

Enhancing Bank Growth through Blockchain-Integrated Supply Chain Finance: An Empirical Analysis of Asian Development Bank-Registered Countries

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Abstract. Blockchain technology has captured the attention of scholars, managers, academicians, and practitioners worldwide. The use of blockchain technology represents a transformative approach to supply chain finance (SCF), enhancing efficiency and transparency while significantly contributing to the bank's growth. This manuscript aims to investigate the impact of supply chain finance (SCF) on banks' growth, with a focus on the moderating role of blockchain technology. The study sample comprises 16 developing countries and 34 banks registered with "The Asian Development Bank's (ADB)" supply chain finance program, covering the period from 2012 to 2024. The results revealed that supply chain finance has a significant positive impact on bank growth, with blockchain technology serving as a moderating factor that strengthens this relationship. Use of Blockchain in supply chain finance transactions enhances the bank's growth and efficiency. The findings of this study offer valuable insights for banks and policymakers on the application of blockchain technology in supply chain finance transactions, enhancing the bank's growth and performance. This study holds significance for policymakers, managers, and academicians at different levels.

Key words: Supply Chain Finance, Blockchain Technology, Bank's Growth

1 Introduction

In the age of digitalization, financial technology (FinTech) innovation leads to increased efficiency for financial banks and small and medium enterprises (SME) (Thakor, 2020). Supply chain finance is a popular financing mechanism for supply chain parties—buyers, sellers, and financial service providers with flexible accessibility to working capital (Munir and Bhutta, 2023; Pfohl and Gomm, 2009; Xu et al., 2025). Pfohl and Gomm (2009), explains that supply chain finance is an "inter-company finance optimization and financing processes integration with suppliers, customers, and financial service providers, and increases the value of all supply chain finance participants". These supply chain finance solutions offering increase the firm's growth (Munir (2024)), but these traditional supply chain finance often suffer from a lack of transparency,

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manual processes, and inefficiencies, which increase the operational costs and hinder their scalability (Chod et al., 2020).

With the growth of the SCF market, more and more secure transaction information is the demand by the market, and all parties in the supply chain finance (Salman, 2025). As a result, the finance provider, like banks concerned is to use new encrypted and secure technology like blockchain. It is a new milestone and light in the tunnel to ensure the business, specifically financial transactions transparent (Kabir et al., 2021).

This new blockchain technology is gradually grabbing the attention of financial service providers Yusuf and Surjaatmadja (2018), when they deal with offering SCF solutions. Furthermore, banks in the Pakistani market are expanding and offering various supply chain finance solutions to enhance their growth. However, despite the growth benefits, there is a need for secure financial transactions to mitigate risk (Khan and Safdar, 2024). Banks' Blockchain adoption increases growth with a reduction in credit risk (Cheng and Qu, 2020; Deng et al., 2021; Liu et al., 2020; Wang et al., 2021). Blockchain offers various benefits, including transaction transparency and deterrence of deception (Chen et al., 2017). To ensure secure transactions and protect financial transactions from fraud, banks now offer supply chain finance solutions powered by blockchain financial technology. This technology is transparent, increasing transaction security and enabling more reliable transactions. Besides, financial technology like blockchain also plays a vital role in the growth of banks (Ali et al., 2025). Despite banks' adoption of blockchain and their financial performance in the different countries, little is known about how such adoption affects and to what extent it strengthens the supply chain finance solutions offered by banks.

By supporting information process theory (IPT) through the use of blockchain technology, banks can enhance their management of complex SCF transactions with more secure and transparent data, thereby further reducing fraud risk (Gangwani and Bhatia, 2025). Aligning with IPT, this study examines how blockchain-integrated supply chain finance enhances bank growth by addressing traditional SCF inefficiencies, like a lack of transparency and fraud risk. Blockchain technology ensures fair and transparent transactions, reduces fraud risk, and increases banks' trust. This study aims to fill the gap in the literature by analyzing registered ADB banks' blockchain adoption, strengthening the SCF by addressing the following research question:

How does blockchain technology integrate supply chain finance influence the bank's growth? Following the introduction, Section 2 unfolds the literature review, which establishes the hypothesis along with the theoretical framework. The next Section 3 is the methodology of the study, research design, sample, and variable description. Subsequently, Section 4, results and data analysis, is the fourth section of the paper. Finally, the last Section 5 is the conclusion, key findings, implications, and future direction of the paper.

2 Literature Review

Blockchain technology records the encrypted transactions of the distributed network into a ledger over a period of time. In this technology, each recorded transaction is entered into a block, and then each block is connected with the previous entered block using hashing and encryption functions, after that, to fingerprint and generate digital data keys. All the recorded data is managed and verified by using automation protocols and consensus governance. All the members of members verified the block transactions because all ledgers are distributed by all network members. If the majority of members mutually agree that the data history and signatures are valid, then the new data transaction of the block is accepted into the ledger and

added to the transaction block chain. The shared verification process uses a modern encryption method of data security in the distributed ledger to prevent unauthorized or manipulated data. This method always ensures that all members in this network have access to transaction activity and perform comprehensive information audits.

In general, there are two types of data access blockchain mechanisms based on the network members' involvement in the consensus process. The first mechanism of public blockchain and transactions is publicly accessible to anonymous users. The second mechanism is permission-based, where permission is required to join the network. All access would be controlled by the private blockchain (Angelis and Da Silva, 2019).

Gong and Zhang (2025), also examined the use blockchain technology potential benefits and the long-lasting risks of supply chain finance operations. This study used the interview approach, interviewing the practitioners of the implementation of blockchain technology in supply chain finance, and concluded that the adoption of blockchain technology addresses the traceability and decentralization of financial transactions.

Due to decentralization, blockchain is widely used in supply chain finance along with transparent tamper-proof characteristics (Zarrin et al., 2021). In supply chain finance, with the help block blockchain, different transactions and events can be recorded through distributed ledger technology to improve the data credibility and transparency of the transactions. One of the important components of blockchain in supply chain finance is smart contracts, which automatically execute pre-set contract terms executions, reduce errors, and improve the security and transaction efficiency (Jabbar et al., 2021).

Supply chain finance uses blockchain technology to identify and evaluate credit terms in the supply chain. By providing a shared, tamper-proof ledger of transactions, blockchain can foster trust and collaboration among stakeholders, streamline workflows, and improve the accuracy and reliability of financial data (Jabbar and Dani, 2020).

Rijanto and Utami (2024), also examined blockchain technology and supply chain finance and concluded that blockchain technology provided better solutions to secure financial transactions and ensure that supply chain finance transactions are smooth and fraud-free. Further, Yu (2024), conducted case study research on Chinese banks and concluded that banks offering supply chain finance with blockchain technology enhance the banking scale and growth of the banks.

This leads to a research hypothesis:

H1: Blockchain moderates the relationship between supply chain finance and bank growth.

3 Empirical Setting

In Asian developing countries, a large number of banks have expressed interest in blockchain technology. The Asian Development Bank also focuses on using a supply chain finance program with the adoption of blockchain technology. This research paper employs a quantitative method to examine the moderating role of blockchain technology in the relationship between supply chain finance and firm growth. The study sample comprises 16 developing countries and 34 banks that are members of the ADB, SCF Program, covering the period from 2012 to 2024. To ensure the accuracy of the analysis, bank data with outliers and nonavailability of data were excluded. The financial data were collected annually from multiple sources, including banks' financial statements, world-bank and the Asian Development Bank. Fixed/Random-effect model is used to draw the analysis by using E-Views.

3.1 Empirical Model

$$GR_{ct} = \beta_0 + \beta_1 SCF_{ct} + \beta_2 BC_{ct} + \beta_3 BC \times SCF_{ct} + \sum_{i=1}^2 \gamma_i Bcon_{ct} + \sum_{i=1}^2 \delta_i Con_{ct} + \varphi_t \sum Year + \sigma_i \sum Country + \mu_i + \varepsilon_{ct} \quad (1)$$

Where GR is bank growth, SCF is supply chain finance, BC is blockchain technology, $BC \times SCF$ is the moderating variable, Bcon represents the vector of bank-level control variables, and Con represents the vector of country-specific control variables. The year dummy represents $\sum Year$, and the country dummy represents $\sum country$. μ is the entity, and ε is the error term.

3.2 Measurement of Variables

3.2.1 Supply Chain Finance (SCF)

This study used the supply chain finance solutions index (Munir et al, 2023) to measure the supply chain finance and it is used as the independent variable.

3.2.2 Bank Growth (BG)

Bank growth (dependent variable) is measured by using three variables: annual growth in assets, loans, and profit. Beck et al. (2016), used a firm growth proxy measured with annual assets, loans, and profit growth. Year-to-year growth of assets, loans, and profit is calculated as the natural log of the current year value minus -previous year divided by the current year. After calculating it, principal component analysis is used to construct a growth variable, which is used as the dependent variable in the study. The following equation is used to calculate the growth variable (GR), assets growth (AS), loan growth (LO), profit growth (P), and c show country and t = time.

$$GR_{ct} = \beta_{01} + \beta_2 AS_{ct} + \beta_3 LO_{ct} + \beta_4 P_{ct} + \varepsilon_{ct} \quad (2)$$

3.2.3 Blockchain Technology (BC)

Blockchain technology is measured as another operating expense. Blockchain technology adoption involves operational costs, which are often reported as other operating expenses. Prior studies, Zaqeeba (2024), used the other operating expenses as the proxy of blockchain technology. This study used blockchain technology as a moderator.

3.2.4 Control Variables

The control variables are at the bank level, tier-1 capital ratio, and bank size, and country-level control variables are GDP and exchange rate. The tier-1 capital ratio is measured as tier-1 capital by its total risk-weighted assets Sari et al. (2018), bank size is measured as the natural log of assets Doğan (2013). The gross domestic product is measured as the natural log of the country's GDP Doan (2020), the exchange rate is measured as the natural log of the country's exchange rate (Kelilume, 2016).

4 Results & Discussions

4.1 Descriptive Statistics and Correlation Analysis

Table 1 shows the descriptive results for all the variables in the model, such as mean, maximum, minimum, and standard deviation. This table helps to summarize the data and overview of the dataset. The mean value of SCF is 1.798, with a standard deviation of 1.254. The blockchain mean value is 10.755 with a standard deviation is 0.6141. The results in Table 2 are showing the correlation analysis and it is found no perfect correlation, indicating no multicollinearity issue.

Table 1: Descriptive Statistics

Variables	Mean	Maximum	Minimum	Std. Dev.
GR	18.8613	28.315	-2.635	3.959
SCF	1.7977	4.608	0.2595	1.2540
BC	10.753	11.5065	9.2548	0.6141
T1	2.69	4.6	2.02	0.42
BS	13.05	25.3	0.35	4.25
GDP	1.55	2.5	-2.3	0.85
LER	4.5	8.2	0.5	1.4

Table 2: Correlation Analysis

	GR	SCF	BC	T1	BS	GDP	LER
GR	1						
SCF	-0.32	1					
BC	0.45	-0.29	1				
T1	0.28	-0.18	0.34	1			
BS	0.41	-0.22	0.56	0.26	1		
GDP	0.52	-0.35	0.47	0.3	0.44	1	
LER	-0.36	0.48	-0.31	-0.21	-0.27	-0.40	1

4.2 Hausman Test

This paper's estimation is based on a fixed and random effect model to select between the fixed and random effect models. First, applied the Hausman test. The null hypothesis of this

test is that the random effect model is preferred over the fixed effect model. The null hypothesis is rejected with a P-value $\leq 0.0e$ and supports the FEM. Whereas, accepted with the p-value ≤ 0.05 , and supports applying the REM. Table 3 shows the result Hausman test and supports applying the fixed effect model.

Table 3: Hausman Test

GR
SCF 19.4980***

*** $P < 0.05$, ** $P < 0.01$, * $P < 0.1$

The main results of the model are discussed in Table 4. Model I shows all control variables results. Model II shows the results supply chain finance impact on banks' growth. Model-III regresses with the use of blockchain technology variable, and Model-IV regresses with all variables, along with the interaction term of blockchain technology as a moderating variable.

Table 4: Fixed Effect Estimation Results

Variables	Model-I	Model-II	Model-III	Model-IV
SCF		0.0762***(-1.9598)	0.0603*(-1.6587)	0.7301***(1.9560)
BC			0.1218***(2.9190)	0.1856***(2.1367)
BC × SCF				0.0660***(1.961)
BS	0.0350***(3.0287)	0.0271***(2.1370)	0.0264*(1.6693)	0.0281***(1.9701)
T1	(0.0954) *(0.8928)	0.0373***(1.9359)	-0.0466***(1.2265)	0.0127(1.1679)
GDP	0.0218**(0.2487)	0.0281*(0.1157)	0.0492**(0.3817)	-0.0793*(0.0454)
ER	0.0218*(0.4163)	0.0702***(1.7141)	-0.0466***(-2.0693)	0.0138***(1.2944)
Intercept	1.056(0.236)	1.2618(1.6124)	1.0675(1.1842)	1.6071(1.2541)
Time effect	Yes	Yes	Yes	Yes
Country Effect	Yes	Yes	Yes	Yes
F Statistics	12.6070	12.2939	12.1534	11.8699
Adjusted R ²	0.5196	0.5188	0.5215	0.5208

Note: GR bank growth, SCF=supply chain finance, BC= blockchain technology, BC × SCF=Moderation, BS=Bank Size, T1=Tier-1 capital ratio, GDP=gross domestic product, ER=exchange rate.

*** $P < 0.05$, ** $P < 0.01$, * $P < 0.1$

In Table 4, Model I control variables show a significant relationship with the dependent variable, bank growth. In all models, supply chain finance has a significant positive impact on banks' growth. In Model I, 1% increase in the supply chain finance banks' growth will also increase by 0.0762. This strong positive relationship shows that SCF enhances the bank's growth.

SCF provides the liquidity to the buyers and suppliers, also reducing the financial risk, which positively stable the bank's growth. Moreover, in the emerging markets, SCF reduces the credit risk and enhances the bank's growth. Table 4.4 Model III result shows that the direct impact of blockchain technology has a positive and significant coefficient of 0.1856 on bank growth. This technology is used to enhance the transparency and reduce the transaction costs of supply chain finance. This blockchain technology promotes the decentralization of finance, which further improves transaction accuracy and reduces fraud risk (Huzaiifa, 2024). Banks adopting the blockchain technology improve the operational efficiency, which further translates to. Transparency in the supply chain finance refers to the visibility of information and financial transaction information will all supply chain finance parties, enabling the stakeholders to track the financial information and reduce fraud. In countries like Pakistan, the integration of blockchain technology into SCF significantly enhances their banks' growth. With this State Bank of Pakistan instructs the banks to adopt the digital supply chain finance to increase SMEs' access to finance as well as to digitize retail payments (Farooq et al., 2024).

This increased financial visibility can enhance trust between banks and supply chain participants, leading to higher adoption rates of SCF solutions. Furthermore, the automation of smart contracts can streamline processes, reduce operational costs, and enhance working capital efficiency, ultimately boosting banks' profitability and market competitiveness (Kouhizadeh and Sarkis, 2018). Thus, leveraging blockchain in SCF can strengthen banks' financial positions and enable them to better serve SMEs and large enterprises, driving overall economic growth in Pakistan.

The blockchain technology as a moderator shows a positive and significant coefficient of 0.0660. This interaction term indicates that the use of blockchain technology with supply chain finance influences the bank's growth in the ADB-registered countries with the SCF program. With blockchain technology, data visibility will be enhanced, and any fraud risk will be easy to trace, which further improves the financial performance (Rijanto, 2021). Blockchain technology decentralized and immutable ledger that ensures the visibility of transactions, risk reduction, and unauthorized access to transactions. Blockchain's decentralized and immutable ledger ensures real-time visibility of trade transactions, minimizing risks associated with invoice duplication and unauthorized alterations (Zhu et al., 2022). Leveraging the blockchain in SCF can improve the bank's financial position and enable the SMEs to serve better, which will further drive the economic growth in Pakistan.

4.3 Robustness Analysis

To further verify the core results, this study used the wild cluster bootstrap (WCB). Table 5 confirmed and aligned the results with core findings. The blockchain technology has a significant positive impact on firm growth.

*** $P < 0.05$, ** $P < 0.01$, * $P < 0.1$

The moderating role of blockchain technology adoption strengthens the relationship between supply chain finance and firm growth. Adoption of blockchain technology enhances the banks' financial position and increases the more secure financial transactions for the supply chain finance program of SMEs an overall reduction in fraud risk.

Table 5: Robustness Analysis

Variables	WCB
SCF	0.0672*(1.56)
BC	0.1128**(2.70)
BC×SCF	0.0660*(1.58)
BS	0.0356***(2.58)
T1	0.0584(0.37)
GDP	0.0328(0.81)
ER	0.0228(0.43)
Adjusted R ²	0.5232

5 Conclusion

The impact of blockchain-integrated supply chain finance on banks' growth is profound and far-reaching. Though it has a decentralized and immutable ledger system, it has the potential to revolutionize the supply chain finance banking operations, offering high transparency levels, security, and traceability, which will ultimately enhance the bank's growth. Blockchain provides a single source of truth accessible to all authorized participants; further, blockchain technology eliminates the inefficiencies and inherent vulnerabilities in the supply chain. The Asian Development Bank (ADB) is working on implementing blockchain technology to enhance the bank's growth and cross-border transactions transparency, like its trade finance and supply chain finance programs.

Overall, this study examines the blockchain-integrated supply chain finance on banks' growth in Asian development bank-registered countries' banks from 2012-2022 using the fixed-effect model to understand the moderating effect of blockchain. Supply chain finance has more impact on banks' growth when the use of blockchain technology is strengthened. The results highlight that SCF with blockchain technology has positively influenced the bank's growth. Larger banks with prudent capital management also show growth resilience. Moreover, banks offering supply chain finance aim to reduce credit risk, but if this SCF has transparency or fraud risk, then the SCF offering would negatively impact the bank's growth. Blockchain technology mitigates the transparency and fraud risk in supply chain finance transactions. If banks record the supply chain finance transactions in a secure and tamper-proof manner, it will enable the banks to demonstrate compliance with regulatory requirements and sustainability in their growth. All in all, the use of blockchain technology holds the immense promise for the SCF improvement and enhances the bank's growth. However, the successful use of blockchain technology required investments, collaborations, and all stakeholder commitments. Banks continue to explore out potential of blockchain technology, and they work to get more benefit from agility, greater resilience, and competitiveness in an increasingly interconnected world.

Future research should be conducted to understand the complex models of blockchain technology on supply chain finance dynamics. Investigate the AI and machine learning algorithms'

theoretical underpinnings to optimize the SCF. Provide the empirical studies with ML algorithms investigations. Encourage the supply chain finance offering banks and stakeholders to train and provide resources with tailored ML algorithms applications, such as predictive analytics, bank supply chain finance optimization, and performance. Foster the collaboration between the data scientists and supply chain finance parties to develop effective supply chain finance solutions. Further countries advocate for a regulatory framework to promote the use of blockchain technology in supply chain management. Just announce to use if blockchain technology is not enough, develop guidelines and responsible AI adoption in supply chain fiancé, ensure the transaction transparency, algorithm fairness, and accountability are also important. Policymakers also promote the knowledge of AI literacy among the supply chain stakeholders.

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