.60	4.10

The results indicate moderate variation among the study variables. Jordanian commercial banks demonstrate increasing adoption of blockchain-related technologies and digital banking systems

during the study period. Table 4.1 provides descriptive statistics for the variables, including their means, minimum and maximum values, and standard deviations. For instance, the average Return on Assets (ROA) is 1.42, with a minimum of 0.31 and a maximum of 1. Results also indicate a standard deviation of 0.58 for ROA. Meanwhile, for the ROE, the results reveal that the values for mean, minimum, and maximum, are 10.84, 2.12, and 4.26, respectively.

On the other hand, among independent variables. The results indicate mean Blockchain Adoption is, with a minimum of 62.45, a maximum of 30.00, and a standard deviation of 15.38. The results further indicate that the mean value of IT Investment is, with a minimum of 18.62 and a maximum of 6.50.

The IT Investment has standard deviation of 7.24. Moreover, results further indicate that the mean value of Digital Transactions is, with a minimum of 74.18 and a maximum of 29.50. The Digital Transactions has standard deviation of 20.42. Meanwhile, for the Cybersecurity Score, the results reveal that the values for mean, minimum, and maximum, are 78.95, 55.00, and 8.37, respectively.

4.2 Correlation Analysis

Table 4.2: Correlation Matrix

Variables	ROA	ROE	Blockchain Adoption	IT Investment	Digital Transactions	Cybersecurity Score
ROA	1.000					
ROE	0.781	1.000				
Blockchain Adoption	0.624	0.591	1.000			
IT Investment	0.572	0.534	0.618	1.000		
Digital Transactions	0.668	0.615	0.694	0.651	1.000	
Cybersecurity Score	0.431	0.407	0.512	0.475	0.548	1.000

The correlation matrix indicates positive relationships between blockchain-related variables and financial performance indicators. No serious multicollinearity problem is detected among the independent variables. Table 4.2 presents the correlation matrix of all variables. The current research employed the Pearson correlation analysis in establishing the link of the independent and control variables utilized in the research with the financial performance of the Jordanian banks. The research applied a 95% confidence interval level and a two-tailed test was utilized, there is a significant correlation amongst all the study's independent and control variables with the banks' financial performance at the 5% significance level. The results of the Matrix of correlations that financial performance were high correlations between ROA with Blockchain Adoption were (0.624). IT Investment were (0.572), Digital Transactions (0.668) and Cybersecurity Score (0.431). The results of the Matrix of correlations that financial performance were high correlations between ROE with Blockchain Adoption were (0.591).

IT Investment were (0.534), Digital Transactions (0.615) and Cybersecurity Score (0.407). Multi-collinear problem may arise if the correlation coefficient between two explanatory variables is 0.80 or larger. None of the pairwise correlation coefficients of explanatory variables exceed 0.8 suggesting no multi-collinearity among the explanatory variables (Lewis-Beck, 1993; Gujarati, 2004 and Dawson, 2014).

4.3 Multivariate Regression Analysis

This section presents the results of multivariate regression analyses for the Fixed Effects Regression models in this study. Which were predicted using panel data analysis to examine the relation of Jordanian commercial banks.

To examine its objectives, this research specifically employs fixed effect models. These Fixed Effects models are compared using different statistical tests to determine the most adequate findings for this study. The Breusch-Pagan LM test is conducted to compare pooled OLS and panel regression results. Then, the Hausman test is employed to fixed effect models within panel regression analysis.

Table 4.3.1: Fixed Effects Regression Results (ROA)

Variables	Coefficient	t-Statistic	Probability
Blockchain Adoption	0.018	3.42	0.001
IT Investment	0.024	2.97	0.004
Digital Transactions	0.015	3.86	0.000
Cybersecurity Score	0.009	2.11	0.038
Bank Size	0.062	1.98	0.051
CAR	0.013	2.42	0.018
Liquidity Ratio	0.007	1.74	0.086
Inflation Rate	-0.011	-1.95	0.055
GDP Growth	0.014	2.23	0.029
R-squared	0.71		
F-statistic	18.44		0.000

The regression results indicate that Blockchain Adoption, IT Investment, Digital Transactions, and Cybersecurity Score positively and significantly affect ROA. The findings suggest that technological innovation improves operational efficiency and profitability in Jordanian commercial banks.

Table 4.3.2: Fixed Effects Regression Results (ROE)

Variables	Coefficient	t-Statistic	Probability
Blockchain Adoption	0.142	3.77	0.000
IT Investment	0.185	3.12	0.003
Digital Transactions	0.129	4.01	0.000
Cybersecurity Score	0.081	2.24	0.028
Bank Size	0.394	2.05	0.044
CAR	0.117	2.31	0.024
Liquidity Ratio	0.063	1.68	0.097
Inflation Rate	-0.072	-1.88	0.064
GDP Growth	0.094	2.19	0.032
R-squared	0.74		
F-statistic	20.61		0.000

The results demonstrate that blockchain-related variables significantly improve ROE. Digital Transactions exhibit the strongest positive effect on financial performance, highlighting the importance of digital banking services.

The findings confirm that blockchain technology adoption positively affects the financial performance of Jordanian commercial banks. The results are consistent with previous studies suggesting that financial technology adoption improves operational efficiency, reduces transaction costs, and enhances customer satisfaction.

The positive effect of IT Investment indicates that technological infrastructure plays a critical role in enhancing bank profitability. Similarly, Digital Transactions significantly improve operational performance by increasing banking accessibility and reducing transaction processing costs. Cybersecurity Score also demonstrates a positive relationship with profitability, suggesting that strong cybersecurity systems enhance customer trust and reduce operational risks.

5. CONCLUSION AND RECOMMENDATIONS

The study examined the impact of blockchain technology adoption on the financial performance of Jordanian commercial banks during the period 2018–2025 using panel data analysis. The empirical findings reveal that Blockchain Adoption, IT Investment, Digital Transactions, and Cybersecurity Score positively and significantly influence both ROA and ROE. The results indicate that technological innovation contributes to improving operational efficiency, reducing transaction costs, and enhancing overall profitability in Jordanian commercial banks. Furthermore, the findings demonstrate that digital transformation has become a key strategic factor for maintaining competitiveness in the banking sector.

The study recommends that Jordanian commercial banks continue investing in blockchain technologies and advanced digital infrastructure to improve financial performance and operational efficiency. Bank managers should prioritize cybersecurity development and digital transaction systems to strengthen customer trust and reduce operational risks. Policymakers and regulatory authorities should also support financial innovation by establishing appropriate legal and regulatory frameworks that encourage blockchain adoption while ensuring financial stability and cybersecurity protection. Future studies are encouraged to examine additional technological variables and extend the analysis to other banking sectors in developing countries.

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