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Original Research Article

## Integration and optimization of agricultural industry chain: exploring the path to enhance efficiency and sustainable development

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**Abstract:** This paper mainly discusses the current situation, challenges, theoretical basis, model and case analysis, key factors and practical strategies of the integration of agricultural industrial chain. The article pointed out that the integration of the global agricultural industry chain is a key way to promote agricultural modernization and improve efficiency. The market size has reached about \$10 trillion by 2020, and it is expected to grow at an average annual rate of 3% in the next decade. The integration of Chinas agricultural industrial chain is gradually transforming from traditional decentralized operation to intensive and large-scale, but at the same time, it also faces challenges such as difficulties in connecting small farmers with large markets, information asymmetry and lack of scientific and technological innovation. The article emphasizes the application of supply chain management in the optimization of the agricultural industrial chain. Through effective supply chain management, the overall efficiency and response speed of the industrial chain can be significantly improved. Finally, the paper puts forward the practical strategies of improving the informatization level of agricultural industry chain, building coordination mechanism and strengthening market orientation, so as to promote the development of agricultural industry chain to a more efficient and sustainable direction.

**Keywords:** Integration of agricultural industry chain; optimization of agricultural industry chain and sustainable development

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## 1. The present situation and challenges of agricultural industry chain integration

### 1.1. Overview of the global agricultural industry chain integration

Globally, the agricultural industry chain integration has become a key way to promote agricultural modernization and improve efficiency. According to statistics, the market size of the global agricultural industry chain integration has reached about 10 trillion US dollars in 2020, and is expected to grow at an average annual rate of 3% in the next decade. This growth not only benefits from technological advances and the expansion of global trade, but also reflects the growing concern about food safety and sustainable development. For example, multinational agricompanies such as Monsanto and Cargill have achieved full control from the field to the table by integrating seed research and development, planting, processing and distribution, significantly improving product quality and market response speed. Moreover, theoretical models of the integration of agricultural industry chains, such as Porters value chain theory, emphasize enhancing competitiveness by optimizing internal activities and external relationships. As Peter Drucker said, "Innovation is the only way for companies to survive and grow." Technological innovation plays a vital role in the integration of the agricultural industry chain. It not only improves the production efficiency, but also promotes the rational allocation of resources and the sustainable utilization of the environment.

### 1.2. Current situation of the integration of Chinas agricultural industry chain

The current situation of the integration of Chinas agricultural industrial chain presents diversification and

complexity. With the promotion of national policies and market demand, Chinas agricultural industrial chain is gradually transforming from the traditional decentralized operation to intensive and large-scale. According to statistics, Chinas agricultural industrialization management organization has exceeded 800,000 organizations, driving more than 120 million households. However, there are also many challenges in this process, such as the connection problem between small farmers and large markets, information asymmetry in the agricultural industry chain, and the lack of innovation and application of agricultural science and technology. Take the “company + peasant household” mode as an example. Although this mode has realized the integration of the industrial chain to some extent, there are still problems such as uneven distribution of interests and insufficient risk management. At the theoretical level, the economic principles of agricultural industrial chain optimization emphasize the importance of economies of scale and scope, while the perspective of management focuses on organizational structure and process reengineering, while the theory of sustainable development requires that environmental and social benefits be considered in the process of integration. Therefore, the practical strategy of the integration of Chinas agricultural industrial chain needs to comprehensively consider these theoretical bases, combine with the actual situation of Chinas agriculture, and promote the development of the agricultural industrial chain to a more efficient and sustainable direction through policy guidance, technological innovation and the improvement of the market mechanism.

### **1.3. Challenges facing the integration of the agricultural industrial chain**

In the context of globalization, the integration of agricultural industry chain is facing many challenges. First, the natural nature of agricultural production determine its sensitivity to climate change, which threatens the stability of the industrial chain. For example, according to the Food and Agriculture Organization of the United Nations (FAO), the frequency of extreme weather events due to global climate change has had a significant impact on agricultural production. Secondly, the agricultural industry chain involves many links, from planting, breeding to processing and sales, the efficiency and coordination of each link are very important. However, resources are wasted and inefficient due to information asymmetry and poor management. For example, according to the World Bank report, the loss rate of agricultural products in developing countries is up to 30% after harvest. In addition, the integration of the agricultural industrial chain is also faced with the uncertainty of the policy and regulatory environment, the policy differences between different countries and regions, and the existence of trade barriers, all constitute obstacles to the cross-border integration of the industrial chain. Finally, although the rapid advancement of technological innovation provides new opportunities for the integration of the agricultural industrial chain, it also brings the challenges of technological adaptation and upgrading. Therefore, how to realize the efficient integration and optimization of the agricultural industry chain under the premise of ensuring food safety and ecological balance is an urgent problem to be solved.

## **2. The theoretical basis of agricultural industry chain optimization**

### **2.1. Economic principles of agricultural industry chain optimization**

When discussing the economic principles of agricultural industrial chain optimization, we have to mention Adam Smiths theory of division of labor. In his book *The Wealth of Nations*, Smith argued that division of labor is the key to improving productivity. In the agricultural industry chain, this theory also applies. Through specialization and division of labor, agricultural producers can focus on specific production links, thus improving the efficiency and output quality of that link. For example, according to the Food and Agriculture Organization of

the United Nations, specialized farming and farming can improve crop yields and animal production efficiency by 20 percent and 30 percent, respectively. In addition, the integration of the industrial chain can also reduce the unit cost through economies of scale, and further improve the economic benefits of the overall industrial chain. Taking the flower industry chain of the Netherlands as an example, through the integration of planting, processing, logistics and other links, the Netherlands has become the worlds largest flower exporter. The optimization of its industrial chain not only improves efficiency, but also promotes sustainable development.

## **2.2. Management perspective of agricultural industry chain optimization**

From the perspective of management of agricultural industrial chain optimization, we realize that effective management can not only improve the efficiency of agricultural production, but also promote the sustainable development of the entire industrial chain. For example, by introducing the concept of lean production (Lean Production), agribusinesses can reduce waste and improve resource utilization. Through lean management, certain agribusinesses are able to reduce waste in production processes by up to 30 percent, according to a study. In addition, supply chain management (Supply Chain Management, SCM) plays a crucial role in optimizing the agricultural industry chain. By integrating upstream and downstream resources, realizing information sharing and process coordination, the agricultural industry chain can more flexibly respond to market changes and improve the overall competitiveness. For example, the Dutch flower industry chain is a successful case. Through efficient supply chain management, the Netherlands has become the worlds largest flower exporter. Under the framework of management science, Porters value chain model (Porters Value Chain) is also widely used in the optimization of the agricultural industry chain. By analyzing every link in the industrial chain, companies can identify the key activities that increase value, and improve the overall benefits by optimizing these activities. This analysis method helps agricultural enterprises to better understand their own positioning in the industrial chain and how to enhance their market competitiveness by improving management.

## **2.3. Sustainable development theory of agricultural industrial chain optimization**

Under the theoretical framework of the sustainable development of the optimization of the agricultural industry chain, the integration and optimization of the agricultural industry chain not only focuses on the short-term economic benefits, but also pays more attention to the long-term ecological balance and social welfare. For example, according to the Food and Agriculture Organization of the United Nations (FAO), global agricultural land accounts for 38% of the worlds land area, but it contributes to 25% of global greenhouse gas emissions. Therefore, to optimize the agricultural industrial chain, we must reduce resource consumption and environmental pollution as the core goal. By adopting precision agriculture technologies, such as intelligent irrigation systems and drones to monitor crop health, resource use efficiency can be significantly improved and the excessive use of fertilizers and pesticides can be reduced, thus reducing the negative impact on the environment. At the same time, the sustainable development theory emphasizes that the integration of agricultural industrial chain should promote social equity. For example, through the cooperative model, farmers can share resources, technology and market information, improve bargaining power and ensure the fair distribution of income. As economist E.F. Schumacher said, “the small is beautiful”, it is equally important to support the sustainable development of small-scale farmers in the optimization of the agricultural industry chain.

### **3. Mode and case analysis of agricultural industry chain integration**

#### **3.1. A typical mode of agricultural industrial chain integration**

In the wave of global agricultural industry chain integration, one of the typical models is “vertical integration”, which realizes the efficient allocation of resources and cost reduction by controlling every link from seed selection, planting, harvesting to processing, distribution and retail. Cargill (Cargill), for example, is one of the worlds largest private agricultural and food companies through vertical integration. Cargill not only has a wide planting base worldwide, but also involved in feed, meat processing and food distribution and other fields, through this integration, cargill is able to better control product quality, improve market response speed, and maintain a stable supply chain during price fluctuations.

Another model worth exploring is “horizontal integration”, which refers to expanding market share and enhancing market control by merging or acquisition of other enterprises in the same industry at a particular link of the industrial chain. Take JBS SA in Brazil as an example. As the worlds largest meat processing company, JBS has achieved horizontal integration in the beef, pork and poultry processing fields by acquiring several competitors, thus optimizing resource allocation and improving production efficiency worldwide.

In addition, the model of agricultural industry chain integration also includes “contract agriculture”, which is a model between vertical integration and market transactions, closely linking farmers with processing enterprises or distributors through contractual relations. Contract agriculture can ensure that farmers can obtain stable sales channels and price guarantee, while processing enterprises can also obtain a stable supply of raw materials. Indias milk cooperatives, for example, connect millions of small dairy farmers with processors to form an efficient milk supply chain through contract agriculture.

When analyzing these models, we have to mention Michael Porters competitive advantage theory, whose concept of “value chain” provides an analytical framework for the integration of the agricultural industry chain. Through the value chain analysis, enterprises can identify the key links in the industrial chain, and create greater value by integrating these links. For example, by integrating research and development, procurement, production, marketing and other links, enterprises can better control costs, improve product quality, and finally achieve competitive advantage.

To sum up, the typical models of agricultural industrial chain integration have their own characteristics, but their common goal is to realize the sustainable development of agriculture by optimizing the allocation of resources, improving the production efficiency and enhancing the market competitiveness. Whether it is vertical integration, horizontal integration or contract agriculture, these modes provide a feasible path for the optimization of the agricultural industry chain, and constantly verify its effectiveness in practice.

#### **3.2. Successful cases of agricultural industry chain integration at home and abroad**

In the world, there are numerous successful cases of agricultural industry chain integration, among which the integration of flower industry chain in the Netherlands is particularly striking. Through the establishment of an efficient supply chain management system, the Netherlands has realized the seamless connection of flowers from planting to sales, and its flower exports account for more than 60% of the global market. This achievement is due to the fine management of the Dutch agricultural industry chain and the high emphasis on scientific and technological innovation. For example, the application of greenhouse technology, automated irrigation systems and precision agriculture technology in the Netherlands has greatly improved the production efficiency and

product quality of the flower industry.

China has also made significant progress in the integration of the agricultural industrial chain. Take the hybrid rice project led by Academician Yuan Longping as an example, by integrating scientific research, planting, processing and sales, it not only improved the rice yield, but also promoted the optimization and upgrading of the agricultural industry chain. Yuan Longping once said: “ Science has no borders, but scientists have their motherland.” This sentence has inspired countless Chinese agricultural researchers to devote themselves to the integration and optimization of the agricultural industry chain to achieve food security and sustainable development of agriculture.

In terms of analytical model, Porters value chain theory provides a strong theoretical support for the integration of agricultural industry chain. The theory holds that companies can create greater value by optimizing their internal activities and external relationships. In the agricultural industry chain, this theory also applies. For example, the integration model of the agricultural industry chain in the United States emphasizes the whole process control from seed research and development to the final product sales, and through vertical integration, the cost reduction and efficiency improvement are realized.

To sum up, both the flower industry chain in the Netherlands, the hybrid rice project in China, and the agricultural integration model in the United States show the great potential of the integration and optimization of the agricultural industry chain in improving efficiency and realizing sustainable development. These successful cases not only provide valuable experience for the development of the global agricultural industry chain, but also point out the direction for the practical strategy of the integration and optimization of the agricultural industry chain in the future.

### **3.3. Comparison and enlightenment of integration modes**

In the wave of the integration of the global agricultural industry chain, different countries and regions have formed diversified integration modes according to their own resource endowment, technology level and market demand. For example, the Dutch “glass house agriculture” model, with the precision planting of crops in high-tech greenhouses, greatly improves the efficiency of land and water use. According to statistics, the greenhouse agricultural output of the Netherlands accounts for more than 60% of the global flower exports, which not only shows the key role of technological innovation in the optimization of the agricultural industry chain, but also inspires us that the efficient and sustainable development of agriculture can be achieved through scientific and technological means.

When comparing different integration models, we can find that successful integration often depends on effective supply chain management, policy support and market orientation. Take the integration of the agricultural industry chain in the United States as an example, through the establishment of strong agricultural cooperatives and agricultural enterprise groups, it has realized the integrated management from planting, processing to sales. This model not only improves the scale economy effect of agricultural production, but also ensures the competitiveness of agricultural products through the market mechanism. According to the US Department of Agriculture, agricultural cooperatives provide American farmers with about 25 percent of their agricultural income, which fully demonstrates the importance of the synergy mechanism in improving the efficiency of the industrial chain.

On the basis of analyzing the successful cases at home and abroad, we can draw some enlightenment. First of all, the integration of agricultural industry chain needs the policy guidance and regulatory support of

the government to ensure fair competition and market order in the integration process. Secondly, technological innovation is the core driving force to promote the optimization of the agricultural industry chain. Both the application of intelligent agricultural technology and the progress of biotechnology all provide the possibility for the upgrading of the agricultural industry chain. Finally, market orientation is the key to the success of the integration model. Only by paying close attention to the market demand can we ensure that the results of the integration process of the agricultural industrial chain can be transformed into actual economic benefits. As economist Peter Drucker puts it, “The sole purpose of corporate existence is to create customers.” Agricultural industry chain integration and optimization of the practice strategy, should also take this as a starting point, constantly explore and innovate.

## **4. The key factor of the optimization of the agricultural industry chain**

### **4.1. The role of technological innovation in the optimization of the agricultural industry chain**

In the process of optimizing the agricultural industry chain, technological innovation plays a vital role. With the rapid development of technologies such as the Internet of Things, big data, artificial intelligence and blockchain, the agricultural production mode is undergoing a profound transformation. For example, the application of precision agriculture technology makes agricultural production more refined, and through the combination of satellite positioning systems (GPS) and geographic information systems (GIS), farmers are able to accurately fertilize and irrigate their crops, thus improving yield and resource utilization efficiency. Precision agriculture technology is expected to increase global food production by 1 percent to 3 percent by 2025, according to the International Data Corporation (IDC) report.

Technological innovation not only improves the efficiency of agricultural production, but also promotes the integration of the agricultural industry chain. Through the use of blockchain technology, agricultural products can be traced from the field to the table, ensuring food safety and enhancing consumer confidence. For example, the Food Trust solution, developed in partnership with IBM, uses blockchain technology to trace food sources, reducing the time and cost of food recalls.

In addition, technological innovation has also promoted the informatization level of the agricultural industry chain. The application of intelligent greenhouse, UAV monitoring, automatic harvesting machinery and other technologies not only reduces the labor intensity of farmers, but also improves the quality and yield of crops. According to the Food and Agriculture Organization of the United Nations (FAO), agricultural mechanization can increase Labour productivity by 30 to 50 percent.

The role of technological innovation in the optimization of agricultural industry chain is also reflected in the improvement of supply chain management. By introducing advanced supply chain management software, agribusinesses can better predict market demand, optimize inventory management, and reduce waste. For example, through the use of advanced supply chain management technology, the flower market in the Netherlands has realized the rapid circulation of flowers from picking to sales, which greatly improves the freshness and market competitiveness of flowers.

To sum up, technological innovation is the key driving force for the optimization of the agricultural industrial chain, which not only improves the efficiency of agricultural production, but also promotes the integration and sustainable development of the industrial chain. As American inventor and futurist Ray Kurzweil puts it, “Technological progress is accelerated, not linear.” With the continuous progress of technology, the

optimization of the agricultural industry chain will continue to deepen, providing a solid foundation for global food security and sustainable development.

#### **4.2. The impact of policy support and regulatory environment on the optimization of the industrial chain**

Policy support and regulatory environment are the important driving forces for the optimization of the agricultural industry chain. For example, in the 13th Five-Year Plan, the Chinese government proposed to speed up agricultural modernization and promote the integration and optimization of the agricultural industry chain through policy support and capital investment. The governments subsidy policies, tax incentives, financial support and other measures provide strong external conditions for the upgrading of the agricultural industrial chain. The improvement of the legal environment, such as the Food Safety Law and the Agricultural Product Quality and Safety Law, provides a legal guarantee for the standardized operation of the agricultural industry chain, and ensures the quality control of the whole process of agricultural products from the field to the table. In addition, through the introduction of blockchain technology, the establishment of agricultural products traceability system, not only improves the transparency of the industrial chain, but also enhances the trust of consumers in agricultural products. As the economist Joseph Schumpeter said, "Innovation is the driving force of economic development." The combination of technological innovation and policies and regulations jointly promotes the optimization and sustainable development of the agricultural industry chain.

#### **4.3. Application of supply chain management in the optimization of agricultural industrial chain**

Supply chain management plays a vital role in the optimization of the agricultural industry chain. Through effective supply chain management, the overall efficiency and response speed of the agricultural industrial chain can be significantly improved. For example, the use of advanced information technologies, such as the Internet of Things (IoT) and big data analytics, can enable real-time monitoring and management of agricultural production processes, thus reducing resource waste and increasing crop yields. According to the International Food Policy Research Institute (IFPRI), the application of precision agriculture technology can increase crop yields by 10 to 15 percent. In addition, supply chain management can also reduce the wastage of agricultural products from the field to the table by optimizing the logistics and distribution networks. Wal-Mart, for example, has successfully reduced food wastage rates by 15% by implementing an efficient supply chain management strategy by working closely with its suppliers. The synergies of supply chain management are not limited to efficiency improvement, but also reflected in enhancing the transparency and traceability of the industrial chain, which is crucial to enhancing consumer confidence and meeting the market demand for sustainable products.

### **5. The practical strategy of the integration and optimization of the agricultural industrial chain**

#### **5.1. Improve the informatization level of the agricultural industry chain**

In the process of the integration and optimization of the agricultural industrial chain, improving the level of informatization is one of the key driving forces. Informatization can not only improve the efficiency of agricultural production, but also enhance the transparency and coordination of all links of the industrial chain. For example, through the application of Internet of Things technology, real-time monitoring of the farmland environment, and precise control of irrigation and fertilization, thus improving crop yield and quality. According

to the report of International Data Corporation (IDC), the installation base of global IoT devices is expected to exceed 55 billion units by 2025, which will provide strong technical support for the informationization of the agricultural industry chain.

The improvement of the information level can also optimize the decision-making process of the agricultural industry chain through big data analysis. By collecting and analyzing a large amount of agricultural data, including soil status, climate change, market demand, etc., scientific planting advice and market prediction can be provided for agricultural producers. For example, John Deere, a American agribusiness, uses its smart agriculture platform to help farmers analyze data to achieve more efficient crop management. This data-driven decision-making model is, as management master Peter Drucker says: “If you can't measure it, you can't manage it.”, Is particularly important in the agricultural industry chain.

In addition, the improvement of the information level has also promoted the market orientation of the agricultural industry chain. Through e-commerce platforms and mobile applications, agricultural products can be directly connected to consumers, reducing the intermediate links, and improving the market response speed and consumer satisfaction of agricultural products. China's rural Taobao project launched by Alibaba Group is a successful case. It sells agricultural products to a broader market through an online platform, and helps farmers understand market demand and adjust production strategies through data analysis. This model not only improves the efficiency of the industrial chain, but also promotes the sustainable development of agriculture.

## **5.2. Build a cooperative mechanism of the agricultural industry chain**

In the construction of the cooperative mechanism of agricultural industrial chain, the key lies to realize the seamless docking and efficient operation of all links of the industrial chain. Take China as an example. According to the National Bureau of Statistics, the added value of agriculture accounted for 7.7% of GDP in 2020, and the optimization of the agricultural industry chain can significantly increase this proportion. The construction of the collaborative mechanism needs to rely on advanced information technology, such as the Internet of Things, big data and cloud computing, to achieve precision agriculture and intelligent logistics. For example, through the Internet of Things technology, crop growth and soil humidity can be monitored in real time, so as to achieve accurate irrigation and fertilization and improve the efficiency of resource utilization. At the same time, the construction of the coordination mechanism should also consider the policy support and regulatory environment, such as the agricultural subsidy policies and agricultural product quality standards launched by the government, which provide an institutional guarantee for the coordination of the industrial chain. In addition, the introduction of supply chain management, such as the use of supply chain synergy model (SCM), can optimize inventory management, reduce waste, and improve the response speed and flexibility of the entire industrial chain. As Peter Drucker says, “Synergies are at the heart of your corporate strategy.” In the agricultural industry chain, through the construction of the coordination mechanism, the optimal allocation of resources can be realized, and the overall competitiveness and sustainable development ability of the industry chain can be improved.

## **5.3. Strengthen the market orientation of the agricultural industry chain**

In strengthening the market orientation of the agricultural industry chain, the key is to understand and meet the consumer needs, while improving the response speed and flexibility of the industry chain. Guided by market demand, the agricultural industrial chain can allocate resources more efficiently, reduce waste, and enhance the overall competitiveness. For example, through big data analysis, agribusiness can predict market trends and adjust



their production plans, which can reduce the risk of surplus or shortage. According to the Food and Agriculture Organization of the United Nations, about 1.3 billion tons of food is wasted every year worldwide, and that figure is expected to decrease significantly through market-oriented industrial chain optimization. In addition, using the “timely production” (Just-In-Time) model in supply chain management can reduce the inventory costs, improve the capital turnover rate, and further strengthen the market orientation. As Peter Drucker says, “The only reason a business exists is to create customers.” Therefore, the integration and optimization of the agricultural industry chain must be carried out around the market orientation, to ensure that every link can provide the maximum value to the ultimate consumers.

## **6. Future trend of the integration and optimization of the agricultural industry chain**

### **6.1. Application prospect of intelligence in the integration of agricultural industrial chain**

With the continuous progress of science and technology, the application prospect of intelligent technology in the integration of agricultural industry chain is increasingly broad. Intelligent technologies, such as the Internet of Things (IoT), big data analytics, artificial intelligence (AI) and robotics, are changing the face of traditional agriculture and improving the efficiency and sustainability of the entire industrial chain. For example, through the Internet of Things technology, farms can monitor the crop growth environment in real time and automatically regulate irrigation and fertilization, thus improving the efficiency of resource utilization and crop yield. According to the International Data Corporation (IDC), global IoT spending will reach \$1.1 trillion by 2025, and agriculture will be one of the important growth points.

In the integration of agricultural industry chain, the application of intelligent technology is not limited to the production link, but also runs through the supply chain management, product traceability, market analysis and other aspects. For example, through big data analysis, agribusinesses can more accurately predict market demand, optimize inventory management, and reduce waste. At the same time, the application of AI technology in disease and insect pest identification and prediction can help farmers to take timely measures to reduce losses. As Bill Gates said: “Innovation is the key to agricultural progress, and technology is the driving force of innovation.” Intelligent technology is the concentrated embodiment of this driving force.

The integrated application of intelligent technology provides new possibilities for the optimization of the agricultural industry chain. Taking precision agriculture as an example, through satellite positioning system (GPS) and remote sensing technology, farmers can accurately carry out land cultivation and crop management to realize accurate allocation of resources. The application of this technology not only improves the yield and quality of crops, but also reduces the impact on the environment. In practice, some farms in the United States have already increased crop yields by more than 10 percent through precision agriculture techniques, while reducing the use of chemical fertilizers and pesticides by 30 percent.

In the future, with the further development of intelligent technology and the reduction of cost, its application in the integration of agricultural industrial chain will be more extensive and deep. Intelligent technology will help the agricultural industry chain to optimize the whole process from the field to the table, improve the transparency and traceability of the whole industrial chain, and enhance consumers trust in agricultural products. At the same time, intelligent technology will also promote the international cooperation of the agricultural industry chain, and promote the sustainable development of global agriculture through technology sharing and experience exchange.

## **6.2. Sustainable development trend of the integration and optimization of the agricultural industry chain**

In the sustainable development trend of the integration and optimization of the agricultural industry chain, technological innovation plays a vital role. Taking precision agriculture as an example, by using advanced technologies such as remote sensing technology, geographic information system (GIS) and the Internet of Things (IoT), agricultural producers can more accurately manage the growing environment of crops, reduce resource waste and increase yield. For example, according to the International Organization for Agricultural Development, the application of precision agriculture technology can increase the efficiency of water use by 10 to 20 percent and the efficiency of fertilizer use by 15 to 20 percent. This technology-driven optimization not only improves the efficiency of agricultural production, but also reduces the negative impact on the environment, in line with the concept of sustainable development.

Policy support and the improvement of the regulatory environment is another key factor to promote the integration and optimization of the sustainable development of the agricultural industry chain. The government can encourage participants in all links of the agricultural industry chain by formulating policies to encourage innovation and sustainable practice, such as tax incentives, subsidies and green credit. For example, in the 14th Five-Year Plan, China proposed to accelerate agricultural modernization and promote the green transformation of the agricultural industry chain, which provides policy guidance for the sustainable development of the agricultural industry chain. At the same time, the formulation and implementation of regulations, such as organic agricultural standards and environmental protection regulations, ensure that agricultural activities are carried out without damaging the ecosystem, providing a legal guarantee for sustainable development.

The application of supply chain management in agricultural industry chain optimization is an effective way to realize sustainable development. By establishing an efficient supply chain management system, the whole process traceability from the field to the table can be realized to ensure food safety and quality. For example, through cooperating with suppliers, Wal-Mart has implemented a “farm-to-shelf” traceability system, which not only improves the transparency of the supply chain, but also reduces food waste and enhances consumers trust in the brand. The optimization of supply chain management not only improves the efficiency of the agricultural industry chain, but also promotes the rational allocation of resources and the protection of the environment, which is the key to realize the sustainable development of the agricultural industry chain.

## **6.3. Outlook for international cooperation on the integration and optimization of the agricultural industrial chain**

In the context of globalization, the prospect of international cooperation in the integration and optimization of agricultural industry chain is particularly important. With the gradual reduction of global trade barriers, the interconnection of agricultural industrial chains in various countries has become the key to improving efficiency and sustainable development. For example, according to the Food and Agriculture Organization of the United Nations (FAO), global food trade has increased by about 20% in the past decade, indicating the growing role of international cooperation in the agricultural industry chain. Through transnational cooperation, the optimal allocation of resources, the sharing and dissemination of technologies, and the joint development of the market can be realized. For example, the opening of the China-Europe freight trains has not only promoted the circulation of goods between China and Europe, but also provided new possibilities for the rapid transportation

of agricultural products, thus strengthening the integration of the agricultural industry chain. In addition, international cooperation can also learn from the “agricultural cooperation zone” model such as the “Belt and Road” initiative to promote the optimization and upgrading of the agricultural industrial chain through policy coordination, infrastructure construction, trade facilitation and other measures. As the economist Paul Samuelson said, “International trade is the engine of economic growth”, and international cooperation plays a vital role in the integration and optimization of the agricultural industry chain.

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