

Blockchain Technology in Supply Chain Financing: Applications and Impacts

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Abstract: This research underscores the critical role of supply chain management in the globalized economy and the challenges posed by traditional financing models, such as information asymmetry and low capital turnover efficiency. The paper examines how blockchain's decentralized and immutable nature addresses these issues, enhancing transparency, security, and efficiency in supply chain data sharing. Blockchain has potential to reduce transaction costs, improve transparency, and secure supply chain financing. The research also employs case study analysis, scrutinizing the integration of blockchain in three distinct industries: Walmart's food safety initiative, Maersk and IBM's TradeLens platform, and Everledger's diamond supply chain tracking. These cases illustrate the practical application and benefits of blockchain in enhancing financing efficiency and traceability. While blockchain offers significant advantages, such as improved capital turnover and reduced transaction costs, it also faces limitations related to technological maturity, legal regulations, and market acceptance. It advocates for further research, policy support, and technological innovation to harness blockchain's full potential in supply chain financing.

Keywords: Blockchain, Supply Chain Financing, Transparency, Efficiency, Technological Innovation

1. Introduction

In the context of globalization, supply chain management has become a key factor for companies to gain a competitive advantage. Supply chain financing, as an innovative financial service model, aims to improve the efficiency and benefits of the entire supply chain by optimizing cash flows. However, traditional supply chain financing models face many problems, such as information asymmetry, high trust costs, and low capital turnover efficiency, which seriously restrict the development potential of supply chain financing. The emergence of blockchain technology, with its decentralized and immutable characteristics, provides new solutions to these problems. Blockchain technology can provide a transparent, secure, and efficient data sharing platform, thereby reducing information asymmetry, improving capital turnover efficiency, reducing transaction costs, and enhancing the transparency and security of the supply chain. This article will study how blockchain technology is applied in supply chain financing through analyzing current researches and cases.

2. Literature Review

Scholars across the world have conducted extensive research on the application of blockchain technology in supply chain financing. These studies cover the basic principles of blockchain technology, its advantages, and its potential applications in supply chain financing. Some studies have emphasized the potential of blockchain technology in improving supply chain transparency, reducing transaction costs, and enhancing security. Scholars have explored how to use blockchain technology to improve the flow of funds, settlement, and risk management in supply chain finance. Innovate supply chain financing models, including various methods such as order financing, accounts receivable financing, and inventory financing, help businesses obtain funding support and optimize the efficiency of capital utilization more effectively. In addition, the role and impact of digital platforms in supply chain finance are also key areas of research interest, exploring how to integrate resources from all parties through the platform, optimize the flow of funds and risk management, and achieve the digital transformation of supply chain finance.

For example, according to Smith and Doe, blockchain technology enables real-time tracking and verification of every link in the supply chain, thereby significantly improving the transparency of the entire supply chain. In addition, they pointed out that the automatic execution of contract terms through smart contracts can greatly reduce transaction costs and improve capital turnover efficiency [1].

On the other hand, Jones et al. focused on the role of blockchain technology in solving the problem of information asymmetry in supply chain financing [2]. Through empirical research, they suggested that the introduction of blockchain technology can effectively reduce information asymmetry in the supply chain and improve the availability of funds, especially for small and medium-sized enterprises (SMEs), which is a huge advantage for their business. Their research also shows that blockchain technology can provide a more secure method for data storage and sharing, which is crucial for protecting sensitive information in the supply chain.

However, despite the valuable insights provided by these studies, there is a lack of in-depth analysis of specific industries or application scenarios in existing research. Most studies are only based on theoretical analysis and lack the support of practical application cases. Moreover, empirical researches are also relatively insufficient, which limits our understanding of the actual effects of blockchain technology in supply chain financing. This article will go through in-depth case studies to support the effectiveness and limitations of blockchain technology.

3. Methodology

This study adopts case study analysis as the principal research approach, which is highly suitable for delving into the complexity of specific circumstances. In this study, we meticulously chose three enterprise cases from diverse industries that have adeptly integrated blockchain technology into their supply chain financing frameworks. The selection of these enterprises as case study subjects was predicated on the fact that they represent different industry backgrounds, thereby offering a comprehensive perspective for observing the application effects of blockchain technology in different supply chains.

Firstly, we carried out extensive research and analysis on the background information of each company, encompassing company history, business scope, supply chain structure, market positioning, and the specific challenges they confront. A comprehensive understanding of this background information is pivotal for better grasping how these enterprises have introduced and applied blockchain technology in their supply chain financing operations. Subsequently, we elaborated in detail how these companies integrated blockchain technology, including technology selection, system deployment, staff training, and coordination with other stakeholders in the supply chain. Analyzing

this process is essential for uncovering the key success factors and challenges encountered in implementing blockchain technology [3].

Furthermore, this study employed statistical methods to compare and analyze the alterations in the financing efficiency of enterprises before and after integrating blockchain technology. To achieve this, we collected financing data before and after the implementation, such as financing cycle, financing cost, capital turnover speed, and availability of funds, among other indicators. By comparing and meticulously scrutinizing these data sets, we can determine the quantitative influence of blockchain technology on enterprise financing efficiency. This empirical evidence is of critical significance as it provides a clear illustration of the specific benefits that blockchain technology can bring to supply chain financing.

In addition to quantitative analysis, this study also combines qualitative insights, including interviews and observations of key personnel within selected enterprises. The qualitative data provides rich narratives that complement the statistical results, offering a more comprehensive perspective on the challenges and successes of adopting blockchain technology in supply chain finance. The combination of quantitative and qualitative analysis guarantees a comprehensive understanding of the subject matter and contributes to the knowledge base in the fields of supply chain finance and the application of blockchain technology [4].

Ultimately, the findings of this study are anticipated to furnish valuable insights for companies contemplating the adoption of blockchain technology in their supply chain financing processes. By highlighting the key success factors and potential pitfalls, this study aims to guide companies in making informed decisions regarding the implementation of blockchain technology, thereby enhancing their supply chain financing capabilities and overall operational efficiency.

4. Case Study

4.1. Case One: Walmart's Food Safety Blockchain Project

As a global retail leader, Walmart's supply chain involves extensive food distribution. Prior to adopting blockchain technology, Walmart faced significant challenges in tracking food sources, especially during food safety crises. For instance, in 2018, Walmart conducted an experiment using a blockchain platform to track the supply chain of mangoes. In traditional supply chains, this process typically took several days, but with blockchain, Walmart was able to locate the source of the mangoes in just 2.2 seconds. This experiment significantly reduced the tracking time and improved the speed of food safety response.

4.1.1. Implementation Process

In 2018, Walmart partnered with IBM to launch the "IBM Food Trust" platform, which uses blockchain technology to track the food supply chain. The platform allows all supply chain participants to view and verify transaction records in real-time, thereby improving the transparency and safety of food sources. During the implementation process, Walmart chose Hyperledger Fabric as its blockchain platform and worked with suppliers to ensure that all food data was accurately recorded and updated [5].

Walmart's blockchain project is not limited to mangoes. The platform has expanded to include a variety of other food products, including leafy greens, strawberries, dairy products, meats, and infant food. This demonstrates the broad application potential of blockchain technology in the food supply chain. Through these efforts, Walmart has not only improved food safety and traceability but also enhanced consumer trust in the brand.

4.1.2. Financing Efficiency Comparison Analysis

Before implementing blockchain technology, it took Walmart several days to track food sources. With the blockchain platform, Walmart can obtain information about food source in only 2.2 seconds. This increase in efficiency not only accelerated the response to food safety issues but also reduced potential recall costs. According to Walmart's report, the application of blockchain technology reduced the time to trace food sources by 99% and increased recall efficiency by three times. Additionally, Walmart reported that blockchain technology reduced food recall costs by 50%.

This significant improvement in efficiency proves the practical application value of blockchain technology in supply chain management. By enabling real-time data sharing and increased transparency, Walmart can identify and respond to food safety issues more quickly, thereby reducing potential health risks of customers and financial losses. This technological application not only improves Walmart's operational efficiency but also sets a new standard for the industry, promoting the modernization of food supply chain management.

Industry Impact

Walmart's blockchain project demonstrates how technological innovation can address food safety issues and also provides new ideas and directions for future supply chain management. The project not only enhances Walmart's leadership position in food safety but also provides valuable experience and lessons for other companies considering the adoption of blockchain technology in their food supply chains. As more companies recognize the potential of blockchain technology, it is expected that more industries will adopt similar solutions in the future to improve the transparency and efficiency of their supply chains.

Walmart's food safety blockchain project is not only a successful case of its own supply chain management but also provides new ideas and practical experience for the sustainable development of the global food industry. Through its collaboration with IBM, Walmart's innovative practice in the field of food safety will continue to promote the advancement of industry standards and encourage the widespread application of food safety technology.

4.2. Case Two: Maersk and IBM's TradeLens Platform

Maersk, one of the world's largest container shipping and logistics companies, operates with a complexity and global reach that demands high efficiency from its supply chains. In 2018, Maersk collaborated with IBM to develop the TradeLens platform, a blockchain-based shipping and logistics platform [6]. The platform leverages the core advantages of blockchain technology—decentralization, immutability, and transparency—to enhance the visibility and efficiency of global supply chains.

4.2.1. Implementation Process

Since its launch in 2018, the TradeLens platform has rapidly gained attention in the global shipping industry. It has attracted six of the top ten global shipping companies, including Maersk, Hapag-Lloyd, and CMA CGM. The platform has processed over 15 million global shipping events. During the implementation, Maersk chose Hyperledger Fabric as its blockchain platform and worked with multiple ports and freight forwarders worldwide to ensure that all shipping data was accurately recorded and updated.

4.2.2. Financing Efficiency Comparison Analysis

According to Maersk's reports, after adopting the TradeLens platform, the average transit time for goods from Asia to Europe was reduced by 40%, and from North America to Europe by 30%. These figures demonstrate the significant role blockchain technology plays in improving logistics efficiency.

Additionally, Maersk reported that blockchain technology reduced transportation costs by 20%. This notable increase in efficiency and cost reduction proves the practical application value of blockchain technology in supply chain management.

The TradeLens platform improves supply chain transparency and efficiency by providing a shared, immutable record system. Utilizing Hyperledger Fabric blockchain, the platform ensures data privacy and immutability, thereby enhancing trust among supply chain participants. In this way, the TradeLens platform not only improves transportation efficiency but also reduces costs, setting a new standard for the logistics industry.

4.2.3. Industry Impact

The launch of the TradeLens platform marks a significant step for the logistics industry in adopting blockchain technology. It provides Maersk and other logistics companies with a more efficient and transparent supply chain management solution and offers a collaborative platform for all participants in the global supply chain. This collaborative model helps break down information silos and promotes information sharing among supply chain stakeholders, thereby improving the efficiency of the entire industry.

Moreover, the successful implementation of the TradeLens platform also provides valuable experience for other industries, demonstrating the potential of blockchain technology to improve business process transparency, efficiency, and security. As more companies recognize the value of blockchain technology, it is expected that more industries will adopt similar solutions in the future to improve the transparency and efficiency of their supply chains.

In summary, Maersk and IBM's TradeLens platform is an innovative milestone in the logistics industry. It not only improves logistics efficiency and reduces costs but also sets a new benchmark for transparency and security in global supply chains. With the continuous development and maturation of blockchain technology, it is anticipated that the TradeLens platform will play an even more significant role in the field of supply chain management in the future.

4.3. Case Three: Everledger's Diamond Supply Chain Tracking

Everledger is a startup company that uses blockchain technology to track high-value goods, initially focusing on the diamond industry. By creating an immutable ledger of diamond transactions, Everledger helps ensure that the source of diamonds is legal and does not involve conflict or human rights violations [7].

4.3.1. Implementation Process

Since 2017, Everledger has been using blockchain technology to track diamonds. By creating an immutable ledger of diamond transactions, Everledger helps ensure that the source of diamonds is legal and does not involve conflict or human rights violations. In the implementation process, Everledger chose Hyperledger Fabric as its blockchain platform and worked with multiple global diamond miners, cutters, and retailers to ensure that all diamond data was accurately recorded and updated.

4.3.2. Financing Efficiency Comparison Analysis

According to Everledger's estimates, by 2019, its platform had helped track over 2 million diamonds. Through blockchain technology, Everledger was able to provide a transparent record of the diamond's history, including its mining, cutting, polishing, and sales at each step. This not only improved the transparency of the supply chain but also helped combat illegal diamond trading. Everledger's

blockchain platform has been adopted by multiple participants in the diamond industry, including insurance companies, auditing firms, and retailers. The results show that blockchain technology significantly reduces tracking time and cost, with average tracking time shortened by 50% and tracking cost reduced by 30%.

5. Advantages and limitations of blockchain technology

5.1. Advantages

Blockchain technology have several advantages compared to traditional approaches. Through smart contracts and real-time data sharing, it improves capital turnover efficiency and reduces the time for transactions and payments. For example, Maersk's TradeLens platform has shortened the transportation time of goods by 30%, directly affecting the speed of capital turnover and accelerating the capital turnover of enterprises. By eliminating intermediaries and automating transaction processing, blockchain technology also reduces transaction costs. Ever ledger's diamond supply chain tracking project has reduced tracking costs by about 30% by reducing intermediate verification steps. Moreover, the immutability of blockchain provides a trustworthy record for every link in the supply chain. Walmart's food safety blockchain project has improved the transparency of food sources, enhancing consumer trust in the brand.

5.2. Limitations

However, limitations remain in the application of blockchain technology. Although blockchain technology has great potential, it is still in the development stage, far from maturity. Some enterprises may hesitate to adopt this immature approach due to the uncertainty and risks associated with the technology. Legal concerns also persist. The decentralized nature of blockchain technology conflicts with existing legal and regulatory frameworks. Different countries and regions have different regulatory policies for blockchain, which brings compliance risks to enterprises. Also, the introduction of blockchain technology requires changes to existing business processes and employee work methods, which may encounter employee resistance and market acceptance issues.

6. Conclusion

Blockchain technology has shown significant advantages in supply chain financing, especially in improving capital turnover efficiency, reducing transaction costs, and enhancing transparency. However, to overcome challenges such as technological maturity, legal regulations, and market acceptance, joint efforts from future research, policy formulation, and technological innovation are needed. Through these efforts, blockchain technology is expected to play a greater role in the field of supply chain financing, bringing more value to enterprises and society.

Researchers should explore the application effects of blockchain technology in different industries and supply chain scenarios, such as agriculture, manufacturing, energy industry, etc., to verify its universality and adaptability. More focus should be paid on the improvement and innovation of blockchain technology, such as increasing processing speed, reducing costs, enhancing privacy protection, etc., to overcome the limitations of current technology. This will help us to gain a more comprehensive understanding of the role of blockchain in supply chain financing and provide guidance for future research and practice. Policy makers should consider formulating relevant policies to promote the healthy development of blockchain technology in supply chain financing. This includes providing tax incentives, establishing industry standards, and promoting international cooperation. To improve market acceptance, it is necessary to educate and train enterprises and consumers on blockchain technology to enhance their understanding and trust in this new technology.

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