

Review of Research on the Impact of Blockchain Technology on Supply Chain Operational Decision Making

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Abstract: Blockchain is closely integrated with supply chain management, which can effectively avoid the tampering of real information and realize the effective traceability of supply chain information. At present, how blockchain technology empowers the supply chain and how supply chain operation decision-making has become a hot issue in current supply chain management research. This paper combs through the relevant research on the impact of blockchain technology on supply chain operation decision-making, takes different kinds of supply chains as the perspective, and divides the research into three major types: fresh e-commerce supply chain, shipping supply chain, and green supply chain, forming a literature review. The research results of relevant scholars are elaborated respectively, and the research on the impact of blockchain technology on supply chain operation decision-making is further summarized and the direction of future research is proposed.

Keywords: Blockchain Technology, Chain Management, Supply Chain Operational Decisions, literature Review.

1. Introduction

With the continuous development of the current global economy and the increasing scale of the supply chain, supply chain management has become an increasingly important part of the supply chain, and good supply chain management tools and measures, to a certain extent, affect the efficiency of the overall operation of the supply chain. However, there are still a lot of problems in the current supply chain management mode, such as information asymmetry, leakage, difficulty in tracing, etc. These problems largely restrict the development of the supply chain and bring huge losses to the enterprises in the supply chain, and the generation of blockchain technology provides a new digital solution for the supply chain to solve these problems.

Blockchain technology has the characteristics of tampering, traceability, openness and transparency, and decentralization, etc. Its core technologies, such as distributed ledger, asymmetric encryption, consensus mechanism, and smart contracts, can effectively connect the information of upstream and downstream enterprises in the supply chain, and ensure the authenticity and reliability of transaction information. Blockchain technology can bring more secure, transparent and efficient information sharing, product tracing and management for supply chain management. In recent years, the research of blockchain technology applied to supply chain has become a key issue explored by scholars. Based on this background, this paper combed the current research on the impact of blockchain technology on supply chain operation decision-making from the perspective of different types of supply chains, and summarized the main research directions and issues of current scholars in the research on the impact of blockchain technology on supply chain operation decision-making. And on this basis, it further summarizes the future research directions to provide certain theoretical reference for the subsequent research.

2. Fresh E-commerce Supply Chain

Fresh products have characteristics such as easy corrosive, there are problems in distribution services, logistics costs and food safety, etc. If these problems are not solved in a timely manner, it will cause fresh food e-commerce in the market gradually lose competitiveness. In recent years, with the rapid development of Internet technology, people's acceptance of online channels for shopping has been greatly improved, and the demand for fresh food e-commerce market is growing explosively. The rapid growth in demand has increased the difficulty of keeping fresh products fresh, and the information asymmetry of the supply chain makes it impossible to regulate the freshness of the products, and there are even cases of misrepresentation by supply chain enterprises. In this context, scholars have begun to study the impact of blockchain technology on the operational decision-making of the fresh e-commerce supply chain as a way to improve the current problems in the fresh e-commerce supply chain.

Li et al [1] developed a fresh produce supply chain consisting of suppliers and e-commerce platforms (retailers) by balancing sales revenue, green investment costs, insurance costs, advertising costs and blockchain adoption costs from a dynamic perspective. In the study the supplier invests in improving the greenness of the fresh produce to meet the green production requirements and is responsible for the freshness of the fresh produce deliveries. Retailers invest in advertising to increase goodwill and are ready to adopt blockchain. Comparisons were made to analyze changes in optimal greenness, freshness, preservation, advertising efforts, and goodwill. It is found that blockchain technology can greatly improve freshness of fresh produce, but is not suitable for two specific environments, which are related to the profitability of retailers and suppliers.

Liu et al [2] considered a multichannel supply chain consisting of suppliers, e-commerce platforms and traditional

retailers and used state equations to characterize blockchain-enabled traceability, goodwill and product freshness. The interaction between the e-commerce platform's selling model and business operation decisions is investigated, and the main factors for choosing the selling model in the presence of two traditional retailers are also explored. Competition between the two channels is found to lead to an increase in the price of fresh food on the one hand, and on the other hand to increase the supply chain's incentives to invest in product freshness and goodwill for blockchain traceability. Increased product freshness and blockchain-enabled traceability goodwill offset the loss of market demand due to price increases, thus contributing to higher profits throughout the supply chain.

Wu et al [3] investigated the strategies for adopting blockchain technology in a fresh produce supply chain consisting of a supplier, a third-party logistics provider, and an e-retailer, analyzing the optimal strategies in a baseline scenario without blockchain technology and in three scenarios in which the supplier, the third-party logistics, and the e-retailer each take the lead in building a blockchain-based traceability system (BTS). It is found that the adoption of blockchain technology is not always the optimal decision, which depends critically on the acceptance of products without blockchain technology in consumption, the deterioration rate of fresh products, and the proportion of traceability costs allocated by the supply chain members in the adoption of blockchain technology.

Liu and Li [4] et al. considered the risk aversion of retailers and used blockchain technology to inhibit the problem of misreporting freshness information in the fresh supply chain, analyzed the changes of the equilibrium solution of the supply chain before and after the input of the blockchain technology, got the cost investment threshold of the blockchain technology in different scenarios, and designed the revenue-generating sharing contract and the repurchase compensation contract for the coordination of the supply chain. It is found that the cost investment threshold of blockchain, the size of the supply chain system benefit depends on the unit product blockchain technology investment cost, transaction shortened time and unit product transaction saving cost, and has nothing to do with the risk aversion of the supply chain members; the three kinds of Stackelberg games have a technology investment threshold, and the investment thresholds acceptable to the supplier and the retailer are different; the revenue sharing contract, Repurchase compensation contract coordination all make the supply chain members revenue to achieve win-win effect.

Jiang et al [5] constructed a dual-channel supply chain dynamic decision-making and cost sharing model before and after the blockchain application, compared and analyzed the changes of equilibrium solution, sought the blockchain investment cost threshold, and further obtained the investment conditions and profit peak point. Meanwhile, the effects of key parameters and price correction coefficients of dual-channel on the profit and total profit optimization decisions of suppliers and retailers are explored. It is found that the effectiveness of blockchain investment depends on the multiple influences of variable and fixed input cost thresholds and cost sensitivity thresholds, and that the increase of inter-channel share difference and price elasticity coefficient positively improves the profit and dynamically affects the investment conditions of blockchain.

3. Shipping Supply Chain

The rapid development of the Internet and information technology, the shipping industry market continues to expand, the demand continues to rise, and the digital transformation requirements are further highlighted. The emergence of blockchain technology provides a new opportunity for its development, and its core technologies, such as distributed ledger and asymmetric encryption, can effectively solve the problems of information opacity, information inaccuracy and low transparency of the current shipping supply chain swelling. At present, many scholars have begun to study the impact of blockchain technology on the operational decision-making of shipping supply chain.

Chen and Yang [6] studied the vertical competition between shipping companies and freight forwarders in a shipping logistics service supply chain composed of shipping companies and freight forwarders, and the impact of the application of blockchain technology on the change of market structure. The impact of freight competition on market evolution is found to be reduced after the use of blockchain technology.

Xin et al [7] studied a one-to-two shipping service competition model, constructed a status quo scenario and two different investment scenarios led by two different stakeholders in a Stackelberg game model, and explored the conditions for investment in blockchain technology as well as the impact on the decision-making of the operation of the shipping supply chain. It is found that investment in blockchain technology can significantly improve the profitability of shipping supply chain participants, while the more competitive the services of shipping companies, the lower the level of blockchain technology to improve the logistical capabilities of shipping supply chain participants.

Zhao et al [8] demonstrated the economic and environmental benefits of blockchain technology to improve the efficiency of port operations through paperlessness, exploring the changes in the cost structure, profitability over time, value of blockchain services in market segments, consumer surplus and social welfare, and the relationship between blockchain services and congestion. Also Zhao et al [9] explored the question of whether to centralize and whether to invest in a portfolio strategy in terms of prices and volumes in the shipping market and the economic effects of their shipping market using the Stackelberg model. Government subsidies, multi-parameter analysis, investment efficiency and social effects are also considered. It is found that: the shipping market price is affected by the centralized structure of the system and the investment strategy; under the premise of meeting the investment in blockchain technology, when the investment in blockchain technology and the structure of the system is a centralized structure, the end-market demand of the enterprise reaches the highest; when using a decentralized structure, meeting the conditions of the investment of the carrier can make the maximum revenue.

Chen and Li et al [10] explored the impact of information sharing on investment decision under the application of shipping logistics blockchain platform, and designed two kinds of contracts, namely, service cost-sharing-revenue sharing and blockchain cost-sharing-revenue sharing, to coordinate the supply chain. It is found that the size of the investment threshold for freight forwarders to invest in building a shipping logistics blockchain platform is related to

the unit cost optimization coefficient, the amount of demand information forecasting, and the price sensitivity coefficient; although the application of the shipping logistics blockchain platform by freight forwarders has to be made at the cost of information sharing, the information sharing enables freight forwarders and shipping companies to obtain greater benefits; both the service cost-sharing-revenue-sharing and blockchain cost-sharing-revenue-sharing contracts can both realize the coordination of the shipping supply chain when certain conditions are met.

4. Green Supply Chain

Since the 21st century, the high level of modern economic development has created a high level of material productivity, but at the same time, it has also caused serious environmental pollution, for enterprises and supply chains, how to realize sustainable green development has become a new issue of the times. In the supply chain, information opacity, information asymmetry and information sharing difficulties have led to the green uncertainty of supply chain enterprises and constrained the green development of the supply chain. The decentralization and tamperability of blockchain technology, as well as its distributed ledger and consensus mechanism, can effectively improve the efficiency of information sharing and increase the transparency of the supply chain, thus promoting the green development of the supply chain. Currently, many scholars have begun to conduct research on the impact of blockchain technology on the operational decisions of green supply chains.

Wu et al [11] constructed a green supply chain model consisting of a capital-constrained manufacturer and a retailer, and considered four financing strategies, namely, no financing, trade credit financing, bank credit financing, and blended financing, to study the impact of the application of blockchain technology on the operational decisions of the green supply chain, profits, and on the manufacturers' financing strategies. It is found that blockchain technology can bring some economic value to green supply chain, but its optimal financing strategy is not unique, when the investment efficiency of blockchain technology is low, it is better not to finance; when the investment efficiency of blockchain technology is high, it is better to use trade credit financing strategy; for green supply chain, its optimal decision changes with the change of the investment efficiency of blockchain technology.

Li et al [12] studied the green investment problem of a sustainable supply chain, considering the manufacturing send for blockchain implementation and the emotional concerns of retailers. The supply chain performance before and after the use of blockchain technology was compared. It was found that the adoption of blockchain may undermine the positive impacts of equity on supply chain performance, such as mitigating double marginalization and improving consumer welfare; blockchain encourages green investment and enables zero-prime traders to benefit from it only when blockchain drives high incremental customer green sensitivity.

Lin and Zhang[13] analyzed the value of blockchain technology for green production applications from an economic perspective. A two-stage dynamic game model between the government and enterprises was constructed to analyze the influencing factors of enterprises' green production decision-making under different strategic choices of the government. It is found that blockchain technology can

reduce the enterprise's green production cost and increase the benefit of green products through the traceability mechanism and smart contract mechanism, thus incentivizing enterprises to carry out green production.

Li et al. [14] investigated the blockchain technology-driven supply chain emission reduction information sharing mechanism under the information asymmetry in response to the supply chain collaborative emission reduction efficiency loss caused by the consumer's hidden low-carbon preference. They found that the information sharing mechanism of "blockchain + cooperative emission reduction" can effectively improve the cooperative emission reduction efficiency of upstream and downstream enterprises in the supply chain.

5. Conclusion

In this paper, from the perspective of fresh food e-commerce supply chain, shipping supply chain and green supply chain, the current scholars have sorted out part of the research on the impact of blockchain technology on supply chain operation decision-making, formed a literature review, and obtained the following conclusions and insights through the research sorting.

In the current research on the impact of blockchain technology on fresh food e-commerce supply chain operation decision-making, the current scholars mainly consider that blockchain technology can effectively solve the problem of information asymmetry in the supply chain, and ensure that the insurance work is standardized and processed through the technological advantages of blockchain technology in the information supply chain and information security, and at the same time, improve the goodwill of supply chain enterprises and the profits of the supply chain. Subsequently, these characteristics are further combined with the sales model, dominance, supply chain structure, and the behavior of supply chain enterprises, in order to explore the impact of blockchain technology on the fresh food e-commerce supply chain.

In the shipping supply chain, the scholars combine the blockchain technology with the shipping supply chain for the problem that the blockchain technology can effectively improve the lack of transparency of the supply chain, add the factors of market competition and economic environment benefits to explore the impact of the blockchain technology on the shipping supply chain, and further design the corresponding collaborative contract to carry out the coordination of the supply chain, so as to enable the supply chain to obtain a higher profit.

Among the green supply chain, scholars consider the role of blockchain technology in solving information asymmetry and information sharing. Blockchain technology and green supply chain are combined with supply chain financing strategy, supply chain enterprise concerns, and social welfare, and are studied and analyzed from the perspective of economics. The impact of blockchain technology on green supply chain operational decision-making is explored.

However, from the above research, it can be found that in the current research related to the impact of blockchain on supply chain operation decision-making, scholars mostly focus on the impact of blockchain technology on the optimal decision-making and profit of supply chain enterprises, and are committed to finding the optimal conditions of using blockchain technology and coordinating programs, so as to

maximize the profit of enterprises within the supply chain. Most of the influencing factors in their research come from within the supply chain, and there is not enough research on how blockchain technology affects consumers. In addition, in most of the above articles, the homogenization assumption is made in the consumption in the market, and the existence of different consumer types in the market is not taken into account. In fact, due to the rapid development of Internet technology, the current market consumers in the behavior, preference and risk attitude there are obvious differences, the market is filled with different types of consumers, if not take into account the differences in the types of consumers, it may lead to supply chain enterprises to suffer a great loss of benefits. Therefore, in the future research, it is not only necessary to combine the blockchain technology with the influencing factors within the supply chain, but also need to classify the consumers in the market, and further take into account the behavior, preference and other factors of consumption, so as to obtain more scientific conclusions, and provide more effective guidance for the actual supply chain operation decision-making.

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