



Blockchain and Digital Transformation of Enterprises: Literature Review and Research Prospect*

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Abstract. In the age of Dazhiyiyun (i.e., big data, artificial intelligence, mobile Internet and cloud computing), the digital economy in China has developed more and more steadily, and relying on technological superiority, the digital transformation of enterprises has become a hot topic in the industry. In this paper, literature on the digital transformation of enterprises is teased out from the significance, mechanism, application scenarios, constraints and countermeasures of blockchain technology for the digital transformation of enterprises. Most literature shows that blockchain technology has a positive impact on the digital transformation of enterprises, but there is lack of supporting data and empirical tests. In addition, it is found that the dynamics of the digital transformation of enterprises is not taken into account, the development of enterprises after digital transformation is under-researched, and there is no systematic theoretical framework and experience summary.

Keywords: blockchain; digital transformation; digital economy

1 Introduction

With the rapid development of big data technology, artificial intelligence, cloud computing, blockchain and other technologies, the growth of digital economy in China shows the trends of fast speed, wide coverage and deep influence. As manifested by White Paper on the Development of Digital Economy in China in 2021^[1], the total scale of digital economy in China in 2020 was 39.2 trillion yuan, representing 38.6% of GDP, and occupying an increasingly prominent position in national economy. The 14th Five-year Plan for the Development of Digital Economy also proposed to implement the inclusive service of “Shangyun Yongshu Fuzhi” (i.e., put on the cloud, use data and

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render intelligence), accelerate the digital transformation and upgrade of enterprises, and facilitate the deep application of blockchain and other technologies in banking, securities, insurance and other fields rationally. From 2017 onwards, Postal Savings Bank of China, China Merchants Bank, Ant Financial, Tencent and other enterprises also applied blockchain technology to settlement by letter of credit, asset custody, cross-border RMB clearing, SME financing and other fields. Thus, it has become a general trend and hot spot in the industry to empower enterprises to transform digitally through technology.

So how can blockchain technology assist enterprises in transforming digitally? What are the constraints in the transformation process? Is there any reasonable solution to the digital transformation of enterprises? All of these are issues to be addressed urgently. By sorting out existing literature, this paper summarizes the significance, mechanism, application scenarios, constraints and elevation schemes, etc. of blockchain technology for digital transformation of enterprises, explores the relationship between blockchain technology and digital transformation of enterprises, and provides a future research direction to empower enterprises to transform in an information-based way.

2 Literature Review on the Application of Blockchain Technology in the Digital Transformation of Enterprises

Information technology (IT) is utilized to address the issues in asymmetric access to information by users. With the enrichment of information volume and lower barriers to its access, everyone could benefit from the smaller digital divide. It focuses on providing enormous amount of information, and it changes the information transmission mode by Internet. While social credit issues in the Internet still exist, and fail to be solved by information technology, which could be ameliorated by digital technology. It also plays a crucial role in the emergence and development of blockchain technology.

Blockchain technology is an organic combination of various technologies. By combining distributed storage, sharing protocol, consensus algorithm, encryption algorithm and other technologies, it forms a highly secure, traceable, tamper-free, and decentralized data storage method ^[12] (Zhang et al., 2020). And it has constructed a new credit system, transaction system and rule system with no trust cost and low cost of risk (L.Zhao, 2020). Digital transformation refers to the usage of digital technologies in transformation of enterprises, especially in adjusting its business process, management mode, organization structure and production standards, etc. It contributes the enterprise to reshape an innovative business model.

2.1 The significance of applying blockchain technology to the digital transformation of enterprises

A great many scholars focus on the technical advantages of blockchain and its positive practical significance applied to the digital transformation of companies. According to R. Huang (2019), the asymmetric encryption technology of blockchain can ensure the security and reliability of business data, assist business data to become assets, accel-

erate the flow and encashment of data, enable the enterprises to preserve and trace data to the source and realize its manageability and controllability^[11]. Z.Li et al. (2016) held that four advantages of blockchain technology, that is, decentralized, disintermediation, collective maintenance and reliable database can be used to build financial blacklist and whitelist, so as to promote the efficiency of modern financial credit reference system. Z.Yang (2019) pointed out that the establishment of the financing mode of “blockchain+ big data” was conducive to the decrease of financing risks and increased the willingness to supply funds and the efficiency of resource allocation^[1]. Y.Tan (2018) pointed out that the on-chain digital value transfer technologies, represented by exclusive chain ledgers, shared chain ledgers; certificate management and SaaS layer service, can accelerate the existing workflow, reduce business risks and improve data accuracy^[13]. Y.Wan and X.Chen (2021) found that informatization subsidy of government and informatization input of enterprises can facilitate the role of blockchain application in increasing the efficiency of the internal capital market of enterprises^[14].

Silva and Santos (2022) held that blockchain technology can improve the efficiency and transparency of supply chain, and the decentralized structure offered invariable properties to all parts of the supply chain, and cryptography also guaranteed security^[3]. According to H.Liang and X.Zhang (2020), financial institutions used blockchain technology to increase the cost paid by small and medium-size enterprises(SMEs) to counterfeit credit information, and price differentially according to the risk degree of SMEs, which can alleviate information asymmetry and credit rationing. Taking Guangdong-Hong Kong-Macao Greater Bay Area as an example, J. Cui (2020) posited that the establishment of a cross-border trade financial blockchain platform can solve the problem of authenticity of cross-border trade background, increase the service efficiency of cross-border trade settlement of commercial banks, and enhance the security of cross-border trade finance business of commercial banks. Y. Fang and D. He (2017) argued that blockchain enabled all parties of the industrial chain to have a clear knowledge of the flow of goods, capital and information, raised the transaction efficiency of banks and trade financing enterprises and made the whole trade financing channel more unhindered.

In the insurance industry, blockchain could be conducive to save \$5 billion to \$10 billion of cost, reducing 15%-20% of its entire cost, according to a latest study by PWC^[15] (L.Zhao,2020). And based on the forecast by Gartner Group, market value of blockchain will approach to \$176 billion in 2025 and \$3.1 trillion in 2030 (Miller,2019). In addition, Bank of Spain believes that blockchain technology is beneficial to decrease \$20 billion of its bookkeeping cost until 2022. All of those data demonstrate the significance of blockchain to enterprise digitization.

2.2 The mechanism of how blockchain technology was applied in the digital transformation of enterprises

Taking the application of blockchain technology by Country Garden Holdings for example, L. Zhang et al. (2020) pointed out that digital transformation of enterprises can be achieved through distributed data ledger, decentralized network, consensus mechanism, Cryptography hash algorithm, digital evidence storage and other tech-

nologies, which can assist the enterprises to break data island and accelerate data flow. Q.Gong, M.Ban and Y.Zhang (2021) discovered that when on-chain enterprises on the supply chain reached a certain quantity, and the quality of on-chain information reached a certain level, the enterprise information revealed by the consensus mechanism of blockchain would approach the real information, and thereby play a role in preventing moral hazards, such as the manipulation of enterprise information and malicious fraud^[9]. R.Liao (2021) built a logical correlation model in which blockchain promoted the development of digital economy, by using the technical architecture of blockchain and development characteristics of digital economy, and pointed out that blockchain technology was conducive to spur the development of digital industrialization, industrial digitization, digital governance and digital environment through the underlying P2P structure technology, distributed consensus technology, underlying data structure technology, cryptography application technology and anonymous trading technology, etc^[10]. Y.Huang, J.Pu (2020) pointed out that P2P lending could be beneficial from blockchain technology, for which solves credit problems via tamper-proof and provides powerful online real-time transaction capability to complete at a low cost.

By combining the consortium blockchain technology with hyper ledger fabric and taking Forfeiting business as an example, D. Wei and Z. Chen (2019) analyzed how to implement Fabric technology in specific business fields via business object and transaction process. M. Nakasumi (2017) brought forward a new blockchain information sharing scheme, which allowed users to possess and control their own data without being bothered about security, through a combination of blockchain with homomorphic encryption solution^[6]. R. Jin(2021) held that the cross-border blockchain service platform shared data from other government departments such as the State Administration of Foreign Exchange, tax authorities and logistics offices with banks and other financial institutions, including enterprise loan information, capital flow information, credit information and logistics information, business loan information, capital flow information, credit information and logistics information, etc., which effectively mitigated the information asymmetry between banks and enterprises. T.Chen, Y. Liang et al. (2021) stated that the main reason why blockchain technology can increase the payment efficiency of cross-border e-commerce was that all users in the supply chain had equal access to information, and banks didn't have to acquire real information by relying on intermediary companies as the supervisor, which saved time cost and human resources.

2.3 The application scenarios of blockchain in the digital transformation of enterprises

W. Yang et al. (2020) analyzed the typical application framework of blockchain technology in data sharing scenarios, as well as the applications in safe storage, access control and auditing in the fields of intelligent medicine, intelligent transportation, smart city and supply chain management ^[12]. C. Yang(2019) applied blockchain technology to the digital scenario of maritime industry by setting up a technical inspection model and concluded that the application and future development of blockchain technology can exert a profound impact on shipping-related industries^[2]. Pal

(2021) noted that in the manufacturing field, blockchain technology can make the processing of transactional data more intelligent and flexible through appropriate fusion with Internet of Things technology in terms of the support of data integration and processing, lay emphasis on the necessity to further explore the issue of data security, especially data security in the manufacturing industry. Lu et al. (2021) argued that the application of blockchain technology in agricultural data management included “blockchain+ agricultural internet of things” model, “blockchain+ agricultural supply chain” model and “blockchain+ agricultural data sharing model”, etc.^[8].

In the field of business and trade, B. Zhang (2020) investigated the application development and potential effect of blockchain technology on letter of credit, cross-border payment, supply chain finance, digital logistics, commodity traceability, digital customs and management. Z. Fu and P. Dong et al. (2021) supported the efficient and timely implementation of cross-border transaction by building an asymmetric consortium blockchain system. They designed a new smart contract to lower the opportunity loss of each node, made the profit distribution system more impartial, applied the system to real cross-border transaction scenarios in Shenzhen and Hong Kong and verified the effectiveness and applicability of this system. L. Zhang et al. (2019) proposed that Country Garden Holdings cooperated with Ant Financial to build application scenarios, such as blockchain e-invoicing platform, agricultural product blockchain traceability and credit right and interest trading platform^[7].

In the field of finance, E. Nie et al. (2017) noted that upgrading blockchain technology to the “dual-channel” credit reference technology of “decentralized+ centralized” based on big data can offer solutions for the problem of Internet financial risk control^[4]. J. Guo (2019) pointed out that the insurance industry in China had entered an era driven by digital technologies, such as big data and blockchain^[5]. The digital transformation of insurance companies can enhance the synergy between insurance companies and related enterprises, propel the innovation of insurance products, optimization of customer experience scenarios, and the reform of insurance organizations. Chowdhury, M., Suchana, K. pointed out that large-scale banks, such as J.P. Morgan, HSBC and Bank of America, etc. have effectively utilized blockchain technology and are seeking now technological innovation. This technology showed high efficiency, economy and directness and also analyzed the mechanism of how banks utilized the mechanism of blockchain technology and made banking safer and transactions easier. V. Vysya, A. Kumar (2019) listed the applications of blockchain technology in commercial bank, supply chain finance, cross-border payment, risk management and capital market^[10]. T. Chen, Y. Liang et al. (2021) established a security algorithm for e-commerce payment platform, refined the traditional payment process, and applied blockchain finance to the optimization of secure payment mode.

2.4 Constraints on the application of blockchain in digital transformation of enterprises

J. Cui (2020) pointed out that due to the lag in the unveiling of regulatory laws on blockchain technology, and the absence of a unified technical standard for blockchain applications, the complexity of cross-border trade financial business itself can bring

potential risks. B. Zhang (2020) put forward challenges faced by the digital innovation of cross-border trade, including the enforceability of smart contracts, standardization and security of technology, etc. It was necessary to develop a blockchain regulation framework and unify the technical standard. Venkatesha N., Anjani(2019) presented the advantages of blockchain technology in cutting transaction cost, mitigating counterparty risk, and decentralizing contract enforcement, etc. However, it also had such problems as safety, technical risks and government regulation risks. L. Zhang et al. (2020) asserted that blockchain technology itself had some problems, such as tamper-proof, low fault tolerance rate, low consensus efficiency and small data capacity, etc., which restricted the efficiency of digital transformation of enterprises^[6]. Y. Gong (2022) believed that at present, blockchain technology was still being improved and developed, with low availability of data and lack of accumulation of empirical research. The influence on business administration and marketing, etc. was worthy of further study. Kirbac, G. et al (2021) stated that the blockchain challenges included scalability, privacy and security issues, software problems and cyber attacks, high investment cost, lack of legal regulations, etc. Most authors mentioned the necessity of a unified technical standard for blockchain technology, mainly because it is still a new and immature technology.

2.5 Countermeasures

X. Li (2021) suggested that applying blockchain distributed ledger to all nodes of enterprise production and operation, and adopting “blockchain+ credit reference” technology to promote the data transparency of SMEs in logistics, capital flow and information flow. Z. Yang et al. (2019) believed that it was conducive to increase the value of SMEs to identify the developmental stage of enterprises through the “blockchain+ big data” model, evaluate their financing needs and solvency, build an intellectual property data platform, trading platform and valuation platform. With the digital transformation of SMEs in Germany as an example, X. Tang (2018) indicated that the country should build a unified digital transformation framework, work out an Internet regulation mechanism, and strengthen trust and security in data processing, enterprises should attach importance to and increase input in R&D, and provide vocational training opportunities. According to H. Zhang (2021), SMEs should build up their strength, cultivate talents in digital management, technology and business and benchmark enterprises should take key business of the industry as a point of breakthrough for digital transformation, and build an open and shared industrial Internet platform.

3 Conclusion and Research Prospect

This paper briefly reviews literature on the significance, mechanism, application scenarios, constraints and countermeasures of blockchain technology for the digital transformation of enterprises. It is found that:

(1) Blockchain technology has a positive impact on digital transformation of enterprises, especially via distributed data ledger, asymmetric cryptography technique,

decentralization and consensus mechanism, etc. But the technical details and principle of the underlying mechanism are rarely discussed, while corresponding risks and constraints are mostly skated over;

(2) The existing literature provides more references on the relationship between blockchain technology and enterprise informatization, but most of the articles stay in the stage of theoretical explanation, and the significance of their relationship has not been tested by empirical studies;

(3) In the part of countermeasures, there is also a lack of practices of key enterprises related to blockchain in technology upgrade, and it is insufficient that the practical guidance in blockchain technology model and blockchain application technology standards.

Based on existing studies, the following issues need to be further concerned about:

(1) In the era of “Dazhiyiyun”, the protection of citizens’ information during the digital transformation of enterprises should receive full attention. The use of data by enterprises not only improves the accuracy of marketing, but also divulges the privacy of consumers. Can blockchain be improved in terms of the standardization of technology and enhancement of data security? How should the regulatory framework and specific technical standards of blockchain technology be laid down? These issues need to be further studied.

(2) There is a lack of accumulation of empirical research, and the mechanism and effect of blockchain in the digital transformation of enterprises should be verified through data. In addition, the digital transformation of enterprises is also a dynamic process. It is a significant topics for subsequent research that whether blockchain technology plays the same role in different stages of digital transformation.

(3) So far, blockchain technology has a wide range of application scenarios, but lacks a systematic theoretical framework and industrial experience, so it is of little reference value for other enterprises. Future researches should focus on the summary of digital transformation experience and overview of its system framework. Furthermore, after the blockchain facilitates the digital transformation of enterprises, what impacts it will produce on the operation and management, marketing management and sustainable development ability of enterprises, and whether it will trigger a surge in business cost. This is also a crucial direction of future research.

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