

BLOCKCHAIN TECHNOLOGY AND ITS APPLICATIONS IN BANKING: OPPORTUNITIES AND CHALLENGES

Hassiba Almi¹, Aboubaker Khoualed², Khathir Chine³

Abstract

This paper examines how banks are using blockchain technology and what is hindering the expansion of its use. The paper reviews recent academic literature, as well as actual applications documented in 2025 and 2026. The methodology combines an analysis of peer-reviewed studies with verified data from central banks, market infrastructure providers, and asset managers. The results show that the greatest value comes from the sharing of ledgers among regulated institutions, rather than from public cryptocurrency networks. Most of the measured gains are concentrated in payments, securities settlement, trade finance, and identity verification. Systems operating today deliver real value on a large scale; one repurchase platform settled \$8 trillion in a single month, and tokenized treasury funds exceeded \$15 billion. Adoption remains constrained by regulation, compatibility with legacy systems, and governance. The paper concludes that banks are selectively integrating blockchain into their regulated infrastructure, not to replace their core systems.

Keywords: blockchain, banks, distributed ledger, tokenisation, settlement.

Introduction

Banks deal with trust as part of their daily business. They keep track of who owns what, confirm that payments have been settled, and maintain ledgers that allow strangers to transact with one another. For decades, this work has relied on separate databases maintained by each bank and then reconciled with its partners. Reconciliation is slow, ties up capital, and increases the likelihood of error.

¹ Hassiba Almi, PhD, Badji Mokhtar-Annaba University, P.O. Box 12, 23000 Annaba, Algeria, Tel: +213 553 998 752, E-mail: hassiba.almi@univ-annaba.dz

² Aboubaker Khoualed, Professor, Badji Mokhtar-Annaba University, P.O. Box 12, 23000 Annaba, Algeria, Tel: +213 656 223 061, E-mail: aboubaker.khoualed@univ-annaba.dz

³ University Center of Illizi, PhD, Algeria, E-mail: chine.khathir@cuillizi.dz

Blockchain technology offers a different approach: a shared ledger updated collaboratively by multiple institutions and trusted without a central operator.

The technology combines replicated ledgers, encryption, peer-to-peer verification, and a consensus mechanism, enabling participants to maintain a synchronized transaction history. Its most significant features for banking include a ledger that detects any tampering, programmable transfers via smart contracts, and settlement that can approach real time. The Bank for International Settlements has stated that distributed ledger technology could transform how assets are held, obligations are fulfilled, and contracts are enforced (Dashkevich et al., 2020).

Interest in the topic has grown significantly since 2015. Bibliometric studies document a steady increase in publications and a shift from early conceptual work toward applied studies and case studies (Patel et al., 2022; Rahman et al., 2024). A gap remains between rapidly evolving industry experiments and academic verification that lags behind (Dashkevich et al., 2020; Osmani et al., 2020). This paper addresses that gap by combining peer-reviewed literature with published application data through 2026.

The argument is straightforward. Blockchain is relevant to banks as a shared infrastructure among regulated parties, not as a public cryptocurrency network. The clearest benefits emerge where multiple institutions already maintain overlapping ledgers and pay a high price to reconcile them. When a single bank controls the data, the case weakens. The following sections outline key applications, review performance evidence, highlight emerging applications, and weigh the barriers that continue to limit adoption.

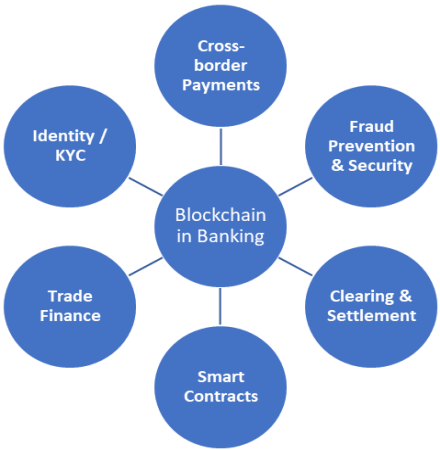


Figure 1. Blockchain applications across banking functions

Source: Authors, based on Guo & Liang (2016) and Javaid et al. (2022).

Methodology and Scope

The study is based on two types of evidence. The first comprises a collection of fifty peer-reviewed papers on blockchain in banking, including foundational frameworks, methodological reviews, bibliometric analyses, and empirical adoption studies. These papers were selected based on their relevance from a larger set identified through keyword searches and citation tracking in major research databases. The second type is a collection of documented applications and market figures published by primary sources in 2025 and 2026, including central bank projects, a repurchase platform based on a distributed ledger, and issuers of tokenized funds.

Each quantitative statement is attributed to a specific source. When figures are issued by a primary institution, they are used directly. Industry forecasts, however, are described as estimates rather than measured results. Figure 2 shows the distribution of the reviewed literature over time reflecting how its focus shifted from concept to application after 2020.

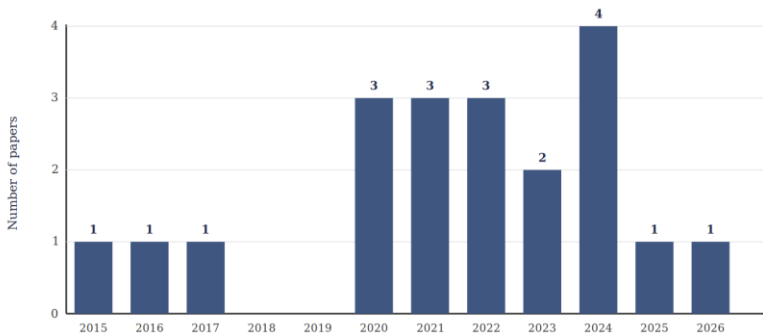


Figure 2. Distribution of reviewed literature by year, 2015–2026

Source: Authors, based on the reviewed corpus.

Core Applications in Banking

Payments, clearing, and settlement attract the most research and investment. A shared ledger eliminates duplicate matching between banks and supports near-continuous settlement. Smart contracts automate conditional transfers and post-trade steps that employees used to perform manually (Javaid et al., 2022; Guo & Liang, 2016). Cross-border payments yield the greatest benefit, as the chain of correspondent banks is where delays and costs accumulate. Transfers that used to take days can be settled in minutes when banks share a single ledger instead of passing messages through the chain (Hashimzai & Ahmadzai, 2024).

Trade finance is a second key area. The shared ledger connects banks, exporters, importers, insurers, and carriers around a single view of documents, ownership,

and payment terms. This reduces duplicate verification and manual processing of documents. However, the benefit depends on participation: the ledger is only useful when parties actually join it (Motta et al., 2020; Mafike & Mawela, 2022).

Regulatory compliance is a third area. Blockchain-based systems for Know Your Customer (KYC) and anti-money laundering (AML) enable authorized institutions to share verified customer data, reducing duplication and improving fraud detection. Rules can be written into smart contracts and enforced the moment a transaction occurs (Kowsar & Mintoo, 2025). The State Bank of India Consortium, formed in 2017 with ten commercial banks, shares compliance information among its members on the blockchain (Jena, 2022). An Italian banking consortium, cited by the European Banking Authority, reached 91 banking nodes and automatically matched approximately 99 percent of transactions.

Interbank identity management and matching round out the suite. Reusable digital credentials allow authorized parties to verify a customer while maintaining an auditable trail, and banks can share synchronized records of bilateral contracts or accounts instead of having to reconcile separate databases later. Table 1 summarizes the applications, the mechanism behind each, and the evidence base.

Table 1. Blockchain applications in banking and their evidence base

Application	Mechanism	Primary benefit	Evidence base
Payments & settlement	Shared ledger, atomic settlement	Fewer reconciliations, faster clearing	Strong
Cross-border payments	Tokenized money, synchronized records	Minutes not days, less friction	Strong
Trade finance	Common ledger, smart contracts	Less duplicate verification, lower fraud	Moderate
KYC / AML	Shared verified attestations	Reduced duplication, better detection	Moderate
Identity management	Reusable credentials, audit trail	Faster onboarding, verifiable records	Moderate
Interbank reconciliation	Synchronized bilateral records	Lower back-office cost	Moderate

Source: Authors, based on Javaid et al. (2022), Kowsar & Mintoo (2025), Motta et al. (2020), and Jena (2022).

Performance Evidence

The track record is still limited but points to a consistent trend. Structural equation modeling of leading Spanish banks found that blockchain adoption is associated with the development of dynamic capabilities and stronger financial performance; adopters built these capabilities more easily than non-adopters (Ogunrinde et al., 2025). A survey of 291 blockchain consultants and bank executives validated a measurement tool for the perceived business benefits of adoption (Garg et al., 2020). Studies of adoption drivers in the Indian and Taiwanese banking sectors

identify enabling conditions, performance expectations, initial trust, and regulatory readiness as significant factors (Jena, 2022; Lu et al., 2024).

Industry projections provide an idea of the scale but should be viewed as estimates. Accenture estimated potential savings for the banking sector at up to \$20 billion, and PricewaterhouseCoopers projected a reduction in transaction costs of over 50 percent through the elimination of intermediaries (Rahman et al., 2024; Daluwathumullagamage & Sims, 2021). The Sponta interbank project in Italy achieved documented gains in data transparency and speed of execution (Cucari et al., 2021). Table 2 summarizes the reported adoption factors and their context.

Table 2. Adoption factors and supporting evidence

Factor	Finding	Context	Source
Facilitating conditions	Significant predictor of use intention	Indian banking	Jena (2022)
Performance expectancy	Significant predictor of use intention	Indian banking	Jena (2022)
Initial trust	Mediates adoption	Indian banking	Jena (2022)
Organizational readiness	Key adoption consideration	Taiwanese banking	Lu et al. (2024)
Legislation & regulation	Most critical success factor	Uncertain environment	Mishra et al. (2023)
Dynamic capabilities	Linked to financial performance	Spanish banking	Ogunrinde et al. (2025)

Source: Authors, compiled from the cited studies.

From Pilot to Production

One notable change since 2024 is that blockchain in banking has moved from pilot projects to systems that hold real value. Three use cases illustrate this transition across bulk payments, securities financing, and asset management.

In cross-border bulk payments, the Agora project tested tokenized settlement with real funds. The project is organized by the Bank for International Settlements and the Institute of International Finance, and brings together eight central banks and more than forty private institutions. In July 2026, it completed a live-value test involving twenty-eight institutions and five central banks in Asia, Europe, and North America. The operation settled approximately 800,000 Swiss francs across 17 scenarios in six currencies, with payments completed in about 80 seconds on average (Bank for International Settlements, 2026). The design preserves the two-tier banking structure, allowing tokenized central bank reserves to correspond with tokenized commercial deposits, and integrates compliance checks at the protocol level. Figure 3 compares this arrangement with the correspondent banking chain it seeks to replace.

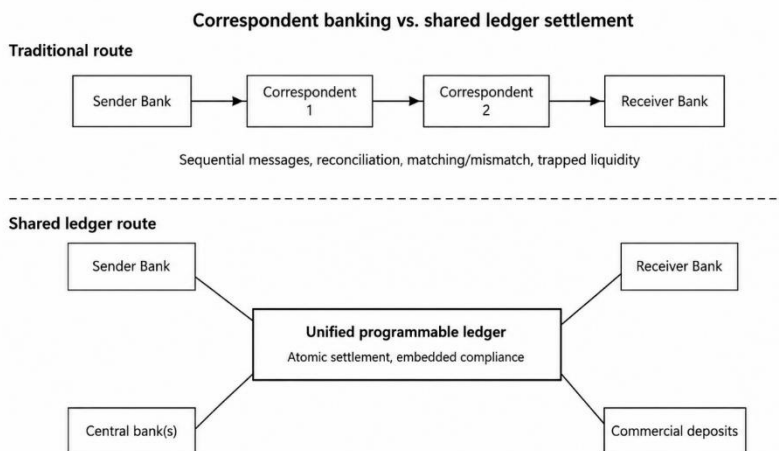


Figure 3. Correspondent banking compared with shared-ledger settlement

Source: Authors, based on Bank for International Settlements (2026) and Rella (2019).

In securities finance, the Broadridge distributed ledger-based repurchase platform has become a major system for settling tokenized repurchase agreements. It processed \$8 trillion in July 2026, with an average daily volume of \$365 billion—an increase of 28 percent over the previous year. Earlier in the year, the daily average had reached \$354 billion in March, a figure that represented a 392 percent year-over-year jump as the platform expanded (Broadridge, 2026). An analysis by Finadium found that shifting 15 percent of a large bank’s volume to daily settlement on the platform reduced the required daily cash reserves by between 8 and 17 percent. Figure 4 tracks the monthly trend in daily volume throughout 2026.

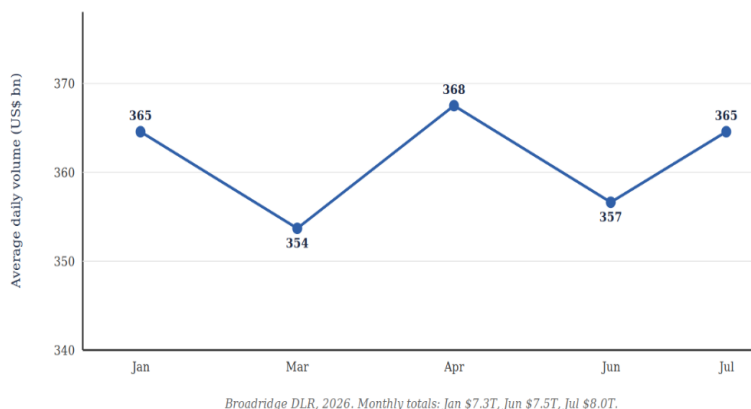


Figure 4. Broadridge DLR average daily volume, 2026

Source: Authors, based on Broadridge (2026).

In asset management, tokenized real-world assets have grown into a market of their own. By mid-2026, the on-chain value of non-stable tokenized assets ranged between \$32 billion and \$35 billion, with U.S. tokenized treasury funds being the largest category at over \$15 billion. BlackRock’s dollar-denominated Institutional Digital Liquidity Fund, launched in March 2024 in partnership with Securitize, had reached approximately \$2 billion to \$2.8 billion in assets by mid-2026 and had distributed more than \$100 million in cumulative returns to token holders. Following its launch on Ethereum, the fund expanded across several public and authorized blockchains (BlackRock & Securitize, 2026). Figure 5 illustrates the structure of the tokenized asset market.

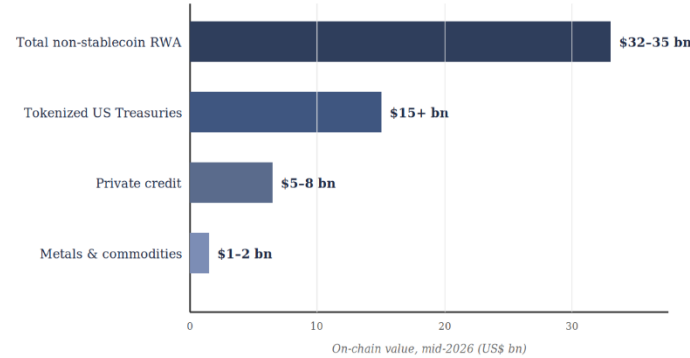


Figure 5. Composition of the tokenized real-world asset market, mid-2026

Source: Authors, based on RWA market data reported in 2026.

Table 3 compares these applications side by side. Together, they represent a transition from proof of concept to an infrastructure that regulated organizations use on a daily basis.

Table 3. Selected production deployments, 2026

Initiative	Domain	Reported metric	Governance
Project Agorá	Cross-border payments	CHF 800k settled, 80s average	BIS / IIF, central + commercial banks
Broadridge DLR	Securities repo	\$8.0T in July 2026, \$365B daily	Enterprise DLT (Canton)
BlackRock BUIDL	Asset management	\$2.4–2.8B AUM, \$100M+ yield paid	Issuer + Securitize, multi-chain

Source: Authors, based on Bank for International Settlements (2026), Broadridge (2026), and BlackRock & Securitize (2026).

Barriers to Expansion

Blockchain does not eliminate the need for governance; rather, it transforms it into rules governing membership, verification, access to data and updates, and accountability. This is why banks prefer permissioned networks, where authorized

participants control access and transaction rights (European Banking Authority, 2023). The main barriers are consistent across the literature.

Regulation comes first. Studies that weigh technical readiness against regulatory readiness often find that the latter is the decisive factor; the ease of local and international legislation and the clarity of data privacy emerge as critically important success factors (Mishra et al., 2023; Chen et al., 2021). Because many applications are cross-border, adoption depends on coordination among regulators—a process that is slow to materialize (Rella, 2019).

Compatibility is the second barrier. Banking systems are built around batch processing and have limited connectivity with continuously operating ledgers. Connecting separate blockchain chains requires enterprise-grade bridge solutions, and the integration of legacy systems remains understudied (Mafike & Mawela, 2022). Security and privacy constitute the third barrier. Transparency is a strength in blockchain but a challenge in finance, where customer data must remain confidential. Robust identity management, consent controls, and privacy-preserving technologies are needed to strike a balance between the two (Fen & Tia, 2021; Shoetan & Familoni, 2024).

A final caveat concerns systemic risks. A distributed network has no single point of failure, but that does not mean it is free of vulnerabilities. Consensus attacks, software flaws, defective smart contracts, or compromised credentials could harm the network or its outputs (European Banking Authority, 2023). Table 4 pairs each barrier with the response suggested by the literature.

Table 4. Barriers to adoption and proposed responses

Barrier	Nature	Proposed response
Regulation	Fragmented, cross-border	Early regulator engagement, standard-setting
Interoperability	Legacy batch systems, siloed chains	Institutional bridging, permissioned consortia
Security & privacy	Transparency vs. confidentiality	Identity controls, privacy-preserving methods
Governance	Rules for access and liability	Permissioned membership, clear dispute rules
Systemic risk	Shared failure modes	Auditing, resilient consensus design

Source: Authors, based on Mishra et al. (2023), Mafike & Mawela (2022), and European Banking Authority (2023).

Conclusion

Blockchain provides banks with a means to maintain a trusted, shared ledger across institutions, and this is where its value lies. The evidence supports tangible gains in payments, securities settlement, trade finance, and identity, but it does not support a comprehensive replacement of core banking systems. The applications of 2026 make this a reality: a repurchase platform settling \$8 trillion monthly, a

cross-border settlement pilot transferring real value in 80 seconds, and tokenized funds holding billions in assets—all of these are production realities, not predictions.

The path forward lies more in regulation, compliance, and governance than in the technology itself, whose capabilities are now well-documented. Banks that engage regulators early, plan for compliant and authorized architectures, and treat security and privacy as design requirements will realize gains more quickly. The likely outcome is selective integration: blockchain components embedded in a regulated banking architecture that operates alongside traditional databases and existing payment channels. The task ahead for researchers is to replace predictions with longitudinal evidence from systems currently in production, so that claims regarding cost and efficiency can be tested on a large scale.

References

1. Bank for International Settlements. (2026). Project Agorá: Real value testing. Basel, Switzerland: BIS. Retrieved from www.bis.org/about/bisih/topics/fmis/agora.htm
2. BlackRock & Securitize. (2026). BlackRock USD Institutional Digital Liquidity Fund (BUIDL): Fund data. Retrieved from app.rwa.xyz
3. Broadridge Financial Solutions. (2026). Distributed Ledger Repo processes \$8.0 trillion in July. New York, USA: Broadridge. Retrieved from www.prnewswire.com
4. Chen, N.-P., Shen, K.-Y., & Liang, C. (2021). Hybrid decision model for evaluating blockchain business strategy: A bank's perspective. *Sustainability*, 13(11), 5809.
5. Chen, W., Xu, Z., Shi, S., Zhao, Y., & Zhao, J. (2018). A survey of blockchain applications in different domains. *Proceedings of the International Conference on Blockchain Technology*, 17–21.
6. Cucari, N., Lagasio, V., Lia, G., & Torriero, C. (2021). The impact of blockchain in banking processes: The Interbank Spunta case study. *Technology Analysis & Strategic Management*, 34, 138–150.
7. Daluwathumullagamage, D. J., & Sims, A. (2021). Fantastic beasts: Blockchain based banking. *Journal of Risk and Financial Management*, 14(4), 170.
8. Dashkevich, N., Counsell, S., & Destefanis, G. (2020). Blockchain application for central banks: A systematic mapping study. *IEEE Access*, 8, 139918–139952.
9. European Banking Authority. (2023). Uses of DLT in the EU banking and payments sector. Paris, France: EBA.

10. Fen, J., & Tia, A. (2021). The effect of blockchain on business intelligence efficiency of banks. *Kybernetes*, 51(8), 2652–2668.
11. Garg, P., Gupta, B., Chauhan, A., Sivarajah, U., Gupta, S., & Modgil, S. (2020). Measuring the perceived benefits of implementing blockchain technology in the banking sector. *Technological Forecasting and Social Change*, 163, 120407.
12. Guo, Y., & Liang, C. (2016). Blockchain application and outlook in the banking industry. *Financial Innovation*, 2, 24.
13. Hashimzai, I. A., & Ahmadzai, M. Z. (2024). Navigating the integration of blockchain technology in banking: Opportunities and challenges. *International Journal Software Engineering and Computer Science*, 4(2), 1–15.
14. Javaid, M., Haleem, A., Singh, R. P., Suman, R., & Khan, S. (2022). A review of blockchain technology applications for financial services. *BenchCouncil Transactions on Benchmarks, Standards and Evaluations*, 2(3), 100073.
15. Jena, R. (2022). Examining the factors affecting the adoption of blockchain technology in the banking sector: An extended UTAUT model. *International Journal of Financial Studies*, 10(4), 90.
16. Kowsar, M. M., & Mintoo, A. A. (2025). Blockchain in banking: A review of distributed ledger applications in loan processing, credit history, and compliance. *American Journal of Scholarly Research and Innovation*, 4(1), 1–22.
17. Lu, Y., Yeh, C., & Kuo, Y. (2024). Exploring the critical factors affecting the adoption of blockchain: Taiwan's banking industry. *Financial Innovation*, 10, 12.
18. Mafike, S. S., & Mawela, T. (2022). Blockchain design and implementation techniques, considerations and challenges in the banking sector: A systematic literature review. *Acta Informatica Pragensia*, 11(3), 396–422.
19. Mishra, R., Singh, R. K., Kumar, S., Mangla, S. K., & Kumar, P. V. (2023). Critical success factors of blockchain technology adoption for sustainable and resilient operations in the banking industry during an uncertain business environment. *Electronic Commerce Research*, 25(1), 595–629.
20. Motta, G. A., Tekinerdogan, B., & Athanasiadis, I. N. (2020). Blockchain applications in the agri-food domain: The first wave. *Frontiers in Blockchain*, 3, 6.
21. Ogunrinde, A., Heredero, C. D., Montes Botella, J. L., & Fernández-Sanz, L. (2025). The impact of blockchain technology and dynamic capabilities on banks' performance. *Big Data and Cognitive Computing*, 9(6), 144.

22. Osmani, M., El-Haddadeh, R., Hindi, N., Janssen, M., & Weerakkody, V. (2020). Blockchain for next generation services in banking and finance: Cost, benefit, risk and opportunity analysis. *Journal of Enterprise Information Management*, 34(3), 884–899.
23. Patel, R., Migliavacca, M., & Oriani, M. E. (2022). Blockchain in banking and finance: Is the best yet to come? A bibliometric review. *Research in International Business and Finance*, 62, 101718.
24. Rahman, S. M. M., Yii, K. J., Masli, E. K., & Voon, M. L. (2024). The blockchain in the banking industry: A systematic review and bibliometric analysis. *Cogent Business & Management*, 11(1), 2407681.
25. Rella, L. (2019). Blockchain technologies and remittances: From financial inclusion to correspondent banking. *Frontiers in Blockchain*, 2, 14.
26. Shoetan, P. O., & FAMILONI, B. T. (2024). Blockchain's impact on financial security and efficiency beyond cryptocurrency uses. *International Journal of Management & Entrepreneurship Research*, 6(4), 1211–1235.

TEHNOLOGIJA BLOKČEJNA I NJENE PRIMJENE U BANKARSTVU: MOGUĆNOSTI I IZAZOVI

Hassiba Almi¹, Aboubaker Khoualed², Khathir Chine³

Apstrakt

Ovaj rad ispituje kako banke koriste tehnologiju blokčejna i šta ometa širenje njene primjene. Rad pruža pregled novije naučne literature, kao i stvarnih primjena dokumentovanih tokom 2025. i 2026. godine. Metodologija kombinuje analizu recenziranih studija sa provjerenim podacima centralnih banaka, pružalaca tržišne infrastrukture i upravljača imovinom. Rezultati pokazuju da najveća vrijednost proizlazi iz dijeljenja knjiga (ledger) među regulisanim institucijama, a ne iz javnih kriptovalutnih mreža. Većina izmjerenih dobitaka koncentrisana je u oblastima plaćanja, poravnanja hartija od vrijednosti, finansiranja trgovine i verifikacije identiteta. Sistemi koji danas funkcionišu ostvaruju stvarnu vrijednost velikih razmjera; jedna platforma za reotkup poravnala je 8 biliona dolara u jednom mjesecu, a tokenizovani trezorski fondovi premašili su 15 milijardi dolara. Usvajanje ostaje ograničeno regulativom, kompatibilnošću sa postojećim sistemima i upravljanjem. Rad zaključuje da banke selektivno integrišu blokčejn u svoju regulisanu infrastrukturu, a ne radi zamjene svojih osnovnih sistema.

Ključne riječi: blokčejn, banke, distribuirana glavna knjiga, tokenizacija, poravnanje.

¹ dr Hassiba Almi, Univerzitet Badji Mokhtar-Annaba, P.O. Box 12, 23000 Annaba, Alžir, Tel: +213 553 998 752, E-mail: hassiba.almi@univ-annaba.dz

² Aboubaker Khoualed, profesor, Univerzitet Badji Mokhtar-Annaba, P.O. Box 12, 23000 Annaba, Alžir, Tel: +213 656 223 061, E-mail: aboubaker.khoualed@univ-annaba.dz

³ Univerzitetski centar Ilizi, dr, Alžir, E-mail: chine.khathir@cuillizi.dz