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Research Article

Decentralized Banking Network for Secure Predictive Assessment and Cross-Entity Knowledge Sharing

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Abstract

The rapid transformation of financial systems requires secure and intelligent architectures capable of supporting predictive analysis, decentralized operations, and collaborative knowledge exchange. Traditional banking infrastructures often depend on centralized data management, creating challenges related to privacy risks, limited interoperability, and restricted cross-entity collaboration. This research proposes a Decentralized Banking Network (DBN) designed to integrate blockchain-based distributed systems, predictive assessment mechanisms, and secure knowledge-sharing capabilities.

The proposed framework enables financial institutions to collaboratively analyse data while maintaining ownership and confidentiality of sensitive information. The architecture combines distributed ledger technology, intelligent prediction models, and decentralized governance mechanisms to improve financial decision-making. Blockchain concepts provide transparency and trust among participating entities, while predictive assessment techniques support risk evaluation, fraud detection, and strategic planning.

The theoretical foundation of this research is derived from distributed ledger systems, decentralized control, and federated financial intelligence. Distributed ledger technology provides mechanisms for secure and transparent transactions across independent participants (Sunyaev and Sunyaev, 2020). Recent developments in federated financial ecosystems demonstrate the potential of decentralized analytics for improving risk assessment while maintaining data sovereignty (Arifin Shawn et al., 2025).

The proposed network highlights how decentralized banking models can improve security, collaboration, and predictive accuracy. However, challenges related to scalability, regulatory compliance, computational complexity, and governance remain significant considerations. This research provides a conceptual framework for future banking ecosystems where institutions can achieve secure knowledge sharing without compromising confidential financial information.

Keywords

Decentralized banking, blockchain, predictive assessment, distributed ledger technology, financial intelligence, secure knowledge sharing, federated learning.

Introduction

The banking sector is experiencing increasing demand for intelligent systems capable of processing complex financial information while ensuring security and privacy. Traditional centralized banking architectures provide effective transaction management but face limitations related to single-point vulnerabilities, restricted data collaboration, and increasing cybersecurity concerns.

Decentralized technologies offer an alternative approach by distributing computational responsibilities among multiple entities. Blockchain and distributed ledger technologies enable secure transaction verification without requiring complete dependence on centralized authorities (Nakamoto, 2008). These technologies create opportunities for developing banking networks where institutions can share verified knowledge while maintaining control over their own information.

Predictive assessment has become an essential component of modern financial decision-making. Banks require accurate prediction mechanisms for evaluating credit risks, detecting suspicious activities, and forecasting market behaviour. However, developing reliable predictive models often requires access to large datasets distributed across multiple organizations. Decentralized learning approaches provide a solution by allowing institutions to collaboratively improve analytical models without directly exchanging sensitive data.

Research on decentralized financial ecosystems demonstrates the importance of combining distributed intelligence with data sovereignty. Arifin Shawn et al. (2025) highlighted that federated cloud finance ecosystems can support decentralized risk analytics and maintain sovereign data integrity through cross-institutional learning. This concept supports the development of banking networks where multiple entities contribute knowledge while preserving confidentiality.

The objective of this research is to propose a Decentralized Banking Network for secure predictive assessment and cross-entity knowledge sharing. The study focuses on integrating blockchain-based trust mechanisms, predictive intelligence, and decentralized governance into a unified banking framework.

The significance of this research lies in providing a conceptual foundation for future financial systems that require secure collaboration, improved prediction accuracy, and transparent operations. Such architectures can support advanced banking applications while addressing limitations of conventional centralized models.

Literature Review

The development of decentralized banking networks is supported by research in blockchain technology, distributed systems, and intelligent financial computation. Existing studies demonstrate that secure information exchange and decentralized control are essential for creating reliable financial ecosystems.

Sunyaev and Sunyaev (2020) explained the role of distributed ledger technology in enabling secure and transparent decentralized systems. Their work highlights how blockchain-based architectures can reduce dependence on centralized intermediaries and improve trust among independent participants.

Nakamoto (2008) introduced the foundation of blockchain-based transaction systems through a peer-to-peer electronic cash model. This concept established the possibility of secure digital transactions without centralized financial authorities.

Swan (2015) discussed blockchain as a foundation for new economic systems, emphasizing its potential for transforming financial services through decentralized applications. Similarly, Mandapuram (2016) explored commercial applications of blockchain and distributed ledger technology, demonstrating their relevance in business and financial environments.

Bakule (2014) examined decentralized control systems and highlighted the importance of coordination mechanisms in distributed environments. These concepts are relevant to banking networks where multiple institutions must operate collectively while maintaining individual autonomy.

Recent research has expanded decentralized finance through federated intelligence. Arifin Shawn et al. (2025) demonstrated the importance of decentralized risk analytics and sovereign data integrity through cross-institutional learning. Their work provides a foundation for secure predictive assessment where organizations can contribute knowledge without exposing confidential information.

Although existing studies address blockchain security, decentralized governance, and financial applications, limited research combines predictive intelligence with decentralized banking collaboration. The proposed framework addresses this gap by integrating distributed ledger technology, predictive assessment, and secure knowledge sharing into a unified architecture.

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Methodology

1 Proposed Decentralized Banking Architecture

The proposed Decentralized Banking Network consists of four major layers:

Distributed Ledger Layer:

This layer manages secure transaction records using blockchain principles. Each participating financial entity maintains synchronized records, improving transparency and reducing dependence on centralized authorities.

Predictive Intelligence Layer:

This component applies analytical models to evaluate financial risks, customer behaviour, and market patterns. The models continuously improve through shared knowledge generated by participating entities.

Knowledge Sharing Layer:

The framework enables institutions to exchange analytical insights rather than raw financial data. This approach supports collaboration while preserving confidentiality.

Governance and Security Layer:

This layer manages access control, validation processes, and compliance requirements. Decentralized governance mechanisms ensure that multiple entities can participate without losing operational independence.

2 Predictive Assessment Process

The framework follows a distributed prediction workflow. Each banking entity analyses local financial information and generates predictive insights. These insights are securely combined to create collective intelligence.

To support AI-driven predictive assessment across decentralized banking environments, scalable multitenant data lake architectures can efficiently orchestrate heterogeneous financial datasets while maintaining resource isolation and computational scalability. Such infrastructures enhance distributed analytics by enabling secure storage, efficient data integration, and high-performance AI workloads across multiple participating institutions (Goyal, 2025).

For example, multiple banks can collaboratively improve fraud detection models by sharing learning outcomes instead of customer transaction records. This improves prediction accuracy while reducing privacy risks.

3 Knowledge Preservation Mechanism

The architecture uses decentralized data ownership principles where each institution maintains control over its information. Federated learning concepts support collaborative model improvement while protecting confidential financial data (Arifin Shawn et al., 2025).

The methodology provides a balance between transparency, predictive capability, and privacy preservation, creating a foundation for secure decentralized banking ecosystems.

Results

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The analysis of the proposed Decentralized Banking Network (DBN) indicates that integrating blockchain-based infrastructure with predictive intelligence can improve financial security, collaboration, and decision-making efficiency. The primary finding is that decentralized architectures provide a reliable alternative to traditional centralized banking models by distributing control among multiple entities.

The first major outcome is improved confidentiality management. Conventional banking systems require extensive data exchange between institutions, which increases privacy concerns. The proposed framework reduces this limitation by allowing entities to share analytical knowledge rather than complete datasets. This approach supports secure collaboration while maintaining institutional data ownership.

The second finding is enhanced predictive capability. By combining insights from multiple financial entities, decentralized predictive models can identify broader patterns and improve risk assessment accuracy. Arifin Shawn et al. (2025) highlighted the effectiveness of cross-institutional learning for decentralized risk analytics and sovereign data integrity. The proposed framework extends this principle by applying collaborative intelligence to banking prediction tasks.

The third finding relates to transparency and trust. Blockchain-based distributed ledgers provide mechanisms for maintaining verifiable transaction histories and reducing dependency on centralized authorities. These characteristics support secure financial operations and improve confidence among participating institutions (Sunyaev and Sunyaev, 2020).

The framework also demonstrates potential benefits in operational scalability. Distributed processing allows multiple organizations to contribute computational resources, reducing pressure on centralized systems. This approach can support applications such as fraud detection, credit evaluation, and financial forecasting.

However, several limitations were identified. Blockchain-based systems may experience performance challenges due to transaction processing requirements and network coordination complexity. Additionally, effective implementation requires common standards between participating financial institutions.

Overall, the findings suggest that decentralized banking networks can improve predictive assessment and secure knowledge sharing. The combination of distributed ledger technology and intelligent analytics provides a foundation for future financial ecosystems requiring transparency, privacy, and collaborative intelligence.

Discussion

The proposed decentralized banking framework represents a significant shift from traditional centralized financial systems toward collaborative and intelligent networks. The findings indicate that future banking

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infrastructures must balance three essential requirements: security, predictive accuracy, and efficient information sharing.

A major contribution of this research is the integration of predictive assessment with decentralized governance. Traditional banking systems often analyse information within isolated organizational boundaries, limiting the availability of collective intelligence. The proposed architecture enables institutions to collaborate while maintaining control over confidential information.

Blockchain technology provides the foundation for trust and transparency in this framework. Previous research on decentralized financial systems highlights the ability of distributed ledger technology to support secure transactions and reduce dependence on centralized intermediaries (Sunyaev and Sunyaev, 2020). Similarly, blockchain applications in commercial environments demonstrate its potential for improving business processes and financial operations (Mandapuram, 2016).

The practical implications of the framework are significant. Banks can use decentralized predictive models for credit evaluation, fraud prevention, and market analysis without transferring sensitive customer information. Such systems can improve operational efficiency while supporting regulatory requirements.

The role of federated financial intelligence is particularly important. Arifin Shawn et al. (2025) demonstrated that decentralized risk analytics through cross-institutional learning can preserve data sovereignty while improving analytical capabilities. This supports the argument that future banking networks should focus on knowledge collaboration rather than direct data sharing.

Despite these advantages, several challenges remain. Decentralized networks require advanced governance mechanisms to manage participation, verification, and compliance. Scalability is another concern because large financial networks may require significant computational resources. Additionally, achieving interoperability between different banking systems remains a technical challenge.

Future research should focus on developing practical implementations, improving predictive model efficiency, and creating adaptive governance frameworks. Integration with emerging artificial intelligence techniques may further enhance the capability of decentralized banking systems.

Overall, the discussion confirms that decentralized banking networks provide a promising approach for secure predictive assessment and cross-entity knowledge sharing. By combining blockchain trust mechanisms with intelligent analytics, financial institutions can develop more resilient and collaborative banking ecosystems.

Another important consideration is the management of large-scale financial datasets generated by decentralized banking networks. AI-oriented multitenant data lake architectures provide scalable storage and orchestration capabilities that improve analytical efficiency while supporting secure data management across distributed financial ecosystems. These architectures strengthen the scalability and operational performance of decentralized predictive frameworks (Goyal, 2025).

Conclusion

This research presented a Decentralized Banking Network for Secure Predictive Assessment and Cross-Entity Knowledge Sharing to address the limitations of traditional centralized financial systems. The proposed framework integrates blockchain-based distributed infrastructure, predictive intelligence, and secure knowledge-sharing mechanisms to support collaborative banking operations.

The study demonstrates that decentralized architectures can improve financial transparency, privacy preservation, and analytical capability. By allowing institutions to exchange knowledge instead of sensitive raw data, the framework enables collaborative intelligence while maintaining data ownership and confidentiality.

The integration of predictive assessment mechanisms provides opportunities for improving risk evaluation, fraud detection, and financial decision-making. Blockchain and distributed ledger concepts strengthen trust among participating entities by providing secure and verifiable transaction management (Sunyaev and Sunyaev, 2020). Furthermore, federated financial approaches support decentralized analytics and sovereign data protection through cross-institutional learning (Arifin Shawn et al., 2025).

However, practical deployment requires addressing challenges related to scalability, regulatory compliance, interoperability, and computational efficiency. Future research should focus on real-world implementation, advanced predictive models, and adaptive governance mechanisms for large-scale decentralized banking environments.

Overall, the proposed Decentralized Banking Network provides a foundation for future financial ecosystems where security, intelligence, and collaboration can coexist. The framework contributes toward developing more resilient, transparent, and privacy-aware banking systems.

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