# Carbon Emission Reduction Strategy of the O2O Agricultural Supply Chain Based on Blockchain

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**Abstract:** In the Internet era, business model is innovating constantly. The emergence of O2O combines the consumer behavior that should have occurred offline with the Internet, making various e-commerce platforms a bridge between consumers and sellers. Under the influence of factors such as the epidemic, a large number of the O2O agricultural products supply chains have emerged. Besides, carbon emission is one of the most important and hottest issues around the world now. Many Countries have clearly put forward the goals and strategies for the greenization planning on all enterprises. To implement the theory of greening development, carbon emission reduction in supply chain processing is an essential way. However, due to supply chain information asymmetry and other issues, it is difficult to verify and supervise the supply chain carbon emission reduction process. As an emerging technology, blockchain has the functions of information traceability and anti-tampering. Blockchain can effectively promote carbon emission reduction in supply chain processing. In the meantime, enterprises can use blockchain to monitor and control fresh agricultural products' quality and promote industrial transformation. This article systematically reviews the relevant literature about the above factors to provide a reference for future research on this topic.

**Keywords:** Agricultural Products Supply Chain, O2O, Blockchain, Carbon Emission Reduction Strategy.

## 1. Introduction

While more and more companies attach importance to the Internet, O2O is expected to become the next gold nugget of e-commerce websites. Due to the rapidity of network information transmission, the model can spread rapidly, and the market can be activated quickly. At the beginning of 2020, the sudden outbreak of COVID-19 completely changed people's lifestyles. Most consumers chose to buy fresh agricultural products through e-commerce platforms. Related e-commerce platforms developed rapidly and quickly met people's offline shopping needs. In the post-epidemic age, on account of the inertia of consumption, both local merchants and consumers prefer this convenient and traceable model.

With its own technical advantages, the blockchain has become a reliable quality information disclosure and traceability technology. Blockchain can improve transparency and operational efficiency in supply chain processing. The concept of blockchain is gradually entering people's vision. With the rapid economic development in recent years, blockchain is currently the most advanced technology in the world. Blockchain has become a very important new infrastructure in many countries. Blockchain technology subtly changes the existing business model. Blockchain technology can reduce many risks faced by supply chain companies during the epidemic. In turn, it can promote the process of digital construction of enterprises. Different from the previous centralized information exchange mechanism, blockchain is decentralized and innovative. Blockchain is good at no data tampering, tracking capabilities, building trust, and reducing transaction costs. Blockchain technology can solve the blind spots in supply chain management, so it is highly valued by the government and enterprises. In reality, blockchain technology has been applied to supply chain management. For example, platforms like Tmall International adopt blockchain technology to trace products and enhance consumers' trust in platform products.

At the same time, blockchain technology can also play a certain role in reducing corporate carbon emissions. Nowadays, climate problems are becoming more and more serious, and actions to reduce

emissions are urgent. Carbon emission reduction is the focus of energy strategic development of various countries. The World Meteorological Organization announced that the average global temperature in the past five years is the warmest on record. Countries all over the world pay attention to the accelerated rise of the earth's average sea level and the increase in the frequency of extreme weather events. In order to comprehensively address the issue of global warming, the United Nations held several climate change conferences. Under the framework of the Paris Agreement, carbon emission reduction becomes a global consensus forming a new pattern of global climate governance. More and more countries put this into a national strategy with a vision for a carbon-free future. Therefore, corporate carbon emission reduction is not an option, but a must.

At present, the agricultural supply chain, O2O, blockchain and carbon emission reduction are hot topics in the world. There are amounts of related literature. This article is about the agricultural products supply chain, its relationship with the O2O model and blockchain, and carbon emission reduction strategies. This paper systematically reviews the relevant literature, so as to guide and help future research.

## 2. Agricultural Supply Chain

Agricultural supply chain management is currently a hot spot and an important research direction. Compared with supply chains in other fields, the agricultural products supply chain has its particularity. First of all, agricultural supply chain's security is directly related to people's lives and health. Secondly, because of perishability, the agricultural products supply chain has higher requirements for logistics. Therefore, the complexity in the agricultural supply chain processing not only provides a broader topic for research in this field, but also poses greater challenges for the application of research theory and research methods. The agricultural products supply chain management becomes a powerful tool for agricultural product production, deep processing, trading and circulation as agriculture-related enterprises participate in market competition.

In previous studies, food safety issues in the agricultural products supply chain are widely concerned by scholars from various countries. At the same time, based on the theoretical knowledge and methods of management and operations management, a large number of scholars embarks on empirical research on supply chain modeling and optimization. Their research conclusions can make more contributions to the theory and practice of management disciplines. On the basis of resource-based theory, strategic management and network theory, scholars from various countries conduct a lot of research on supply chain governance. Different sub-themes of global supply chains are also given attention in the national literature. In addition, due to the rise of e-commerce and the Internet in recent years, scholars from various countries pay more attention to the field of integration of supply chain and e-commerce. Future research can deepen the existing fields and continue to explore more standardized and rigorous research methods. Future research can also combine the agricultural products supply chain with more different emerging fields, such as the blockchain in this article. In this way, scholars can make more valuable research.

## 3. Agricultural Supply Chain and O2O

O2O mainly goes through three stages: offline primary model, service e-commerce model and platform development model. Alex Rampell first proposed the O2O model to attract online users to consume in offline physical stores. In 2012, he again proposed that the characteristics of O2O are based on discounts, interactive information push and artificial scarcity. Chi Ning pointed out that O2O is to allow customers to return from online stores to offline stores [1]. Then experts continuously update the concept of the O2O model based on ALEX Rampell's definition of "online to offline". A new direction of "online-offline-online" appeared against the background of the increasing popularity of the Internet. They proposed that e-commerce enterprises should use O2O to reconstruct the new business model.

The evolution trajectory of China's O2O can be described through the 1.0-4.0 evolution stage in accordance with the development of the O2O model. It emphasizes that e-commerce must adhere to the O2O thinking and realize the omnichannel interactive drainage of online and offline resources. Chen Honghua studied the business model transformation of brick-and-mortar retailers and pointed out that there is still room for improvement in consumer experience satisfaction in brick-and-mortar stores. It is necessary to divert online customer flow to offline through methods such as enriching customer relationships to achieve a win-win situation for multiple entities [2]. Jin Liang deemed that the integration of online and offline is an important mode of O2O. Relevant companies focus on the shopping experience of consumers and realize the transformation from "emphasis on the quantity of goods" to "emphasis on consumption experience" [3].

There are scholars carrying out relevant research on the O2O agricultural products supply chain. For example, Tian Yu et al. researched the optimal cooperation model selection for e-commerce platforms in the O2O agricultural products supply chain processing under the wholesale model and the commission model [4]. Moreover, some scholars found that the optimal choice for offline retailers under the decentralized decision-making situation is the O2O model, while other scholars found that consumers' perceived value has the most significant impact on the sustainable willingness of the O2O agricultural products supply chain.

## 4. Agricultural Supply Chain and Blockchain

Blockchain help various companies reduce transaction costs and gain consumers' trust, thereby improving transparency and traceability of capital and product transactions in supply chain processing. Therefore, many scholars study whether blockchain technology can be applied to finance, medical care, food and so on. In the food area, a food data repository is established using the characteristics of blockchain to ensure transparency of food supply chain transactions. This food data repository can provide complete product information to consumers, so consumers can buy food and products rationally. In the medical care area, a "vaccine supply chain" system based on blockchain technology can ensure vaccine traceability and smart contract functions. Therefore, it can effectively prevent the supply chain from selling expired vaccines and misreporting information such as vaccine raw materials and origins, which can better gain consumer trust. In the financial area, the supply chain uses the financial model through blockchain to gain more benefits.

Many scholars study on the supply chain decisions influenced by blockchain. Yan Yan et al. studied the impact of the degree of application of blockchain and the risk aversion coefficient on supply chain decisions. They found the avoidance coefficient affects the supplier's decision-making. The greater the risk aversion coefficient, the degree of suppliers using blockchain technology will gradually decrease [5]. A small number of academics study on carbon emission reduction decisions influenced by blockchain. Zhang Lingrong et al. put forward the investing scenarios in blockchain, emission reduction technology subsidies, and low-carbon product production subsidies. They also found that government production subsidies can bring more benefits to consumers [6]. Zhao Huida and Liu Jiaguo discussed whether to decentralize and whether to invest in blockchain technology [7].

There are some scholars trying to apply blockchain to the agricultural supply chain. For example, Rana et al. believed that blockchain can promote the sustainability of fresh agricultural product production [8]. Wu et al. found that the optimal decision to adopt blockchain technology is related to consumers' acceptance of products that do not use blockchain, deterioration rate and sharing ratio of blockchain technology costs among supply chain members [9]. The above literature mainly studies whether blockchain can realize agricultural products' information disclosure and the optimal adoption strategy of blockchain, but there is a lack of scholars studying the carbon emission reduction strategy considering both blockchain and agricultural supply chain.

## 5. Carbon Emission Reduction

Scholars conducted research on carbon emission reduction from the perspective of a single enterprise and supply chain member enterprises.

### 5.1. Enterprise‘s Carbon Emission Reduction

In terms of inventory, inventory management can use a mathematical model to take carbon footprint into account in operational decisions. In addition, some scholars used the EOQ model to calculate and adjust the order quantity aimed at reducing carbon dioxide emissions and obtaining the optimal order quantity. Moreover, some scholars considered the carbon emissions of remanufactured products during production and transportation, established an inventory model of the enterprise, and found that the inventory of original products and remanufactured products is different under different conditions.The finding can expand the economic order quantity model.

In terms of production, mathematical models can be used to help companies optimize their own product portfolio and production under different environmental constraints. Ren Jie et al. considered a manufacturer aimed at carbon emission reduction, analyzed its production decision with capacity constraints starting to bite, and finally obtained the manufacturer's optimal production strategy [10]. Liu Tiansen et al. implemented carbon emission control for the whole process and integrated the measurement of carbon assets into the consideration of the production process of enterprises in order to maximize the carbon benefits of enterprises [11].

### 5.2. Supply Chain Enterprises‘ Carbon Emission Reduction

In terms of cooperation mode, Zhao Daozhi et al. thought of the time factor, which means that the carbon emission reduction of enterprises changes with time. Under the two situations of no cooperation and cooperation between the manufacturer and the supplier, they explored carbon emission reduction’s change in the secondary supply chain led by the manufacturer and followed by the supplier through the method of differential game [12]. Ye Tong et al. also studied the changes in carbon emission reductions. Different from the research of Zhao Daozhi et al, this research referred to the effect of low carbon levels [13]. Liu Mingwu et al. analyzed the supply chain that retailers have a leading role. It shows a change in the enterprise's income under the two situations of suppliers not reducing carbon emissions and reducing carbon emissions. Furthermore, on the condition that suppliers carry out low-carbon activities, they obtained the optimal emission reduction, product selling price and total profit of the enterprise under the cooperative game, Nash game and Steinberg game respectively between suppliers and retailers[14].

In terms of coordination contracts among supply chain enterprises, Ghosh and Shah analyzed the impact of green investment costs and other factors on corporate decision-making in the supply chain of green investment [15]. Li Xiaoyan et al. introduced a joint contract consisting of wholesale price and cost-sharing to urge low-carbon manufacturers to transmit real carbon emission reduction cost information, reduce total carbon emissions, and increase supply chain profits [16].

In terms of carbon emission reduction strategies choosing, Wang Qinpeng et al. built an evolutionary game model of carbon emission reduction investment strategies between upstream and downstream manufacturers, analyzed its equilibrium point, and obtained the evolutionary equilibrium result of the game system [17]. Besides, Fu Qiufang et al. took suppliers and manufacturers as the main body of the game, explored which factors affect the game system of carbon emission reduction strategies to reach an evolutionary stable state, and finally proposed a corresponding punishment mechanism for the “free-riding” behavior of companies [18].

## 6. Conclusion

At present, many scholars research topics about agricultural supply chain, O2O, blockchain and carbon emission reduction. There are a large number of related literature. The related literature may link to one factor, two factors, or even three factors. However, there is a lack of literature that

considers the above four factors at the same time. In the future, it can be regarded as a research direction. At the same time, according to the above literature, for the newly developed O2O agricultural products supply chain, blockchain can effectively help reduce carbon emissions.

According to the previous literature review, it can be found that the researches on decision-making in the agricultural products supply chain processing mainly pay attention to the pricing decision. In the future, more research could be done on supply chain services, emission reduction decisions, or combining pricing and financing, pricing and coordination, pricing and service cooperation and other factors for decision-making research. When dealing with issues related to strategies, it is also necessary to take into account the current situation. When it is found that the model is not suitable for application in actual situations, it is necessary to re-examine and review the model to explore whether there are imperfections in the model, so as to promote the modification and re-improvement of the theoretical model.

Most of the literature on non-pricing decision-making only includes one factor of channel preference. In the future, other preferences can be considered and researched from other angles. In addition, some influencing variables can be combined for comprehensive consideration in the future. For example, when a company markets green and low-carbon products and differentiated products, it can comprehensively consider market consumers' fair preferences for sales channels and low-carbon preferences when considering the unlimited choices of consumer groups for any product.

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