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Optimal Pathways for the "Cooperative + E-commerce" Model in the Strawberry Industry in the Context of High-Quality Economic Development

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Abstract Under the background of "Digital Commerce for Rural Vitalization", rural E-commerce has experienced rapid development. However, agricultural products like strawberries, often produced by small-scale, fragmented, and less competitive individual farmers, struggle to meet the compliance and scalability demands of E-commerce, thereby constraining high-quality local economic development. Aiming to address this issue, this paper, guided by relevant policies and strategies, employs case analysis and logical deduction to explore the industrialization path of the "Cooperative + E-commerce" model for the strawberry industry. The research finds that by optimizing the cooperative's organizational structure, implementing multi-channel E-commerce strategies, upgrading the supply chain (including cold chain and quality traceability), and engaging in collaborative brand building, a robust industrial system can be formed. Supplemented by benefit evaluation, policy support, and regulatory oversight, this system can effectively bridge small-scale production with the broader market. This study concludes that this pathway can enhance the added value of the strawberry industry, increase farmer incomes, and provide practical insights for promoting high-quality local economic development.

Key words High-quality development of local economy, Strawberry industry, Cooperative + E-commerce, Operation path

0 Introduction

Under the background of "Digital Commerce for Rural Vitalization", E-commerce has become a key driving force to promote the transformation of rural economy, which helps to promote the development of rural industries, narrow the income gap between urban and rural areas, and promote the common prosperity of farmers. According to the *2023 China Online Retail Market Development Report*, the national rural online retail sales reached 24.9 trillion yuan, a year-on-year increase of 12.9%, indicating rapid development in rural E-commerce. However, in most regions, products sold through rural E-commerce originate from household workshops or individual processors. Constrained by limitations in space, labor, and equipment, these entities cannot achieve scaled or standardized production. This consequently hinders the "compliant sales" of rural E-commerce products on major platforms, impedes the high-quality development of the sector, and slows the resolution of the disconnection between small-scale production and the large market[1]. As important "mutual-aid" economic organizations in rural areas, farmers' cooperatives play a vital role in integrating and upgrading local industries. Their strengths lie in grassroots resource integration, providing social services, and possessing inherent public credibility[2]. In view of this, a key research question has emerged: how to effectively integrate cooperatives with E-commerce to establish an optimal industrialization model that promotes high-quality local economic development.

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1 Endogenous logic of local economic development and the operation mode of "cooperatives + E-commerce"

The *Implementation Opinions on Promoting High-Quality Development of Rural E-commerce* jointly issued in March 2024 by nine departments including the Ministry of Commerce, explicitly proposes to "support new business entities such as farmers' cooperatives in connecting with E-commerce platforms and strengthening industrial chain coordination," providing a policy basis for the integration of "Cooperative + E-commerce"[3]. Theoretically, cooperatives, leveraging their resource integration capabilities, can address the issue of "small-scale, fragmented, and weak" production by individual farmers. By standardizing varieties, techniques, and management, they achieve standardized strawberry production, which precisely meets the demand of rural E-commerce for compliant and scalable supply. E-commerce, relying on its digital channels, connects local strawberry products to the national market, solving the pain points of "multiple circulation layers and information asymmetry" in traditional production-marketing models, thereby shifting the local strawberry industry from being "production-oriented" to "market-oriented". The integration of the two is not a simple superposition. Instead, through the organizational synergy of cooperatives and the channel empowerment of E-commerce, a structured system featuring standardized production, efficient circulation, and value maximization is formed. This not only enhances the added value of the strawberry industry but also boosts farmers' income and local tax revenue, ultimately establishing itself as a distinctive growth pole for high-quality local economic development[4] (Fig. 1).

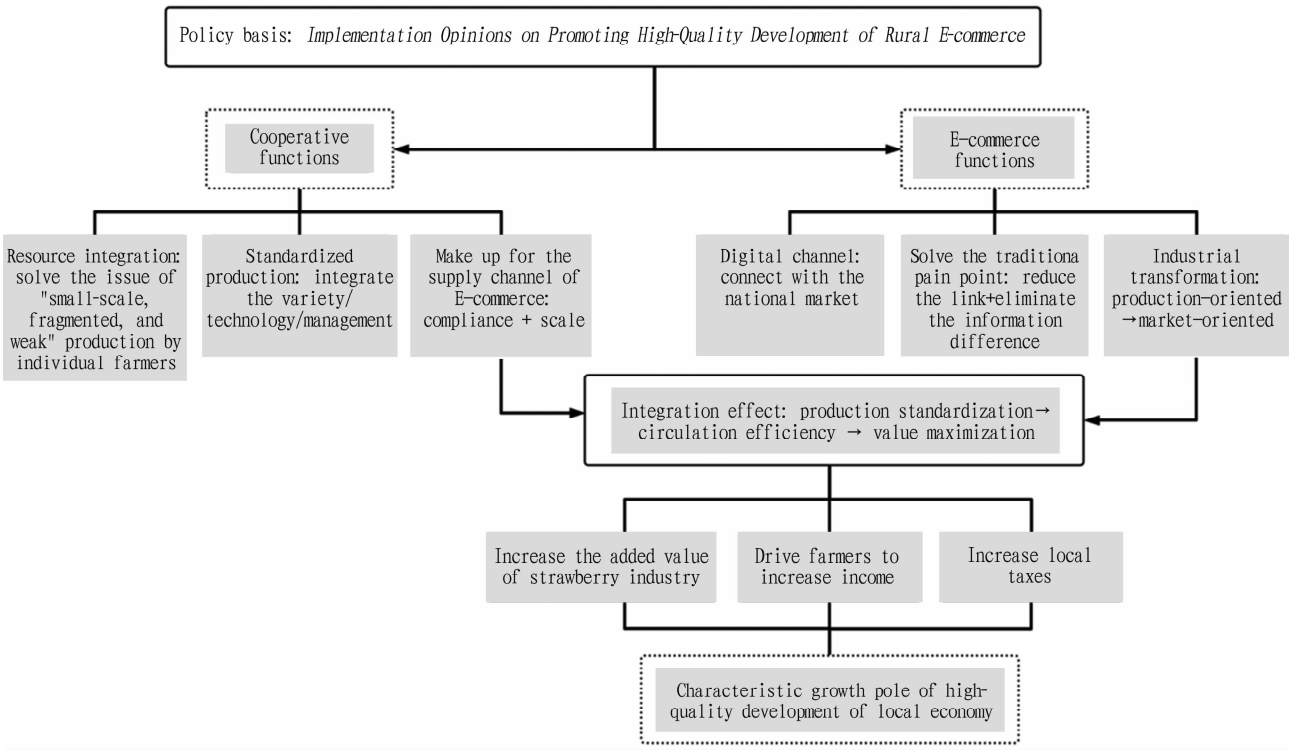

Fig. 1 Endogenous logic framework of "Cooperative + E-commerce" in strawberry industry

2 Optimal operation path of "cooperative + E-commerce" industrialization of strawberry industry under the guidance of high-quality development of local economy

2.1 Optimizing the organizational structure and improve the service efficiency of cooperatives

2.1.1 Strengthening the standardization of cooperatives. Strengthening the standardization of cooperatives is the cornerstone of the "cooperative + E-commerce" model, which requires simultaneous efforts in both governance mechanisms and service capabilities. In accordance with the *Law on Farmers' Professional Cooperatives*, cooperatives should amend their articles of association to clearly define the roles and responsibilities of the general assembly, the board of directors, and the board of supervisors. A robust governance system must be established, stipulating that major issues, such as E-commerce partnerships and profit distribution, require approval by a two-thirds majority of members. Furthermore, the introduction of external supervisors (*e. g.* , staff from township agricultural departments or E-commerce experts) is recommended to conduct quarterly audits and public disclosures of the cooperative's financial records and E-commerce operational data, thereby preventing insider control[5]. To enhance their service capabilities for E-commerce, cooperatives should establish two specialized units: a Production Technology Team and an E-commerce Operations Team. The Production Technology Team will be responsible for developing standardized strawberry cultivation protocols. These protocols will specify the use of varieties suitable for storage and transport (such as 'Hongyan' and 'Zhangji'), regulate the application of fertilizers and pesticides (promoting biopesticides), and define harvesting standards (for example, 80% – 90% maturity, single fruit weight ≥25 g). The team will also provide field guidance to members. In parallel, the E-commerce Operations Team, staffed with professionals, will manage online store operations, order processing, and after-sales services. Team members should regularly participate in training sessions organized by local governments to master essential skills, including product listing and traffic optimization.

2.1.2 Promoting the construction of cooperative alliance and industrial alliance. Local governments should take the lead in guiding small strawberry cooperatives within the county to form an integrated "Strawberry Industry Association," implementing a "Four-Unification" management model. This includes the unified procurement of agricultural inputs, where the association centrally sources seedlings and fertilizers to reduce costs and standardize production materials. Additionally, all members must follow the unified planting and quality control standards formulated by the association[6]. The model also features unified E-commerce operations, whereby the association establishes a shared livestreaming studio and invites professional hosts for centralized sales promotion, thereby avoiding the resource fragmentation that results from individual cooperatives operating alone. Finally, a unified benefit distribution mechanism should be established, allocating E-commerce income according to each cooperative's supply contribution, with an additional 5% drawn as the association's development fund. In building the industrial alliance, the association should act

as the core entity, absorbing diverse stakeholders such as E-commerce platforms [for example, Pinduoduo, Douyin (TikTok)], cold-chain logistics enterprises, strawberry deep-processing companies, and scientific research institutions to form an integrated "production-marketing-research" consortium. Under this framework, E-commerce platforms would provide traffic support and operational guidance, cold-chain logistics enterprises would handle transportation, deep-processing companies would utilize substandard or surplus produce for items like freeze-dried strawberries and jam, and research institutions would provide variety improvement and technical support, such as breeding early-maturing varieties more suitable for E-commerce transportation. This multi-subject collaboration will help open up the entire strawberry industry value chain and promote high-quality development of the local economy.

2.2 Multi-channel E-commerce layout and brand marketing system construction

2.2.1 Multi-channel E-commerce layout. Multi-channel E-commerce deployment is a core initiative for the industrial alliance to break its reliance on single sales channels and expand market coverage. Differentiated strategies must be formulated according to the characteristics of different platforms[7]. The industrial alliance should take the lead in integrating resources from various cooperatives and simultaneously advance efforts on both traditional and emerging E-commerce platforms. For traditional platforms like Taobao and JD. com, the alliance should uniformly establish a "Regional Strawberry Official Flagship Store" and form a professional operations team responsible for store design and product detail page optimization. The pages should highlight the characteristics of strawberry varieties, the origin environment, and inspection reports. Participation in platform promotional events such as "Fresh Food Festival" and "Chinese New Year Sale" is essential. Conversion rates can be boosted by setting up strategies like spend-and-save offers and product bundles. For Pinduoduo, the strategy should focus on "high volume at low prices". Leveraging the alliance's centralized procurement to reduce costs, introduce trial packs priced at 9.9 yuan to attract traffic. Besides utilize the "cloud-based collective farming orders" model to achieve direct supply from the origin, shortening the circulation cycle. For live-streaming E-commerce platforms like Douyin and Kuaishou, the alliance needs to cultivate a "matrix of live-streamers from the production area". Select and train cooperative members to become "Strawberry Experts" who broadcast daily activities such as strawberry picking and packing, interspersed with explanations of planting knowledge. Additionally, collaborate with top fresh food streamers on the platforms to conduct "origin traceability live streams", leveraging the streamers' audience to achieve sales breakthroughs. For community group-buying platforms (*e.g.*, Meituan Youxuan, Duoduo Maicai), the alliance must connect with regional group leaders and formulate a "next-day delivery" supply plan. Centralized sorting and distribution should be carried out based on community orders to reduce last-mile logistics costs[8].

2.2.2 Content marketing and brand communication. Content marketing and brand communication are crucial for the industrial alliance to enhance the recognizability of its strawberry products and build consumer mindshare. This requires building a content system centered on "origin stories + product value." The industrial alliance should establish a brand promotion team to execute the following strategies: First, delve into the unique cultural aspects of regional strawberries, such as documenting the history of cultivation in the area and stories of local farmers. This content should be developed into featured articles/series or short videos and regularly published on platforms like WeChat Official Accounts, Channels, and Xiaohongshu. Second, focus on communicating product value. Collaborate with agricultural testing institutions to release nutritional component reports for the strawberries (*e.g.*, Vitamin C content, sweetness levels) and produce "nutrient education short videos" to educate consumers on the criteria for identifying "high-quality strawberries". Furthermore, plan interactive campaigns. For instance, launch a "Creative Strawberry Recipe Contest" on E-commerce platforms, encouraging consumers to share videos of making strawberry desserts, with outstanding entries rewarded with strawberry gift boxes. Simultaneously, host "Strawberry Picking Festivals" at the origin, broadcasting the event live on Douyin and Kuaishou to invite online consumer participation in "cloud picking". Orders placed during the event could include complimentary picking experience vouchers[9]. Finally, strengthen cross-industry collaborations. Partner with local bubble tea shops and bakeries to launch "limited-time strawberry products," indicating the strawberry's origin and the alliance's E-commerce channel on the product packaging. This strategy aims to achieve "offline traffic generation leading to online conversion", gradually building strong brand recognition for the regional strawberries.

3.1 Upgrading the supply chain system to ensure product quality

3.1.1 Construction of cold chain logistics system. Establishing a comprehensive cold chain logistics system is crucial for addressing the perishable nature of strawberries and minimizing losses in E-commerce distribution. A three-tier network encompassing "origin pre-cooling, refrigerated trunk transportation, and cold chain last-mile delivery" should be implemented. Spearheaded by an industrial alliance, cold chain resources need to be integrated as follows: First, local governments should seek special cold chain subsidies to build pre-cooling facilities in major production areas. These facilities, equipped with vacuum pre-coolers and refrigerated storage, would enable cooperatives to pre-cool strawberries within one hour of harvest, reducing the core temperature to 4 – 6 ℃ and extending shelf life to 7 – 10 d. Second, long-term agreements should be signed with logistics providers like SF Cold Chain and JD Cold Chain for trunk transportation. Using constant-temperature refrigerated trucks equipped with temperature data loggers allows for real-time monitoring and ensures temperature fluctuations remain within ± 2 ℃. Finally, for last-mile delivery, the alliance should establish "cold chain pickup points" at community stations

and convenience stores, equipped with refrigerators. Consumers should receive products packaged with "ice packs + foam boxes + insulated bags" to minimize final-kilometer loss, aiming to keep the total cold chain loss rate for strawberries below 10%[10].

3.1.2 Construction of standardized production and quality traceability system. The establishment of a standardized production and quality traceability system is essential for ensuring the compliant sale of E-commerce strawberries and strengthening consumer trust. This requires full-process control from production to consumption. Guided by the industrial alliance, the Agricultural Technology Extension Center should formulate *Standardized Production Regulations for Strawberry E-commerce*, specifying requirements for seedling cultivation (*e.g.*, virus-free varieties such as Ningyu and Miaoxiang No.7), field management (drip irrigation; organic fertilizer application ≥30 000 kg/ha), and harvesting and grading. Based on fruit diameter, strawberries should be classified into three grades: Super (≥35 mm), Grade I (30 – 35 mm), and Grade II (25 – 30 mm). This grading system aligns with market demands by accounting for commercial value, taste, and storage/transportation requirements. Cooperative members should receive training twice a month, and only those who pass the assessment are permitted to engage in production. Furthermore, a blockchain-based quality traceability system should be implemented. Each batch of strawberries is assigned a unique traceability code, allowing consumers to scan and access information such as grower details, fertilization and pesticide records, and pesticide residue test reports (with weekly third-party sampling to ensure compliance with the *Law on Quality and Safety of Agricultural Products*). Logistics tracking is also included. The alliance can monitor production and circulation data in real time through the system backend, applying a "local retention + accountability" mechanism for any substandard batches. This ensures that 100% of strawberries reaching the market meet food safety standards[11].

3.4 Strengthening brand building and increasing product added value

3.4.1 Coordinated development of regional public brand and enterprise brand. The coordinated development of regional public brands and enterprise-specific brands is essential for the strawberry industry to overcome homogeneous competition and establish a strong brand matrix. This can be achieved through a "government-led public brand, cooperatively cultivated enterprise brand" linkage model. Local governments, in collaboration with industrial alliances, should take the lead in establishing regional public brands. This includes registering geographical indication certification marks such as "XX Strawberry", formulating brand usage standards that comply with requirements for standardized production, qualified pesticide residue testing, and a unified visual identity system (including logos and packaging templates). Additionally, special funds should be allocated to promote the public brand through methods such as advertising on high-speed rail and highway billboards and participation in national agricultural product expos, thereby enhancing regional brand awareness. Meanwhile, cooperatives should develop their own enterprise brands under the umbrella of the public brand. For example, a cooperative may create a sub-brand like "Good Strawberry Farm", emphasizing a differentiated positioning such as "organic cultivation". By highlighting organic certification and showcasing real-time growing processes on E-commerce product pages, a synergistic effect can be formed: "regional public brand endorsement + enterprise brand differentiation". This approach helps avoid homogeneity that may result from relying solely on the public brand.

3.4.2 Promoting and maintaining brand value. Promotion and maintenance of brand value requires a dual focus on "value mining" and "risk prevention and control", ensuring that the strawberry brand premium is consistently translated into industrial revenue and farmer income. An industry alliance should lead this effort by deepening brand value extension. Firstly, partnering with deep-processing enterprises to develop a matrix of strawberry derivatives, such as converting standard fresh fruit into strawberry wine and freeze-dried crisps, can be effective. These items, marketed on E-commerce platforms as "exclusive branded derivatives" and bundled with fresh fruit in "strawberry full-category gift boxes", can increase product added value by over 30%. Secondly, aligning with national initiatives like the "Healthy China" strategy, the alliance can collaborate with the CDC to publish research reports highlighting strawberries' dietary fiber and vitamin C content. This supports the creation of targeted "functional strawberry packages" for fitness enthusiasts and mother-child groups, enabling precision marketing to raise customer unit value. In terms of brand protection, the alliance must establish an "online-offline linkage supervision" mechanism. Online, monthly investigations should be conducted on E-commerce platforms to identify infringing stores, with immediate complaints filed against misuse of brand logos or false advertising. Offline, designated personnel should perform random inspections in wholesale markets and supermarkets, holding merchants accountable for unauthorized brand use. In addition, a brand protection hotline can encourage consumers to participate in supervision, safeguarding the brand image from damage.

4 Safeguard measures for the industrialization of strawberry industry "cooperatives + E-commerce" to achieve optimal operation

4.1 Comprehensive benefit evaluation and construction of operation path To ensure that the "cooperative + E-commerce" model for the strawberry industry aligns with local high-quality economic development goals, it is essential to establish a multi-dimensional and dynamic comprehensive benefit evaluation system. This system serves to prevent path deviation and resource misallocation. Quantitative indicators should be established across three core dimensions: economy, society, and ecology. The economic dimension must incorporate key indicators such as the proportion of sales generated through cooperative E-commerce, the growth rate of the strawberry industry's value-added, and the average household income increase. Annual evaluation benchmarks can be set with ref-

erence to broader national trends; for instance, in 2024, China's online retail sales in rural areas grew by 6.4% year-on-year, with online sales of agricultural products seeing a significant increase of 15.8%. The social dimension should focus on monitoring metrics like the return rate of rural labor and the number of new E-commerce jobs created, with particular attention to the participation of low-income farmers. The ecological dimension needs to prioritize the reduction rate of pesticide and fertilizer usage and the carbon emission intensity of cold chain logistics, aligning with national "Dual Carbon" policy goals. The evaluation should be conducted quarterly. Local agricultural and rural departments can collaborate to collect data by reviewing cooperative accounts, conducting farmer interviews, and integrating data from E-commerce platforms. The resulting assessment report should be made public, and for underperforming areas, such as cooperatives with excessively high cold chain loss rates, specific rectification plans must be formulated and implemented to ensure continuous path optimization[12].

4.2 Improving policy guarantee and strengthening government support Policy support should be closely aligned with the principle of "targeted empowerment" and integrated with the *Implementation Opinions on Promoting High-Quality Development of Rural E-commerce* issued by nine departments including the Ministry of Commerce in 2024. A comprehensive support system encompassing "fiscal + financial + talent" measures should be established. At the fiscal level, local governments should allocate special funds for the strawberry industry, providing 30% to 50% subsidies to cooperatives for building standardized planting bases and purchasing cold chain equipment. Additional operational subsidies should be granted to cooperatives engaged in E-commerce livestreaming and brand registration. At the financial level, United Bank should introduce a "Strawberry E-commerce Loan" to streamline the loan application process for cooperatives, offering interest rates 1 – 2 percentage points below market level. A risk compensation mechanism should also be established to alleviate lending concerns among financial institutions. At the talent level, the "E-commerce Talent Return Program" should be implemented to provide housing subsidies and entrepreneurial support funds to college graduates and veterans who return to their hometowns to engage in strawberry E-commerce operations. In collaboration with vocational colleges, a "Strawberry E-commerce Training Camp" should be set up to offer quarterly practical training covering platform operation, livestreaming skills, after-sales management, and more, thereby addressing the bottleneck of talent shortages.

4.3 Strengthening supervision Supervision should be conducted in accordance with the *E-Commerce Law*, and a multi-tiered supervision system of "government oversight + platform coordination + cooperative self-discipline" should be established to ensure the compliance and orderliness of strawberry E-commerce transactions. At the government supervision level, market regulatory departments should establish a mechanism for "pre-sampling + in-process monitoring + post-traceability" for strawberry E-commerce products. Sampling and testing of pesticide residues, sweetness, and other indicators should be conducted in advance for strawberries to be sold by cooperatives, allowing them to be listed only after passing the tests. During the process, big data should be used to monitor strawberry sales data on E-commerce platforms, providing timely warnings for abnormal pricing and fake reviews. Afterwards, with the aid of a quality traceability system, responsibility for problematic products reported by consumers can be quickly identified and penalized according to the law[13]. At the platform coordination level, E-commerce platforms should be urged to fulfill their primary responsibilities by conducting qualification reviews of strawberry cooperatives, requiring them to disclose business licenses and inspection reports, and taking measures such as delisting products or shutting down stores for violations. At the cooperative self-discipline level, the establishment of strawberry E-commerce industry associations should be encouraged to develop industry standards, regulate packaging labels and after-sales service criteria, and conduct regular self-discipline inspections. This will help foster a regulatory environment where "violations are investigated and penalized", thereby maintaining order in the strawberry E-commerce market.

5 Conclusions and future prospects

To sum up, under the goal of promoting high-quality local economic development, the core value of the "cooperative + E-commerce" model for the strawberry industry lies in its ability to address key industry challenges through organizational collaboration and channel empowerment. Specifically, the standardized development of cooperatives and the establishment of industrial alliances have resolved the issue of fragmented and weak small-scale production. A multi-channel E-commerce strategy coupled with brand building has expanded market reach, while upgrades in cold chain logistics and quality traceability systems have ensured product quality stability. Supported by benefit evaluation mechanisms, policy measures, and the *E-Commerce Law*, these elements together form a complete industrial pathway covering "production-circulation-sales-guarantee". This pathway not only enhances the value-added potential of the strawberry industry and raises the average income of farmers, but also boosts local employment and tax revenue through industrial clustering effects, offering a replicable development model for the high-quality growth of local economies characterized by distinctive industries.

Looking forward, the strawberry industry's "cooperative + E-commerce" model should further align with the trends of the digital and green economies. On the one hand, big data can be utilized to analyze consumer preferences, guiding cooperatives in variety improvement and precision planting, such as developing functional strawberry varieties with low sugar and high anthocyanin content. On the other hand, in line with the "dual carbon" goals, cooperatives should be encouraged to adopt green cultivation techniques and recyclable packaging, and create a "low-carbon strawberry" label via E-commerce platforms to meet the environmental expectations of the new generation of consumers. In addition, it is

essential to deepen collaboration with cross-border E-commerce platforms, drawing on mature domestic operational experience to overcome international market access standards and logistical barriers. This will enable the local strawberry industry to transition from a "regionally distinctive" product to one capable of "global competition," injecting more sustainable momentum into the high-quality development of the local economy.

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5.2 Safeguarding measures

5.2.1 Policy guarantee. It is necessary to formulate policy documents to support the innovation of governance mechanism of agricultural production organizations, clarify the direction of innovation and support measures, strengthen policy publicity and implementation, and ensure that policy dividends benefit agricultural production organizations.

5.2.2 Fund guarantee. It is necessary to increase government financial subsidies, set up special funds for agricultural development, guide financial institutions to innovate financial products, reduce financing thresholds and costs, and encourage social capital to participate in the development of agricultural production organizations.

5.2.3 Land use guarantee. We should improve the farmland circulation market, standardize the circulation procedures, ensure the land demand of agricultural production organizations, and appropriately expand the scale of agricultural facilities on the premise of conforming to the planning.

5.2.4 Talent guarantee. It is necessary to establish talent introduction and cultivation mechanism, attract agricultural professional and technical personnel and management personnel, strengthen the training of members of the organization, and improve their skills and comprehensive quality.

6 Conclusions

(i) Large-scale farmland circulation has facilitated the evolution of governance mechanisms in agricultural production organizations, leading to a trend toward democratized decision-making and standardized management. However, the pace of this evolution varies across different types of organizations. (ii) The performance of current governance mechanisms in agricultural production organizations is uneven. Some organizations still require improvement in terms of production efficiency and economic outcomes. (iii) Factors such as policy, technology, capital, and human resources significantly influence the effectiveness and innovation of governance mechanisms.

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