

# Enhanced Academic Exploration of Blockchain and AI in Financial Services

Jianzheng Shi\* and Yue Wang

Business School, Singapore University of Social Sciences, Clementi, Singapore

\* Corresponding author. Email: Jzshi002@suss.edu.sg (J.S.)

Manuscript received September 16, 2024; accepted December 12, 2024; published March 27, 2025.

DOI: 10.18178/IJBTA.2025.3.1.24-28

---

**Abstract:** The application of blockchain technology and Artificial Intelligence (AI) in financial services is rapidly advancing, driving innovations in Financial Technology (FinTech). This paper reviews the major research advancements of blockchain and AI in the financial sector, explores their benefits, applications, and challenges. Despite the significant advantages of blockchain in enhancing transaction transparency and security, it faces issues related to scalability, regulation, and interoperability. AI excels in risk management, fraud detection, and customer service, but concerns about potential biases in algorithms and ethical issues need to be addressed. The paper also discusses the combined applications of blockchain and AI and suggests future research directions and improvements. The research indicates that although these technologies show great potential in financial services, their widespread application still requires overcoming numerous technical and regulatory barriers.

**Keywords:** blockchain technology, artificial intelligence, financial services, fintech, smart contracts, risk management, data security, regulatory challenges

---

## 1. Introduction

In recent years, the rapid development of blockchain technology and Artificial Intelligence (AI) in financial services has become a crucial force driving FinTech innovation. These technologies have not only improved the efficiency and security of financial services but also provided opportunities for developing new financial products and services [1, 2]. However, despite significant progress in existing research, several unresolved research gaps and challenges remain. This paper will first introduce the advantages of blockchain technology in financial services and its specific applications, followed by a detailed exploration of the challenges encountered in its practical application. Next, it will analyze the advantages and specific applications of AI in financial services, providing detailed examples and case studies and discussing the ethical issues related to its algorithms. Finally, the paper will explore the potential of combining blockchain and AI, expand on successful integration cases of these technologies, and propose future research directions.

Further illustrating the contribution of this research, several studies have highlighted the transformative potential of blockchain and AI in the financial sector. For instance, Guo and Liang (2016) emphasized the disruptive impact of blockchain technology on traditional financial services, particularly in areas such as payment systems and securities trading [2]. Similarly, Buchanan and Kock (2020) explored the application of AI in financial decision-making, risk management, and fraud detection, demonstrating its capacity to enhance operational efficiency and accuracy [3].

Moreover, the integration of blockchain and AI technologies presents unique opportunities and challenges. As pointed out by Salah *et al.* (2019), the synergy between these technologies can lead to more secure, transparent, and efficient financial systems [4]. However, Ekramifard *et al.* [5] noted that there are still significant technical and regulatory hurdles to overcome in successfully implementing these integrated solutions.

This paper aims to bridge the gap in existing literature by providing a comprehensive overview of both blockchain and AI applications in finance, critically analyzing their individual and combined potential, and identifying key areas for future research and development. By doing so, it contributes to the ongoing dialogue on the future of FinTech and provides valuable insights for both academics and practitioners in the field.

## 2. Blockchain Technology in Financial Services

### 2.1. Advantages of Blockchain Technology

Blockchain technology offers highly transparent and immutable transaction records through Distributed Ledger Technology (DLT), addressing trust issues inherent in traditional financial systems. Its applications in financial services offer significant advantages, such as reducing transaction costs, increasing transaction speed, and enhancing security. For instance, Khatwani *et al.* [6] discussed blockchain innovations in banking and financial services, highlighting its potential to significantly improve transaction transparency and security. Additionally, the use of smart contracts enables automated and intermediary-free transaction processes, further enhancing the efficiency of financial services.

### 2.2. Specific Applications of Blockchain in Financial Services

Blockchain is widely applied in areas such as payments, securities trading, and supply chain finance (Table 1). These applications simplify payment processes, enhance the transparency of securities trading, and improve the information transparency of supply chain financing [7-9].

Table1. Blockchain Application

Application Area	Blockchain Application	Main Advantages
Payments	Decentralized payment platforms	Simplifies payment processes, reduces fraud risks
Securities Trading	Decentralized Exchanges (DEX)	Enhances transaction transparency, reduces intermediary costs
Supply Chain Finance	Supply chain financing platforms	Improves information transparency, reduces financing costs
Smart Contracts	Automated contract execution platforms	Enables automated transactions without third-party intervention

### 2.3. Challenges and Limitations of Blockchain Technology

Despite its many advantages, blockchain technology faces several challenges and limitations in practice: Current blockchain systems face bottlenecks in transaction processing speed and network scale. For example, mainstream blockchain platforms like Bitcoin and Ethereum have relatively slow transaction speeds, limiting their large-scale application. Emerging solutions such as the Lightning Network and sharding are still under development [10]. The decentralized nature of blockchain technology complicates its regulation. The legal frameworks for blockchain and cryptocurrencies are not yet unified across countries, increasing the uncertainty of technology application. For instance, the European Union is developing the Markets in Crypto-Assets (MiCA) regulation to provide clearer regulatory guidelines [11]. Interoperability between different blockchain systems remains a significant challenge. Achieving data exchange and smart contract recognition

between different blockchain platforms is crucial for widespread technology application. Cross-chain technology and interoperability protocols are potential solutions.

### **3. Applications of Artificial Intelligence in Financial Services**

#### **3.1. Advantages of Artificial Intelligence Technology**

AI technology has significant advantages in data processing and analysis capabilities, which can greatly enhance the efficiency and accuracy of financial services. Ostmann and Dorobantu [12] detailed the current applications of AI in financial services, emphasizing its crucial role in risk management, market prediction, and customer service. AI technology, through Machine Learning (ML) and Deep Learning (DL) algorithms, can extract valuable information from vast amounts of data, providing scientific bases for financial decision-making [13].

#### **3.2. Specific Applications of AI in Financial Services**

AI is extensively applied in risk management, fraud detection, customer service, and wealth management. Below are detailed examples and case studies: AI algorithms can analyze market data in real-time to predict potential risks. For instance, JP Morgan's AI platform can analyze transaction data in real-time, predicting market fluctuations to help investors mitigate risks. AI can quickly identify abnormal transactions and prevent fraud by analyzing user behavior data. PayPal uses AI technology to detect fraudulent activities, significantly reducing fraud losses. AI-driven intelligent customer service systems provide 24/7 support, enhancing customer satisfaction. Major institutions in the banking industry, such as JP Morgan and Citibank, have adopted AI customer service robots, significantly improving service efficiency. Robo-advisors use AI technology to offer personalized investment advice, significantly improving the efficiency and effectiveness of wealth management. Companies like Wealthfront and Betterment use AI to provide personalized investment portfolio recommendations.

#### **3.3. Ethical Considerations and Potential Biases of AI Algorithms**

The application of AI algorithms in financial services also raises several ethical issues and potential biases: AI systems rely on large amounts of user data, and the collection and use of this data may infringe on user privacy. Financial institutions need to ensure data security and privacy. AI algorithms may reflect the unconscious biases of developers, leading to unfair decision outcomes. For example, a study found that certain credit scoring algorithms exhibit systemic bias against users of specific races and genders. The black-box nature of AI decision-making processes results in insufficient transparency, making it difficult for users to understand and trust AI decisions. Financial institutions need to improve the transparency and explainability of AI systems. Explainable AI (XAI) techniques are being widely researched and applied to enhance transparency.

### **4. The Potential of Blockchain and AI Integration**

#### **4.1. Successful Integration Cases**

The combination of blockchain and AI can further enhance the security and efficiency of financial services. Here are some successful integration cases:

By recording user credit data with blockchain technology and using AI algorithms for credit scoring, the accuracy and transparency of credit evaluations can be improved. Some FinTech companies have already adopted this method to offer fairer credit evaluation services. Blockchain technology can ensure the

authenticity of transaction records in the supply chain, while AI can analyze this data to optimize supply chain finance services. For example, the TradeLens blockchain platform, developed by IBM and Maersk, combines AI and blockchain technology to improve the transparency and efficiency of supply chain finance. Blockchain smart contracts can enable automated transactions, and AI algorithms can optimize these transaction strategies. For instance, AI can adjust the parameters of smart contracts in real-time based on market data to ensure optimal execution of transactions.

## **4.2. Technical and Operational Challenges**

Despite the great potential of blockchain and AI integration, several technical and operational challenges exist in practical applications:

The quality of data in blockchain systems directly affects the accuracy of AI algorithms. Ensuring the authenticity, completeness, and timeliness of data is a major challenge. Both blockchain and AI technologies require substantial computational resources. Efficiently utilizing these resources is a problem that needs to be addressed. Ensuring compatibility between blockchain and AI systems is essential for seamless integration [14].

## **5. Current Research Limitations and Future Directions**

### **5.1. Limitations of Existing Research**

Despite the significant advancements in the application of blockchain and AI in the financial sector, many challenges and research gaps remain. For example, how to effectively integrate blockchain and AI technologies to achieve more efficient financial services requires further research. Additionally, regulatory and ethical issues concerning these technologies need more exploration. Buchanan and Kock noted that existing research largely focuses on the application level of the technology, with insufficient attention to system compatibility, data privacy, and security issues during the technology integration process.

### **5.2. Future Research Directions**

Future research could focus on the following areas: Exploring how to optimize the combination of blockchain and AI to achieve more efficient financial services. For example, researching the application of smart contracts in AI algorithms and how blockchain technology can enhance the training and validation process of AI models. Investigating the regulatory frameworks and ethical issues of blockchain and AI in financial services to ensure the safe and fair application of technology. For example, how to ensure data transparency with blockchain technology while protecting user privacy and how to formulate corresponding laws and regulations to standardize the application of AI algorithms [15]. Expanding the application areas of blockchain and AI in financial services, such as green finance and inclusive finance. Researching how to use blockchain and AI technologies to promote sustainable financial development and provide technical support for financial inclusion [16].

## **6. Conclusion**

The application prospects of blockchain and AI technologies in financial services are broad. They not only enhance the efficiency and security of financial services but also open up new possibilities for developing new products and services. However, to fully realize the potential of these technologies, future research needs to delve into issues related to technology integration, regulation, ethics, and application expansion. Through systematic research and practical applications, blockchain and AI are expected to bring more innovation and transformation to the financial industry.

## Conflict of Interest

The authors declare no conflict of interest.

## Author Contributions

Jianzheng Shi and Yue Wang participated in conceptualization, methodology, data collection, analysis, writing the original draft, reviewing, and editing; both authors had approved the final version.

## References

- [1] D. K. Citron and F. Pasquale, "The scored society: Due process for automated predictions," *Washington Law Review*, vol. 89, no. 1, pp. 1–33, 2014.
- [2] Y. Guo and C. Liang, "Blockchain application and outlook in the banking industry," *Financial Innovation*, vol. 2, no. 1, p. 24, 2016.
- [3] B. Buchanan and J. Kock, "Artificial intelligence: A tectonic shift in financial services," *Journal of Financial Transformation*, vol. 51, pp. 8–13, 2020.
- [4] K. Salah, M. H. U. Rehman, N. Nizamuddin, and A. A. Fuqaha, "Blockchain for AI: Review and open research challenges," *IEEE Access*, vol. 7, pp. 10127–10149, 2019.
- [5] A. Ekramifard, H. Amintoosi, A. H. Seno, A. Dehghantanha, and R. M. Parizi, "A systematic literature review of integration of blockchain and artificial intelligence," *Blockchain Cybersecurity*, pp. 137–175, 2020.
- [6] R. Khatwani, M. Mishra, and M. Bedarkar, "Impact of blockchain on financial technology innovation in the banking financial services and insurance (BFSI) sector," *Journal of Statistics and Management Systems*, vol. 26, no. 3, pp. 593–605, 2023.
- [7] G. Yang, "Optimization of university financial services using the blockchain technology," *Scientific Programming*, pp. 1–10, 2022.
- [8] C. Zhao and X. Meng, "Research on innovation and development of blockchain technology in the financial field," in *Proc. 2019 International Conference on Pedagogy, Communication and Sociology*, pp. 736–739.
- [9] C. Zhao and X. Meng, "Application research of blockchain technology in financial field," *DEStech Transactions on Economics, Business and Management*, 2019.
- [10] Y. Luo, "Research progress on financial innovation based on blockchain technology," *Frontiers in Business Economics and Management*, vol. 2, no. 1, pp. 32–38, 2023.
- [11] D. Dillenberger *et al.*, "Blockchain analytics and artificial intelligence," *IBM Journal of Research and Development*, vol. 63, 2019.
- [12] F. Ostmann and C. Dorobantu, "AI in financial services," *The Alan Turing Institute*, 2021.
- [13] B. Yu, "Fintech application: Artificial intelligence and blockchain," *Advances in Economics, Management and Political Sciences*, vol. 6, no. 1, pp. 31–37, 2023.
- [14] H. Taherdoost, "Blockchain technology and artificial intelligence together: A critical review on applications," *Applied Sciences*, vol. 12, no. 24, 2022.
- [15] A. A. Hussain and F. A. Turjman, "Artificial intelligence and blockchain: A review," *Transactions on Emerging Telecommunications Technologies*, vol. 32, no. 9, 2021.
- [16] H. Guo and P. Polak, "Intelligent finance and change management implications," *Humanities and Social Sciences Communications*, vol. 10, p. 413, 2023.

Copyright © 2025 by the authors. This is an open access article distributed under the Creative Commons Attribution License which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited ([CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)).