CZU: 336.71:004.652.3.056.5 https://doi.org/10.59295/dnwe2025.47

THE PARTICULARITIES OF USING BLOCKCHAIN IN BANKING

Ivan LUCHIAN
Moldova State University, 60 Alexe Mateevici, Chisinau, Republic of Moldova,
ivan.luchian@usm.md
ORCID iD: 0000-0002-8683-7228

Inesa BRUMĂ
Moldova State University, 60 Alexe Mateevici, Chisinau, Republic of Moldova
ina.bruma@usm.md
ORCID iD: 0000-0002-0901-5191

Purpose of the article: *The purpose of this study is to analyze the technological, functional, and strategic aspects of blockchain implementation in the banking sector, with a focus on its impact on operational efficiency, transparency, and security of financial transactions. The paper also examines issues of regulation, scalability, and sustainability accompanying the integration of blockchain into commercial banking activities.*

Methodology: *The research is based on a qualitative analysis of contemporary academic publications, institutional reports, and expert assessments from international financial organizations and consulting firms. Comparative, analytical, and generalization methods were applied to identify the advantages, limitations, and prospects of blockchain use in banking practice.*

Conclusions: *The results indicate that blockchain technology provides significant advantages for digital banking: increased transparency and data integrity, reduced transaction costs, faster settlements, and improved compliance with KYC/AML standards. At the same time, substantial implementation barriers remain, including high investment costs, technological complexity, and regulatory uncertainty.*

Originality: *This study contributes to understanding how blockchain can transform traditional banking systems in the Republic of Moldova and beyond, offering practical recommendations for policymakers and financial institutions regarding the sustainable integration of digital technologies.*

Keywords: *blockchain, banking, benefits, challenges,JEL Classification: G20.*
JEL Classifications: G21, O33, E58

INTRODUCTION

The digital transformation of the banking sector is a structural process of the contemporary economy, driven by the evolution of information technologies, the increase in the volume of electronic transactions and the intensification of security and compliance requirements. Banking institutions are under continuous pressure to streamline their internal processes, reduce operational costs and meet the increasingly high expectations of customers in terms of speed and transparency of financial services.

In this context, blockchain technology is emerging as an innovative solution, capable of changing the traditional architecture of banking. By using distributed ledgers, blockchain offers the possibility of recording transactions in an immutable and verifiable way, reducing dependence on intermediaries and the risks of data manipulation. From an economic perspective, these features can lead to reduced transaction costs and increased operational efficiency of banking institutions. (WEF, 2016), (PwC, 2022)

The purpose of this paper is to present a multi-faceted presentation of the implementation of blockchain technology in banking activities.

MATERIALS AND METHODS

The research was carried out using a qualitative-analytical method suitable for economic and institutional analysis. The analysis focused on national regulatory documents pertinent to banking and payment services, specifically the laws concerning electronic currency and payment systems.

International institutions' reports on preventing money laundering and terrorist financing, pertinent to banking compliance procedures, were also reviewed.

The techniques employed consist of comparative analysis, synthesis, and generalization, enabling the identification of the benefits, drawbacks, and risks linked to the implementation of blockchain in the banking sector. Concurrently, proprietary analytical tools like thematic tables and SWOT analysis were employed to evaluate the economic and institutional effects of this technology, in relation to global trends in digital financial infrastructure

RESULTS AND DISCUSSIONS

Blockchain in banking involves employing a decentralized digital ledger to document transactions, offering security, transparency, and permanence without requiring a central authority.

Banks can enhance efficiency in processes like payments, trade finance, and identity verification by establishing a shared, tamper-proof data record across a network of computers, leading to cost reduction and fraud prevention.

The use of blockchain in banking has the following elements:

- *Distributed Ledger*: Instead of a single, central database, a blockchain database is shared across a network of computers.
- *Blocks of Data*: Transactions are grouped into "blocks," which are cryptographically linked to previous blocks, forming a chronological "chain".
- *Consensus Mechanism*: For a new block to be added, a consensus must be reached among network participants, ensuring the transaction is valid.
- *Immutability*: Once a block is added to the chain, it cannot be altered or deleted, creating a permanent and verifiable record of all transactions.

It is also important to highlight the key features of blockchains in banking:

- *Permissioned Access:* Unlike public blockchains, permissioned blockchains are restricted to a known set of participants, such as financial institutions and regulators.
- *Enhanced Security:* These blockchains incorporate advanced security measures, including encryption and multi-signature protocols, to protect sensitive financial data and ensure compliance with regulations.
- *Interoperability:* They are designed to integrate with existing legacy banking systems through interoperability layers, enabling seamless data flow between new and old infrastructures.
- *Tokenization:* Banks are using blockchain to tokenize real-world assets, like stocks and bonds, creating more fluid and efficient ways to transfer and manage them.

The use of blockchain technology in the banking industry is varied and aims at several operational and compliance functions. Examining usage guidelines enables the identification of areas where the economic effect is instant, along with those that have strategic prospects in the medium and long run. (WEF, 2016)

Table 1. Directions of application of blockchain technology in banking activity

Direction of application	*Economic impact*	Main benefits	Limitation
Payments and settlements	*High*	Reduce time and costs	Complex IT integration
KYC / AML	*High*	Enhance compliance	Limited interoperability
Asset tokenization	*Medium*	Increase liquidity	Insufficient legal framework
Trade finance	*Medium*	Automate documents	Low standardization
Digital identity	*High*	Reduce fraud	Data protection

Source: Prepared by the authors based on WEF (2016) and PwC (2022) reports

The presented data highlights that blockchain generates the greatest economic benefits in the area of payments and KYC/AML compliance, where the reduction in processing time and administrative costs is immediate. (WEF, 2016)

In the case of asset tokenization and trade finance, the impact is rather strategic, being conditioned by the development of the regulatory framework and the maturity of financial markets. (PwC, 2022)

The use of blockchain technology in banking generates a direct economic impact on operational efficiency, by reducing transaction costs and optimizing internal processes. (WEF, 2016)

The automation of operational flows, especially in the field of payments and settlements, contributes to reducing processing times and reducing dependence on traditional intermediaries, which is reflected in the decrease in administrative and operational costs. (PwC, 2022)

From a financial intermediation perspective, blockchain can reduce information asymmetries and increase transparency in relationships between banking institutions and customers. This feature is particularly relevant in the context of cross-border transactions and digital financial services, where operational and compliance risks are higher. (WEF, 2016)

For a comprehensive assessment of the opportunities and risks associated with the adoption of blockchain in banking, it is relevant to apply SWOT analysis, which allows the identification of internal and external factors influencing this process. (PwC, 2022), (WEF, 2016)

Table 2. SWOT analysis of the use of blockchain technology in the banking sector

Category	Factors	Economic and institutional implications
Strengths	High transparency of transactions	Reduces information asymmetries and operational risk
	Immutability of records	Increases auditability and trust
	Process automation	Decreases administrative costs
Weaknesses	High initial costs	Limits adoption
	Technological complexity	Requires digital skills
	Difficult integration	Increases implementation time
Opportunities	Harmonization of the regulatory framework with the EU	Enables pilots
	Digitalization of financial services	Increases demand
Threats	Regulatory uncertainty	Postpones investments
	Cyber risks	Reputational losses
	Energy impact	Sustainability issues

Source: Prepared by the authors based on (BNM, 2012), (FATF, 2024), (MONEYVAL), (PwC, 2022), (WEF, 2016)

The SWOT analysis highlights a clear contrast between the technological potential of blockchain and existing institutional constraints. (PwC, 2022), (WEF, 2016)

Weaknesses and threats are largely associated with regulatory and technological aspects, while opportunities are generated by the process of digitalization and legislative harmonization. (BNM, 2012)

The adoption of blockchain technology in the banking sector involves not only technological changes, but also significant institutional transformations. The role of financial regulators and supervisors is essential in establishing a regulatory framework that allows for the testing and gradual implementation of blockchain solutions, without compromising the stability of the financial system. (BNM, 2012), (FATF, 2024)

In this context, pilot projects represent an appropriate mechanism for assessing the risks and benefits of blockchain in banking. The lack of a clear and predictable regulatory framework may lead to the postponement of strategic investment decisions and the underutilization of the economic potential of this technology. (MONEYVAL), (PwC, 2022)

The majority of banks use permissioned or private blockchains. Unlike the open, public blockchains used for cryptocurrencies, these private networks offer more control, privacy, and

improved security necessary for financial operations because they are limited to authorized participants like banks and regulators.

Neo-banks are building new financial services on blockchain technology, sometimes offering both crypto and traditional fiat currencies:

- *Mercury*: Is a fintech business bank specifically for startups, Web3 companies, and crypto-friendly firms.
- *Wirex*: Is a financial service that isn't a traditional bank but has become a major platform for crypto-financial services.
- *Crypto Bank*: Is an example of a project aiming to provide a full suite of services (trading, fiat-crypto conversion, ATM services, etc.) on a blockchain-based platform.

Traditional banks using blockchain for services:

- J.P. Morgan: Uses blockchain for internal operations like its JPM Coin and the Link network for secure information exchange among financial institutions.
- DBS Bank: Offers traditional banking services along with a digital asset exchange for trading and storing cryptocurrencies like Bitcoin and Ethereum.
- Citi: Has piloted blockchain solutions to tokenize deposits and improve liquidity management.
- HSBC: Is involved in blockchain projects like Contour for trade finance.

The use of blockchain in banking is linked to a wide range of issues, which can be presented as follows (Budisteanu, 2025), (Marr, 2023), (Sushree, 2025):

➢ *Cost and Complexity*

• *High Implementation Costs:* Implementing blockchain technology in the banking sector entails substantial financial, technical, and human resource investments, often creating a high barrier to entry despite its potential for long-term savings.

• *Complexity and Lack of Expertise:* Blockchain technology in the banking sector is frequently limited by its high technical complexity and a significant shortage of specialized, in-house expertise, often causing institutions to struggle with implementation, training, and troubleshooting. While adoption is growing, many banks find the expertise needed to build, maintain, and secure blockchain networks is severely lacking within their existing workforce.

➢ *Technical Limitations*

• *Scalability:* Many blockchain networks struggle with scalability, processing a limited number of transactions per second, which can significantly slow down the network and make it less efficient for high-volume banking operations.

• *Interoperability:* There are challenges in enabling different blockchain networks to communicate and work together, limiting their ability to form broader, integrated systems.

• *Energy Consumption:* Some consensus mechanisms, particularly Proof-of-Work, are extremely energy-intensive, raising environmental concerns.

➢ *Regulatory and Security Concerns*

• *Regulatory Uncertainty:* The legal and regulatory framework for blockchain technology is still evolving, creating uncertainty for businesses and making compliance a significant hurdle.

• *Data Privacy:* While blockchain offers security, integrating it with existing systems can create new vulnerabilities, and ensuring the privacy of sensitive customer data is a major concern.

• *Private Key Management:* The use of private keys for asset access introduces a significant security risk; if a key is lost or compromised, the associated assets become irretrievably lost.

➢ *Integration and Operational Issues*

• *Integration with Legacy Systems:* Overhauling and integrating blockchain with existing, often outdated, banking infrastructure is a costly and time-consuming process.

• *Immutability:* The inability to alter or delete data once it's on the blockchain can be a disadvantage, especially in banking where the ability to correct errors or reverse transactions is necessary.

Widespread adoption faces significant hurdles.

Technical challenges related to scalability, high energy consumption, and integration with legacy systems remain barriers. Regulatory uncertainty and concerns about privacy and data protection have also slowed implementation. In addition, blockchain's potential to eliminate intermediaries raises existential questions for the traditional role of banks as intermediaries in financial transactions.

Despite being hailed as a breakthrough technology, blockchain adoption in the financial industry has encountered considerable obstacles. There have been numerous operational, legal, and technical obstacles in turning its promise into reality.

First, it's worth noting the Blockchain Trilemma which was first used by Vitalik Buterin to describe a set of three primary problems that developers face when creating blockchains: decentralization, security, and scalability. (Coinbase), (Coinmarketcap)

It's critical to understand the tradeoffs inherent in blockchain design because Blockchain 3.0, the generation associated with ubiquitous banking, demands more network capacity.

These tradeoffs revolve around three main elements (Coinbase), (Coinmarketcap):

• *Decentralization*: It's about distributed control and decision-making authority across the entire network. This is a major property of blockchain technology, where control over the network is equitably dispersed among all participants, rather than being centralized in a single central organization. Since all users have equal access to the data on the blockchain, decentralization improves the network's transparency and equity.

• *Security*: Blockchain networks ought to have strong defenses that keep bad actors from seizing control. The strong defenses that blockchain networks need to have in place to stop malevolent actors from taking over are referred to as security in the context of blockchain. A secure blockchain makes it harder for malevolent parties to change or manipulate the data it contains by guaranteeing its integrity and security.

• *Scalability*: Is the ability of the network to handle an increasing number of transactions per second while maintaining its performance. Blockchains should be able to handle a massive volume of users and transactions without faltering by raising transaction times and fees. This speaks to a blockchain network's ability to manage an increasing volume of work and its capability for expansion to support that expansion. A scalable blockchain can handle a large number of transactions fast and effectively without appreciably raising transaction costs or processing times.

The trilemma arises from the inherent tension between improving one aspect and, inevitably, compromising another (Miah, 2025), (Saha & Koushik, 2025):

- *Decentralization vs. scalability*

Greater decentralization requires more nodes to validate each transaction. However, a larger number of validators slows down the network due to consensus requirements. Faster networks often focus on speed by using fewer validators, which leads to increased centralization.

- *Security vs. scalability*

Robust security relies on comprehensive validation systems. These meticulous checks, while crucial, slow down transactions. Faster systems may compromise security rigor to achieve faster speeds.

- *Decentralization vs. security*

Distributing control among multiple participants can improve security, but it hinders rapid response to threats. In contrast, a more centralized system can respond quickly to attacks, but it concentrates control in fewer hands. All banks have legacy IT systems, and the transition to blockchain takes considerable time and resources. Compatibility and standardization issues further complicate integration, as the World Bank has found with its attempts to create blockchain-based bonds.

CONCLUSIONS

1. Blockchain technology has significant potential to modernize banking, contributing to increased operational efficiency, reduced costs and strengthened security and compliance mechanisms.
2. At the same time, there are essential barriers to using the examined technology in banking.
3. Its widespread adoption is conditional on regulatory clarity, institutional capacity and investments in digital skills.
4. In terms of time perspective, the impact of blockchain on banking can be differentiated in the short, medium and long term. In the short term, the benefits are concentrated in areas with immediate operational impact, such as payments and KYC/AML compliance.
5. In the medium and long term, the integration of this technology can contribute to the diversification of financial instruments and the transformation of the financial infrastructure, depending on the maturity of the institutional framework and the evolution of regulations.

REFERENCES

1. Banca Națională a Moldovei (BNM) (2012) *Legea cu privire la serviciile de plată și moneda electronică, nr. 114 din 18 mai 2012*. Available at: https://www.legis.md/cautare/getResults?doc_id=151002&lang=ro# (accessed October 16, 2025)
2. Budisteanu Tudor-Gabriel (2025) *Blockchain and the Banking Sector: Benefits, Challenges and Perspectives*. Open Journal of Social Sciences, Vol.13 No.3, March 2025. Available at: https://www.scirp.org/journal/paperinformation?paperid=141256#:~:text=Nevertheless%2C%20the%20adoption%20of%20blockchain,et%20al.%2C%202020 (accessed October 15, 2025)
3. Coinbase. *What is the blockchain trilemma?* Available at: https://www.coinbase.com/learn/crypto-glossary/what-is-the-blockchain-trilemma (accessed October 14, 2025)
4. Coinmarketcap. *Blockchain Trilemma*. Available at: https://coinmarketcap.com/academy/glossary/blockchain-trilemma (accessed October 14, 2025)
5. Financial Action Task Force (FATF) (2024) *Moldova's progress in strengthening measures to tackle money laundering and terrorist financing (Follow-Up Report)*. Available at: https://www.fatf-gafi.org/en/publications/Mutualevaluations/Moldova-FUR-2024.html?utm_source=chatgpt.com (accessed October 17, 2025)
6. Marr Bernard (2023) *The 5 Biggest Problems With Blockchain Technology Everyone Must Know About*. Available at: https://www.forbes.com/sites/bernardmarr/2023/04/14/the-5-biggest-problems-with-blockchain-technology-everyone-must-know-about/ (accessed October 15, 2025)
7. Miah Sal (2025) *The Blockchain Trilemma: Decentralization, Security & Scalability*. Available at: https://www.webopedia.com/crypto/learn/blockchain-trilemma-explained/#:~:text=8%20MIN%20READ-,The%20Blockchain%20Trilemma%3A%20Decentralization%2C%20Security%20%26%20Scalability,-SHARE (accessed October 16, 2025)
8. Moneyval**.** *Republic of Moldova: Second Enhanced Follow-up Report*. Available at: https://rm.coe.int/moneyval-2024-4-md-5thround-2ndenhfur/1680b05e46?utm_source=chatgpt.com (accessed October 16, 2025)
9. PricewaterhouseCoopers (PwC) (2022*) PwC Global Crypto Regulation Report 2023*. Available at: https://www.pwc.com/gx/en/new-ventures/cryptocurrency-assets/pwc-global-crypto-regulation-report-2023.pdf?utm_source=chatgpt.com (accessed October 15, 2025)
10. Saha Reno, Koushik Roy (2025) *Navigating the Blockchain Trilemma: A Review of Recent Advances and Emerging Solutions in Decentralization, Security, and Scalability Optimization*. Available at: https://www.sciencedirect.com/org/science/article/pii/S1546221825006563#:~:text=At%20its%20core%2C%20blockchain%20promises,dApps)%20could%20clog%20the%20network (accessed October 16, 2025)
11. Sushree Swagatika Pati (2025) *Advantages and Disadvantages of Blockchain Technology in 2026*. Available at: https://kanerika.com/blogs/advantages-and-disadvantages-of-blockchain/ (accessed October 15, 2025)
12. World Economic Forum (WEC) (2016) *The future of financial infrastructure: An ambitious look at how blockchain can reshape financial services*. Available at: https://www3.weforum.org/docs/WEF_The_future_of_financial_infrastructure.pdf?utm_source=chatgpt.com (accessed October 18, 2025)