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Research on the Development of Digital Circulation Opportunities of Agricultural Products under the Background of Rural Revitalization

Yulian Liu

School of Economics, Guangzhou College of Commerce, Guangzhou, Guangdong, China
297241079@qq.com

Abstract: *This article starts from the research on rural areas in my country, based on theory and practical situations. This article starts from the research on rural areas in China, based on theory and actual conditions. It aims to promote the digital transformation of agricultural product marketing, including live-streaming sales, online payment, and smart logistics, to change the circulation of agricultural products with technology, solve the marketing problems of agricultural products, promote the development of rural areas, and achieve the grand goal of empowering rural revitalization with technology.*

Keywords: *Digitalization; Rural Revitalization; Agricultural Product Circulation*

1. Background and significance of the study

Since the rural revitalization strategy was proposed, it has been six years since it was proposed, and the strategy has played a significant guiding role in solving the "three rural issues". Since the comprehensive construction of a moderately prosperous society, my country has always attached great importance to ensuring and improving people's livelihood in the process of development, especially in rural areas where low-income groups are relatively concentrated, aiming to improve farmers' overall income level and meet their growing needs for a better life. As a traditional agricultural power, although the "three rural issues" have improved significantly in recent years, the problem of farmers' income growth still plagues the public. As a major agricultural country, we should give priority to the development of integrated development of agriculture, rural areas and urban-rural areas, and do a good job in coordinated development of rural products, rural industries, and talents in the new era [1]. Against the backdrop of the rapid development of Internet information and technology, we will accelerate the process of rural construction, give full play to the key role of informatization in implementing the rural revitalization strategy and promoting the development of the agricultural economy, promote the circulation of agricultural products and improve the level of rural modernization, achieve comprehensive agricultural upgrading, and thus promote the steady development of the agricultural economy.

From the government's policy orientation, it can be seen that the rural revitalization plan has received great attention. The plan is committed to promoting the digital transformation of agriculture and agricultural products, a move that marks profound changes in the information age. Its core goal is to improve the current situation of rural construction and open a new chapter in rural development. In the context of the rural revitalization strategy, we will give agricultural products digital characteristics, open up new circulation channels for agricultural products, promote the industrialization and commercialization of agricultural products, and thus increase farmers' income and promote the rapid development of the agricultural economy [2]. As an important part of the modern circulation system, the development of digital circulation of agricultural products is not only a structural reform in the field of agricultural product supply, but also helps to expand effective supply and effectively solve the problem of supply and demand mismatch. At present, rural areas mainly adopt traditional agricultural product production and circulation models, which has information asymmetry with the current development of the market economy, resulting in an increase in agricultural product circulation links, rising costs, difficulty in upward production, and slow market response. This situation not only reduces the profits of farmers, but also increases the burden on consumers. Therefore, in the development of rural agriculture in the new era, the digitalization of agricultural products is urgent. Integrating Internet technology into the field of agricultural product circulation will bring new opportunities for

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transformation and upgrading to the agricultural product market.

The Internet information age has given higher efficiency and transparency in the circulation of agricultural products, optimized the allocation of various resources, enhanced market competitiveness, effectively alleviated the unreasonable phenomenon of the integrated development of agricultural products circulation, built a healthy circulation bridge for farmers and consumers, created better circulation channels and models, promoted the high-quality development of the agricultural economy, and thus demonstrated the importance of promoting the rural revitalization of the agricultural economy.

2. Digital construction of agricultural products under the background of rural revitalization strategy

The proposal of the rural revitalization strategy has become an important policy cornerstone for my country to promote agricultural and rural modernization. Digital construction is an indispensable way for rural areas to move towards modernization. Deeply integrating the rural revitalization strategy with digital construction is the key path to solve the imbalance between urban and rural development and stimulate the endogenous driving force of rural areas in the new era. To vigorously implement the rural revitalization strategy, we must take scientific planning as the leader, give full play to the leading role of planning, and then fully realize agricultural and rural modernization through urban-rural integration and scientific and technological empowerment. The digitalization and networking of rural infrastructure are the cornerstone of digital rural construction. For example, to improve network coverage and narrow urban-rural gaps, digital construction provides necessary conditions for the circulation of rural agricultural products[3]. The rural revitalization strategy and the digital construction of agricultural products complement each other and deeply integrate them. Digital construction is empowered through information technology to effectively solve the bottlenecks in agricultural and rural development.

In this process, the application of advanced information technologies such as the Internet of Things, big data, and cloud computing not only improves the efficiency of production, processing, circulation and sales of agricultural products, but also promotes the transparency and traceability of agricultural product information[4]. Through digital platforms, farmers can more accurately grasp market demand, arrange production reasonably, reduce resource waste, and increase the added value of agricultural products. At the same time, consumers can also understand the source, quality and transportation of agricultural products at any time through smart terminals such as mobile phones, and enhance their trust and willingness to purchase agricultural products [5]. This two-way interaction and information transparency have further promoted the healthy development of the agricultural product market and injected new vitality into the implementation of the rural revitalization strategy.

3. Current status of traditional agricultural product circulation channels

With the advancement of agricultural modernization and marketization, the circulation model of agricultural products continues to evolve, and traditional agricultural product circulation channels have also been adjusted accordingly due to changes in market demand. At present, the traditional distribution channels of rural agricultural products have the following characteristics.

3.1 Farmer-producer-sales wholesaler-retailers-consumer

This is the current common circulation model. Agricultural products are purchased centrally by buyers from the origin, and then sold to wholesalers in various places through modern logistics, and then distributed to farmers' market stall owners, supermarkets and other retailers. Consumers then purchase to complete the consumption closed loop. This kind of distribution channel has many links, long chains, large price range, high cost, and the price obtained by consumers is 2-5 times more expensive than the origin, and farmers have less profits [6].

3.2 Farmers-processing enterprises-retailers-consumers

By signing an "order model" with the enterprise, the two parties sign a contract, formulating the types and quantity of cooperative products, the enterprises purchase agricultural products and process and sell them, providing farmers with corresponding services to alleviate the contradiction between supply and demand, and farmers are highly dependent on this.

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3.3 Farmers-local farmers' market-consumers

Farmers with small-scale production usually set up stalls in local markets or farmers' markets for dispersed sales, and the circulation link is relatively short. However, due to the lack of unified production standards and bargaining power, its radiation range is limited and its degree of standardization is low. In addition, factors such as difficult transportation, simple site facilities, small flow of people and poor purchasing power have led to meager profits from producers, which may lead to the situation where planting is no longer available in the later stage.

4. Main issues in the digital circulation of agricultural products

Against the backdrop of the continuous deepening of the rural revitalization strategy and the rapid integration of digital technology into the entire agricultural chain, the digital circulation of agricultural products has become a key way to solve traditional circulation problems and help the process of agricultural modernization. This transformation can not only effectively enhance the market competitiveness of agricultural products and promote the accurate matching of agricultural product supply and demand information, but also significantly reduce intermediate links and improve circulation efficiency, thereby increasing farmers' income and stimulating the vitality of the rural economy. The digital circulation of agricultural products is an important part of the upgrading of agricultural industries and is of far-reaching significance for promoting my country's agricultural modernization and promoting rural revitalization. Based on the current situation of traditional circulation channels for agricultural products, the main problems existing in the circulation of agricultural products are as follows.

4.1 Low circulation efficiency and high transportation cost

Multi-level distribution leads to long circulation time (such as 2-5 days from the place of origin to the city), and the cost of warehousing, transportation, labor, etc. is superimposed, which ultimately pushes up the terminal price, while the actual income of farmers is low (usually only 20%-30% of the retail price).

4.2 Weak quality assurance and severe wear

Agricultural products have the characteristics of perishable, strong timeliness, significant regional and seasonality, and large differences in biological characteristics. They have high quality assurance requirements and large losses, and their costs increase accordingly. Most fresh agricultural products are susceptible to biological contamination and have shortness of breath. If leafy vegetables are shelf life at room temperature for only 1-2 days, and meat may deteriorate within 24 hours without refrigeration, which will lead to edible safety risks. Northern wheat is sown in late autumn and harvested in early summer. Southern lychees only mature in May-July, and after season, supply shortage or quality declines. Agricultural products are also affected by "soil and water" factors such as soil, water quality, and climate, forming unique local specialties. For example, geographical indication products such as "Yantai Apple", "Wuchang Rice", and "Ningxia wolfberry" will be difficult to replicate the quality after leaving specific production areas.

4.3 Inconsistent market supply and demand, poor risk resistance

Farmers have lagged in grasping market dynamics and consumption preferences. Information differences make it difficult for farmers to adjust their planting structure according to market demand, and are prone to "follow-up planting", which leads to unsalable sales problems (such as concentrated planting in a certain place resulting in oversupply); prices fluctuate greatly due to uncoordinated supply and demand, and farmers' income is unstable; logistics in remote areas are weak and agricultural products are difficult to transport; market transactions rely on cash settlement and manual accounting, and supply and demand data are difficult to integrate and precise scheduling is impossible.

5. Practical application of digital circulation of agricultural products

With the popularization of the Internet in the 21st century, information technologies such as big data, blockchain, and artificial intelligence can be used in the flow process, and digital upgrades from the

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production end to the consumer end (agricultural product production area, logistics and transportation, market sales, quality monitoring, supply and demand matching), and can solve the problems of high loss, low efficiency, and information asymmetry in traditional circulation [7]. The digital circulation method has effectively broken the barriers to traditional agricultural product sales, made full use of the informatization and digital advantages of "Internet + circulation" and the brand effect of chain operations, and built a new flat agricultural product circulation model. This model has made circulation methods increasingly diversified, providing solid and sustainable technical support for the efficient circulation of agricultural products and the rural revitalization strategy.

5.1 Digitalization of the origin

The planting areas of agricultural products use IoT sensors to control the soil temperature, humidity and light, and then combine it with drone inspection to collect growth environment data in real time, and analyze and guide planting from cloud platforms (such as precise irrigation and fertilization). Yunnan flower production areas monitor the temperature and humidity of greenhouses through the Internet of Things, and automatically adjust the intelligent temperature control equipment. The flower picking period is extended by 5-7 days, and the quality compliance rate is increased to more than 90%. Digital archives are established for each batch of agricultural products at the place of origin, recording the origin information, planting process (fertilization, drug use records), and testing reports (pestic residues, heavy metals). Through QR code association, the "one product, one code" traceability basic data collection is realized [8].

5.2 Digitalization of logistics links

Logistics plays a crucial role as the core link in the agricultural product circulation system. Especially in the field of cold chain logistics, realizing digital monitoring throughout the process has become a key measure to ensure the freshness and quality of agricultural products. To this end, advanced GPS positioning technology and temperature and humidity sensors are deployed in the logistics system to monitor and record temperature and humidity data during transportation in real time to ensure that every link is within a controllable range. In addition, with the help of big data analysis technology, historical logistics and transportation data are deeply mined and scheduled and optimized, and combined with intelligent path planning of AI algorithms, the optimal transportation route can be accurately calculated. Through this intelligent distribution method, not only greatly improves transportation efficiency, but also effectively reduces the air rebate rate and reduces logistics costs, thus providing a strong guarantee for the smooth circulation of agricultural products.

5.3 Digitalization of the transaction link

The agricultural product trading link is digitalized, and an e-commerce platform (Taobao, Pinduoduo, Douyin, etc.) is used to build a "direct supply of origin" zone and a B2B electronic trading platform (Meicai.com) to connect origin cooperation with catering companies and commodity supermarkets, from online ordering to electronic contracts and electronic settlement completion [9]. Live streaming sales can explain the product characteristics in real time, direct delivery from the origin, limited-time rush purchase and other links, and then complete the transaction with digital payment (WeChat, Alipay).

5.4 Digitalization of regulatory links

The digitalization of agricultural products is traced through the entire chain of blockchain, and the inspection report and production process: planting, picking, sorting, transportation, sales and other data can be generated by traceable QR codes. Consumers can view the entire process information by scanning the code. Enterprises upload data from rapid detection equipment (such as pesticide residue speed measuring instrument) to the supervision system. The regulatory authorities view various inspection data and logistics temperature control records online through the Internet supervision platform, and conduct targeted random inspections of high-risk categories to achieve "instant inspection, transmission and inspection". The digitalization of quality sampling achieves "sources can be checked, destinations can be traced, and responsibilities can be investigated" to solve consumers' concerns about food safety, and at the same time standardizes quality control in the circulation link.

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5.5 Digitalization of supply and demand matching

The supply and demand information of agricultural products is analyzed through big data to analyze annual historical consumption trends, inventory data, and climate impacts, and digitally realize accurate supply and demand forecasts, guide planting planning and circulation scheduling, and solve the problems of difficulty in selling and expensive buying caused by seasonal and regional nature. For example: Hema Fresh predicts that "the demand for Yunnan flower cakes surges before the Mid-Autumn Festival" through consumption data, locking in production capacity with Yunnan companies three months in advance, the accuracy of stocking volume increased by 40%, and the loss of unsalable sales was reduced by 35%. Establishing a digital platform for agricultural product inventory at the national or regional level can enable real-time investigation of warehouse inventory and quality grades, and recommend the best transportation plan through AI algorithms (for example, "Transporting apples from Shandong to Shanghai costs 15% less than transporting them from Shaanxi").

6. Effective integration measures for digital circulation of agricultural products

Agricultural products have the characteristics of "complex natural attributes, long circulation chains, and diverse participation entities". Through information technology, we can unblock key links of circulation, build an integrated digital platform for "government, enterprise and agriculture", establish standardization and traceability, improve policy and infrastructure, main body coordination, and policy support, and realize the digital integration of the entire chain from production to consumption. The purpose is to reduce circulation costs (loss, labor, logistics, etc.), improve circulation efficiency, enhance product value, and ultimately promote the full chain upgrade of agricultural products from "field" to "dining table", and realize the effective integration of digital circulation of agricultural products. The following are specific integration measures.

6.1 "Digital Transformation of the Whole Chain" as the core, clearing key links of circulation

Agricultural product circulation covers multiple links such as production, warehousing, logistics, sales and digital traceability. Through information technology, data management in each link is empowered to effectively break information barriers. Production side: Digital breeding and planting are integrated with supply and demand, and the production plan is guided by big data prediction of market demand in reverse, reducing circulation losses caused by unreasonable supply and demand. Warehousing end: intelligent temperature control and fresh preservation system, real-time monitoring of the warehousing environment, traceability of warehousing data, and intelligent sorting. Logistics end: Establish a full-process visual tracking system for transportation trajectories, and optimize delivery routes through GPS positioning of logistics vehicles and road condition information. Sales end: Digital integration with e-commerce platforms, multi-terminal inventory sharing, unified order processing, and combined with consumption data analysis to identify consumer preferences, supply and demand are met as needed, forming a closed loop from consumption to production.

6.2 Build a digital circulation ecosystem with "cross-subject collaboration" as the support

The circulation of agricultural products involves multiple entities such as farmers, cooperative groups, logistics enterprises, e-commerce platforms, and government regulatory authorities. Through government leadership, a digital circulation platform for agricultural products is jointly built to integrate production data and promote collaborative cooperation. Provide services such as equipment rental and order matching for small-scale farmers to help them integrate into the digital circulation chain.

6.3 Taking "standardization and traceability" as a starting point, improve the flow communication responsibilities

The quality and safety of agricultural products is the top priority in the circulation link. Through the construction of digital standards and the establishment of a traceability system, the "one product, one code" system was implemented, and the perfect mechanism of "record production, traceable circulation, and identifiable responsibility" was established, which significantly improved consumers' trust.

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6.4 Taking "policy and infrastructure" as a guarantee, lay a solid foundation for digital integration

The government can implement policy-oriented approaches to strengthen the coverage of 5G networks and IoT base stations in remote areas; formulate agricultural product data sharing standards, clarify the division of responsibilities, and strengthen data security legislation to prevent data leakage and abuse; carry out simplified digital tool use training for grassroots farmers and cooperative personnel to lower the operation threshold.

7. Conclusion

To sum up, under the background of rural revitalization, the development opportunities for digital agricultural product circulation mainly come from strong policy support, steady growth of market demand, continuous innovation of technology, continuous optimization of supply chains, vigorous rise of e-commerce, innovation of logistics models, and strong promotion of regional development. These factors intertwined and worked together, providing broad space and rich opportunities for the vigorous development of digital circulation of agricultural products, effectively improving circulation efficiency, and effectively promoting innovative development in the agricultural field. The circulation of agricultural products in agricultural development still faces many problems and challenges. In the future, policies need to be further improved, agricultural product circulation, promote the coordinated development of the agricultural industrial chain, and make greater contributions to the realization of rural revitalization.

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