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The Role of Big Data Analysis in Digital Currency Systems

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Abstract: In the contemporary era, characterized by the Internet and digitalization as fundamental features, the operation and application of digital currency have gradually developed into a comprehensive structural system. This system restores the essential characteristics of currency while providing auxiliary services related to the formation, circulation, storage, application, and promotion of digital currency. Compared to traditional currency management technologies, big data analysis technology, which is primarily embedded in digital currency systems, enables the rapid acquisition of information. This facilitates the identification of standard associations within currency data and provides technical support for the operational framework of digital currency.

Keywords: Big data; Digital currency; Computational methods; Transaction speed

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1. Introduction

Big data technology primarily refers to the utilization of existing methods, theoretical frameworks, and specialized technical approaches to efficiently integrate and process digital currencies within a short timeframe. This technology offers distinct advantages, particularly in handling large volumes of data. In a global context, its effectiveness has been increasingly evident.

2. Digital currency characteristics

Compared to traditional currencies, digital currency is essentially a virtual currency based on Internet platforms and digital encryption methods. Its main features are reflected in the following aspects. Firstly, in terms of operation and application, digital currency primarily relies on open computational methods facilitated by the Internet. As a result, it does not have a central issuing authority, nor does it require any institution or organization to regulate its issuance. Secondly, because both the computational methods and results are predetermined, the overall supply of digital currency remains fixed. This fundamentally eliminates the risk of inflation caused by the uncontrolled issuance of virtual currencies. Thirdly, virtual currencies offer enhanced security in online

transactions, as they require verification from multiple nodes on the Internet platform [1].

2.1. Low cost

In comparison to traditional bank transfers, remittances, and other related methods, digital currency transactions do not require third-party service fees. Consequently, transaction costs are significantly lower. Additionally, digital currency provides greater flexibility and versatility in the selection of payment channels and methods [2].

2.2. Transaction speed

Digital currency transactions typically utilize blockchain technology, which enables decentralization. Since these transactions do not rely on any centralized clearing platform for data and information processing, they achieve higher efficiency, faster processing speeds, and greater convenience [3].

2.3. High privacy

In currency transactions, physical cash allows direct exchanges without intermediaries. Similarly, digital currency offers significant advantages in remote peer-to-peer payments, as transactions can be conducted without third-party platforms acting as intermediaries. This enables two parties—who may be complete strangers—to engage in financial transactions without the need to establish mutual trust. Consequently, digital currency ensures a high level of anonymity and effectively protects the privacy and security of both parties. However, the excessive flexibility of this transaction model also creates opportunities for illicit activities. Due to its anonymity, digital currency is highly susceptible to misuse in criminal activities.

3. Impact of digital currency

3.1. Monetary policy

The widespread adoption and promotion of digital currency, while enhancing the fundamental functions of money, may weaken the effectiveness of monetary policy. This poses challenges in the formulation and implementation of monetary development strategies. The core issue lies in the fact that digital currency issuance is typically not subject to the constraints and regulations of third-party supervisory platforms. As a result, currency creation occurs outside the traditional banking system, with the total supply dependent entirely on the issuing institutions' discretion. This leads to instability in the overall money supply. Additionally, the inability of third-party platforms to effectively monitor and regulate the base issuance and circulation of digital currencies prevents accurate assessments of economic conditions, industrial performance, and market trends. Consequently, this weakens the effectiveness of monetary policy and disrupts its implementation [4].

3.2. Financial markets

The widespread use of digital currencies and ledger-based technologies presents challenges to the existing financial market structure. Banks, as financial intermediaries, are responsible for monitoring and managing financial activities, particularly overseeing borrowers on behalf of depositors. Traditionally, banks facilitate highly liquid financial management operations that efficiently connect depositors with borrowers. However, if digital currencies and distributed ledger systems become widely adopted, the resulting disintermediation could significantly impact banks' ability to manage financial savings and lending operations.

3.3. Financial infrastructure

The application of digital currencies based on distributed ledger technology effectively transforms the financial

market infrastructure. At the same time, the distributed ledger management model introduces challenges to financial transactions, calculations, and management processes. By facilitating the disintermediation of traditional service providers across various financial sectors, these innovations and structural reforms will have a profound impact on the financial payments industry [5].

3.4. Security risks

Compared to traditional payment methods, digital currency is gaining public recognition due to its unique characteristics. If digital currency becomes widely used over an extended period, it could potentially replace traditional currencies. However, its high flexibility also increases the risk of cyberattacks, leading to security breaches and negative incidents affecting users. Furthermore, since digital currency systems based on blockchain technology are often controlled by a limited number of individuals, long-term use may result in significant security vulnerabilities and systemic risks.

4. Strategies for the application of big data analytics

4.1. Financial Sector

Big data technology primarily refers to the application of existing professional theories, methods, technical tools, and hardware equipment to rapidly perform data analysis, information processing, and related tasks. This ensures the effective integration of large volumes of data, particularly in the context of digital currency, where big data technology exhibits various distinct features and advantages [6].

In terms of data processing capacity, the total volume of data that can currently be processed using big data technology has far exceeded historical levels. With the continuous advancement and optimization of big data, processing efficiency has demonstrated exponential growth. Regarding the speed of digital currency transactions, data dissemination and propagation occur at significantly higher rates. Since big data technology enables the continuous flow of information across different timeframes, spaces, and fields, digital currency transactions exhibit unique fluidity. Moreover, due to the role of big data technology, the intrinsic value of data diminishes rapidly, increasing the computational and application capacity requirements.

From the perspective of data application value, as the scale of digital currency transactions expands, the underlying data also increases in value. At this stage, big data applications and computational methods are typically categorized into batch processing and stream processing. The batch processing method involves large-scale data storage, followed by centralized computation and processing of static data to improve accuracy and comprehensiveness. In contrast, stream processing cannot predefine the data flow direction or store all information. As a result, modern digital currency storage methods have largely moved away from this approach. Instead, real-time processing occurs directly within large-scale memory, although this method demands higher accuracy in data processing and is applicable in more flexible scenarios [7].

Currently, financial institutions employ batch processing for information and data management, creating corporate-level databases to facilitate internal structured processing. Big data technology not only supports these objectives but also enables business modeling to identify deeper connections between digital currencies, driving financial innovation and improvement.

4.2. Currency operation system

As the regulatory and operational authority of the currency system, monetary management organizations play a crucial role in developing financial infrastructure and implementing digital currency operational frameworks. Regulatory bodies must clearly define the fundamental responsibilities of digital currency systems and, within

the legal framework, actively promote the integration of big data technology and the structural design of digital currency. By leveraging the analytical capabilities of big data, monetary policies can be stabilized, currency system operations can be strengthened, and regulatory oversight can be maximized.

At present, global economic systems lack universally established legal standards for digital currency operations, making it difficult to conduct comprehensive empirical analysis. Therefore, theoretical exploration and predictive modeling remain the primary approaches for understanding its development. To address this, regulatory agencies should adopt a multi-perspective approach, integrating big data technology with digital currency characteristics for deeper analysis [8].

First, in the application of big data technology within digital currency systems, it is essential to adopt appropriate methods for refining core information related to issuance, circulation, exchange, storage, application, marketing, and recycling. Based on this information, relevant data models should be established, along with a structured simulation and analysis framework. From a spatial perspective, regulatory bodies should develop an operational structure map for digital currency, accurately tracking transaction scale, location, and time. This should include real-time coordinate data to ensure that authorities have a clear and comprehensive understanding of digital currency applications. In terms of system design, implementation teams must consider the scalability of big data applications and ensure that data structure and service layers are comprehensively analyzed to enhance the accuracy of analytical models.

Second, big data analysis should be applied to assess digital currency from multiple dimensions, including visibility, stability, and controllability. By evaluating key metrics such as the total supply index and price signal index, a deeper understanding of digital currency's economic impact can be achieved. Additionally, digital currency processing teams should utilize big data analysis techniques to monitor currency supply levels and structural changes within the financial system, enabling a thorough examination of internal financial asset trends. Moreover, attention should be given to analyzing digital currency transaction patterns, facilitating better demand forecasting for currency issuance and usage [9].

Regulatory agencies and implementation teams must also focus on monitoring the circulation velocity of digital currency and its fluctuations over time. By analyzing changes in transaction durations, liquidity speed, and other relevant factors, a detailed assessment of digital currency flows can be conducted. This enables the identification of trends in total currency supply, demonstrating that big data analytics plays a significant role in optimizing issuance volumes and frequency [10].

5. Conclusion

Digital currency, within the realm of economic transactions, presents both advantages and challenges. On one hand, this transaction model primarily relies on blockchain technology, effectively achieving decentralization. Its applications extend beyond digital currency itself to various other fields. On the other hand, the widespread adoption of digital currency significantly impacts monetary management policies, financial infrastructure, and financial markets, introducing both opportunities and regulatory challenges.

Disclosure statement

The author declares no conflict of interest.

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