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Development History, Challenges, and Future Prospects of Digital Currency

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Abstract: In recent years, digital currency has experienced rapid growth and garnered widespread attention from various sectors. By reviewing its developmental trajectory—from early conceptualizations and theoretical foundations, to the emergence and rise of Bitcoin, the exploration and implementation of central bank digital currencies (CBDCs), and the proliferation of alternative cryptocurrencies—this paper outlines the key stages in the evolution of digital currency. It highlights current challenges such as privacy protection and regulatory issues, while projecting future advancements in technological innovation, regulatory frameworks, and expanded application scenarios.

Keywords: digital currency; Bitcoin; digital technology; central bank

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1. Introduction

With the rapid advancement of information technology, the form of currency has undergone continuous transformation. As an emerging monetary form, digital currency has garnered significant attention in recent years. Since the inception of Bitcoin, the digital currency market has witnessed explosive growth, attracting a substantial influx of investors and enterprises. Concurrently, governments and regulatory agencies around the world have begun to recognize the profound impact of digital currencies and are actively engaged in exploring appropriate regulatory frameworks. This review aims to systematically analyze the developmental trajectory, challenges, and future trends of digital currencies, thereby providing valuable insights and references for related research and decision-making processes.

2. The Development History of Digital Currency

2.1. Early Conceptualization and Theoretical Foundations (1980s–2008)

Chaum first proposed the theoretical framework for digital currency and introduced the concept of electronic cash. He also developed cryptographic formulas for network encryption, laying the theoretical foundation for the development of digital currencies[1]. In these early conceptualizations, digital currencies were envisioned to break the monopoly of traditional financial systems and enable more convenient and efficient payment and transaction methods. Although digital currencies had not yet materialized during this period, these theoretical proposals inspired subsequent research and practical

applications. For instance, David Chaum's electronic cash concept emphasized the anonymity and security of digital currencies, providing crucial design principles for future developments. Over the following decade, emerging technological prototypes based on these concepts solidified the groundwork for the eventual emergence of digital currencies. In 1997, the Proof-of-Work mechanism introduced by Hashcash later became a core technology for Bitcoin and other digital currencies.

These early technological explorations and conceptual innovations, though developed independently, collectively laid the foundation for the embryonic framework of digital currency systems. Each contribution provided essential technical components and theoretical underpinnings from diverse perspectives, gradually transforming digital currency from an abstract concept into a tangible and viable possibility.

2.2. The Birth and Rise of Bitcoin (2009-2013)

On January 3, 2009, the first block containing 50 Bitcoin was created, officially ushering in the era of digital currency. Bitcoin quickly gained market attention due to its decentralized nature, anonymity, and tamper-proof characteristics. The advent of Bitcoin marked a pivotal milestone in the development of digital currencies by addressing a critical challenge: the double-spending problem. Traditional electronic payment systems, relying on centralized authorities, were vulnerable to the repeated spending of the same digital assets due to the absence of an effective decentralized trust mechanism. Bitcoin revolutionized this paradigm through its innovative use of blockchain technology and the Proof-of-Work consensus mechanism. By recording transactions transparently on a distributed ledger that is maintained and verified by a network of nodes, Bitcoin ensures the uniqueness and immutability of each transaction. This not only eliminates the risk of double-spending but also grants users greater autonomy and enhanced privacy protection [2].

2.3. Exploration and Practice of Central Bank Digital Currencies (2017-2020)

Since 2017, central banks worldwide have actively explored the feasibility of Central Bank Digital Currencies (CBDC). The Digital RMB Research and Development Working Group of the People's Bank of China (2021) published the "White Paper on the Progress of Digital RMB Research and Development," which comprehensively detailed China's digital yuan development from conceptual design to pilot implementation.

However, the exploration and practice of CBDCs have not been without challenges. As noted by Zhou Qiwen, Guan Shuxuan, Meng Yueting et al., technical obstacles such as blockchain scalability and system security persist, with potential risks including cyberattacks and data breaches constantly threatening digital currency systems [3].

In terms of social acceptance, public concerns regarding security and privacy protection have posed significant barriers to the widespread adoption of digital currencies. For example, during the pilot programs of the digital yuan, although substantial user participation was achieved, some individuals remained hesitant to fully embrace it. This reluctance stemmed from either deeply ingrained payment habits or lingering doubts about the security of the digital currency [4].

2.4. The Rise of Altcoins and the Expansion of Blockchain Technology (2017-Present)

With the growing popularity of Bitcoin, various blockchain-based cryptocurrencies have emerged in rapid succession. Cryptocurrencies such as Litecoin and Ripple have addressed diverse market needs through technological innovations and expanded application scenarios. These new digital currencies have enriched the variety and use cases of cryptocurrencies. While inheriting Bitcoin's core technical principles—including decentralization and distributed ledger technology—they have introduced innovations and improvements to overcome Bitcoin's limitations in transaction speed, energy consumption, and application scope.

This evolution has propelled the continuous advancement of digital currency technology, tailoring solutions to meet the needs of diverse user groups and market demands. In doing so, it has collectively nurtured a more vibrant and diversified cryptocurrency ecosystem.

3. Challenges Facing Digital Currencies

With the rapid development of the digital economy, digital currencies have gradually become a focal point in the financial sector. Bai Yushuang points out that digital currencies face numerous challenges during their development, including potential disruptions to financial system stability and impacts on the business models and profitability of traditional financial institutions [5]. Qin Anliu and colleagues examine the challenges associated with the issuance of central bank digital currencies (CBDCs) in China, including technical security concerns, changes in monetary policy transmission mechanisms, and regulatory complexities [6].

3.1. Privacy Protection

In the field of digital currencies, the security of user information and privacy protection constitute critical social and ethical concerns. Particularly during user authentication processes, risks related to data collection and privacy breaches persist. Many digital currency projects require extensive user information during registration and transactions to comply with regulations and ensure transaction security.

Furthermore, vulnerabilities in the verification procedures of some digital currency exchanges may lead to user data leaks [7]. While transaction records maintain a degree of anonymity, advanced technical methods can potentially trace and analyze them, thereby infringing on users' privacy rights [8].

3.2. Financial Stability

From a financial stability perspective, Bouis R's balance sheet analysis indicates that central bank digital currency (CBDC) issuance may impact financial stability by altering banks' funding structures and increasing financial system fragility [9]. Jin Zhonghao suggests that digital currency development could exacerbate financial disintermediation, potentially disrupting traditional financial systems' credit creation and capital allocation functions [10].

Lu Xunfa and colleagues examined the effects of unexpected events on risk spillover levels between cryptocurrency and energy markets. Their findings reveal that the high volatility of digital currency markets can trigger chain reactions in other markets, thereby threatening overall financial stability [11].

3.3. Regulatory Challenges

The regulatory issues surrounding digital currencies have persisted for years. Given their cross-border nature and technological innovation, significant disparities exist in regulatory approaches across jurisdictions. These differences have not only created regulatory gaps and gray areas but also negatively impacted market order. Xiao Xiang et al. (2024) reviewed global digital finance regulatory trends, highlighting current challenges such as inconsistent regulatory standards and substantial opportunities for regulatory arbitrage [12].

Furthermore, ambiguous regulatory policies make it difficult for businesses to determine compliance boundaries, thereby increasing operational risks. Hu Xiaofei and Guo Hua identified challenges financial institutions face in identifying high-risk digital currency users, emphasizing the need to develop effective risk assessment models [13].

3.4. Cross-Border Circulation

Regarding the cross-border circulation of digital currencies, Wu Xiaoyan analyzed the opportunities, challenges, and countermeasures of the digital yuan's cross-border flow. The study identified multiple policy coordination challenges, including monetary sovereignty conflicts, foreign exchange management issues, and prudential supervision of cross-border capital flows [14].

From a risk regulation perspective, Yang Dong and Gao Qingchun examined the dilemmas in cross-border circulation of central bank digital currencies (CBDCs), highlighting legal challenges in cross-border payments and regulatory coordination difficulties [15]. Fan Xiaobo investigated the legal challenges and regulatory coordination pathways for CBDC cross-border payments, emphasizing the need to establish international regulatory coordination mechanisms to facilitate

healthy development [16]. Pang Ye and Xian Xiang explored the application of digital currencies in international trade and their challenges to traditional financial systems. Their research suggests that cross-border use of digital currencies may impact international trade settlement systems and financial stability [17].

4. Future Prospects of Digital Currency

With the rapid global development of digital currencies, academia has engaged in extensive discussions regarding their future trajectories. Current research indicates that the outlook for digital currencies primarily focuses on three key dimensions: technological innovation, regulatory policy refinement, and application scenario expansion.

4.1. Technological Innovation Drives Development

In terms of technological innovation, Chen Liuqin, from the perspective of new-quality productive forces, has pointed out that the in-depth integration of finance and technology is the key path for credit innovation, and this idea is also applicable to the field of digital currency [18]. In the future, digital currency is expected to make breakthroughs in technological security and scalability. For example, the development of quantum-resistant cryptographic algorithms to counter the threats posed by quantum computing, and the exploration of new consensus mechanisms and technical architectures to enhance transaction processing capabilities. Meanwhile, the integration of emerging technologies such as artificial intelligence and the Internet of Things with digital currency will also bring new opportunities for its development. Artificial intelligence technology can be used for risk monitoring and early warning in the digital currency market, while the Internet of Things technology can expand the application scenarios of digital currency, enabling automatic payments and settlements between devices.

4.2. Regulatory Policies Gradually Improve

The improvement of regulatory policies is an important safeguard for the sustainable development of digital currencies. Jin Dianchen and Li Chengwei, in their analysis of the latest developments in U.S. digital currencies, pointed out that governments and regulatory authorities around the world are gradually strengthening the regulation of digital currencies. In the future, regulatory policies will focus more on balancing innovation and risk, such as adopting flexible methods like regulatory sandboxes to provide space for industry innovation [19]. Meanwhile, international regulatory cooperation will also be enhanced to jointly address the challenges brought by cross-border digital currency transactions and to promote the orderly development of the global digital currency market. Zhou Kejie et al., starting from the development trends of global central bank digital currencies, emphasized the importance of international regulatory cooperation and argued that strengthening the coordination of cross-border transaction regulation is a key measure to cope with the global challenges of digital currencies [20]. This regulatory trend helps to create a fair, transparent, and secure market environment, thereby promoting the orderly development of the digital currency market.

4.3. Continuous Expansion of Application Scenarios

In terms of expanding application scenarios, Li Zhenrong et al. have proposed that digital currencies can empower public services, achieving value creation and model innovation. This perspective reveals the diversified trend of digital currency applications [21]. In addition to traditional payment settlement and digital asset management, the potential applications of digital currencies in cross-border trade, supply chain finance, and digital identity authentication are being continuously explored. For example, the promotion of central bank digital currencies can significantly improve the efficiency of cross-border payments and reduce transaction costs. In supply chain finance, their application can enable real-time fund settlement and transparent supply chain management. Sun Ninghua and Yan Yunnong further pointed out that the improvement of transaction efficiency and the protection of privacy will accelerate the penetration of digital currencies in various economic scenarios, making them an indispensable part of future economic life [22].

5. Research Review

Existing literature reviews on digital currencies have systematically explored multiple dimensions, including their developmental history, challenges faced, and future prospects. These studies hold significant academic and practical value but also offer room for further expansion.

In terms of research strengths, firstly, the existing studies provide a clear and comprehensive account of the developmental history of digital currencies. From the early construction of theoretical foundations to the rise of Bitcoin, the exploration of central bank digital currencies, and the innovative development of alternative coins, these studies link key milestones through a chronological narrative. By integrating typical case studies and technical principles, they illustrate the evolution of digital currencies from concept to practice, offering a detailed basis for understanding their developmental logic. Secondly, in addressing challenges, these studies focus on core areas such as privacy protection, financial stability, regulation, and cross-border circulation. They integrate multidisciplinary perspectives and international research findings to deeply analyze the difficulties faced by digital currencies, revealing the complex challenges at the technological, economic, and social levels.

However, current research still has certain limitations. Firstly, in terms of research methods, existing literature is predominantly qualitative, with a relative lack of quantitative research. There is insufficient quantitative assessment of the factors influencing the development of digital currencies, making it difficult to precisely measure the intensity and direction of these factors' impact on digital currency development. Secondly, in terms of research depth, although various issues are covered, some areas are not explored deeply enough. Thirdly, from a research perspective, the depth and breadth of interdisciplinary integration need to be expanded.

Based on the above analysis, future research on digital currencies should explore the complex issues in their development from multiple dimensions, providing more comprehensive and operational theoretical support and practical guidance for the healthy development of digital currencies.

Disclosure statement

The author declares no conflict of interest.

References

[1] Chaum, D., Sherman, A. T., & Rivest, R. L. (1983). BLIND SIGNATURES FOR UNTRACEABLE PAYMENTS. In Advances in Cryptology, 199–203. Springer. https://doi.org/10.1007/978-1-4757-0602-4_18

[2] Meiklejohn, S., Pomarole, M., Jordan, G., Levchenko, K., McCoy, D., Voelker, G. M., & Savage, S. (2013). A fistful of bitcoins: characterizing payments among men with no names. Proceedings of the 2013 Conference on Internet Measurement Conference, 127–140. https://doi.org/10.1145/2504730.2504747

[3] Zhou, Q., Guan, S., Meng, Y., et al. (2025). Global digital currency development trends and exploration practices of Chinese and foreign banking sectors. International Finance, (2), 32-38.

[4] Li, Y. (2025). Research on the transformation of financial technology regulation by China's central bank in the era of digital currency. Qinghai Finance, (2), 52-57.

[5] Bai, Y. (2025). Challenges and institutional safeguard strategies in digital currency development. Business News, (7), 101-103

[6] Deng, J., Qin, A., & Qin, Y. (2021). Discussion on challenges in the issuance of digital currency by China's central bank. Financial Technology Times, 29(10), 83-86.

[7] []Jia, P. (2025). Central bank digital currency and personal privacy: With discussion on its economic impacts. Journal of Quantitative & Technological Economics, 42(6), 132-150.

[8] Deng, Y. (2023). Research on cross-border application of CBDC and international regulatory coordination. Financial Regulation Research, (10), 80–94.

[9] Bouis, R. (2025). The impact of central bank digital currency issuance on financial stability: A balance sheet analysis. New Finance, (6), 64-73.

[10] Jin, Z. (2025, February 28). The impact and challenges of digital currency on traditional financial systems. Market Information News, p. 006.

[11] Lu, X., Huang, N., Zhang, Z., et al. (2025). Research on the impact of unexpected events on risk spillover levels between cryptocurrency and energy markets. Journal of Systems Science and Mathematical Sciences. https://knshtbprolcnkihtbprolnet-p.libvpn.cwu.edu.cn/kcms/detail/11.2019.O1.20250126.1102.034.html.

[12] Xiao, X., Wang, Y., Ding, Y., et al. (2025). 2024 global digital finance regulatory policy trends review. Contemporary Financiers, (5), 104-106.

[13] Hu, X., & Guo, H. (2025). Research on financial institutions' digital currency risk user identification models. Jiangsu Communication, 41(2), 102–107.

[14] Wu, X. (2025). Opportunities, challenges and countermeasures of digital yuan cross-border circulation. Jiangsu Business Review, (6), 66–69.

[15] Yang, D., & Gao, Q. (2025). Dilemmas and solutions in cross-border flows of legal digital currency: A risk regulation perspective. Beijing Social Sciences, (1), 63–74.

[16] Fan, X. (2024). Legal challenges and regulatory coordination pathways for cross-border payments with central bank digital currency. Tribune of Political Science and Law, 42(6), 86–97.

[17] Pang, Y., & Xian, X. (2024). Application of digital currency in international trade and its challenges to traditional financial systems. Prices Monthly, (7), 87–94.

[18] Chen, L. (2025). Credit innovation from the perspective of new quality productivity: Exploring pathways for finance-technology integration. Credit Reference, 43(4), 21–29.

[19] Jin, D. C., & Li, C. W. (2025). The latest developments, strategic intentions, and countermeasures of U.S. digital currencies. Finance Science, (3), 137-145.

[20] Zhou, K. J., Kou, Z. L., & Liu, L. C. (2025). The development trend of global central bank digital currencies and the strategic significance of the digital renminbi. Economist, (2), 65-75.

[21] Li, Z. R., Guo, X., & Shangguan, Z. J. (2024). Digital currency empowering public services: Value creation and model innovation. Journal of Nanjing University, 61(5), 133-140.

[22] Sun, N. H., & Yan, Y. N. (2025). The promotion and economic effects of central bank digital currency: From the perspective of transaction efficiency and privacy. Contemporary Finance & Economics. Retrieved June 20, 2025, from https://doihtbprolorg-s.libvpn.cwu.edu.cn/10.13676/j.cnki.cn36-1030/f.20250410.001.