# Research on the High-quality Development of Chinese Agriculture Enabled by New Quality Productivity

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**Abstract:** The new quality of productive forces is an urgent need and a key focus for promoting the high-quality development of China's agriculture. Currently, China's agricultural high-quality development faces challenges such as the urgent need to break through key technologies, a shortage of agricultural talent, outdated agricultural production methods, and an imperfect agricultural system and mechanism. To address these issues, the path for empowering the high-quality development of Chinese agriculture with new quality of productive forces should include: using modern agricultural technology innovation to enhance arable land quality and further ensure food security; accelerating the development of agricultural science and technology innovation to improve the efficiency of the agricultural industry; promoting the deep integration of agriculture and the digital industry to enhance the resilience of the industrial and supply chains; improving the quality of agricultural talent by building a multi-level and diversified talent pool; optimizing the construction of agricultural development systems and mechanisms to promote a virtuous cycle of scientific and technological innovation and optimize market resource allocation.

## 1. Introduction

The new quality productive forces are characterized by innovation as the leading force, breaking away from traditional economic growth models and productivity development paths. These forces are marked by high technology, efficiency, and quality, aligning with the new development philosophy. Driven by these new quality productive forces, production capacity and resource allocation have become more efficient, industrial structures more optimized and rational, and industrial systems more complete, all of which contribute to high-quality economic development. Moreover, high-quality development provides a favorable environment for scientific and technological innovation, a high-caliber talent pool, and a solid foundation in both software and hardware, which helps the rapid formation and development of new quality productive forces [1].

High-quality agricultural development is a key task in achieving Chinese-style modernization. The high-quality development of agriculture aims to meet the people's needs for a high-quality life through high-quality agricultural products and high-level agricultural services. This involves enhancing the quality and value of agricultural products and services, driven by the upgrading of public demand levels. To achieve this high-quality development, it is essential to accelerate technological innovation, which can boost productivity, accelerate the flow of agricultural data, and optimize the allocation of agricultural production factors, thereby improving the quality and efficiency of agricultural production. The intrinsic requirement for high-quality agricultural development is coordinated development, which means promoting the coordination between agricultural product production and consumption, the coordination between the quantity and quality of agricultural products, and the coordination between agricultural development and industrialization, digitalization, and urbanization. The inevitable path to high-quality agricultural development is green, low-carbon, and sustainable development, which involves producing high-

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quality, healthy, and safe green agricultural products. The inevitable trend in high-quality agricultural development is integrating data elements with agriculture to connect the agricultural industry chain and supply chain, and optimizing the allocation of agricultural resources. Whether technological innovation can serve as the primary driving force is a decisive factor in achieving high-quality agricultural development. The new wave of technological revolution and industrial innovation has spurred new qualitative productivity in agriculture, and agricultural technological innovation is the core and important driving force behind transforming traditional agricultural production and management methods into modern advanced ones.

The formation of new agricultural productivity is closely linked to the high-quality development of agriculture, jointly driving the process of sustainable agricultural development. This process begins with the integration of key elements, including modern agricultural technology, efficient farming tools, high-quality seeds and fertilizers, and sustainable water resource management, which form the solid foundation of agricultural production. Through scientific management and organizational methods, efficient production processes can be established, optimizing the allocation and utilization of resources. Innovation plays a central role in this process, with talent and education forming the solid foundation of innovation. Technological innovation, management innovation, and institutional innovation collectively enhance agricultural productivity, while government policies and market mechanisms provide support and guarantees for the development of new agricultural productivity. The emergence of new quality productivity in agriculture, driven by innovation, has significantly enhanced production efficiency, product quality, and the sustainability of agricultural development. By leveraging information and intelligent technologies, agricultural management and decision-making capabilities have been strengthened, with a focus on sustainable resource use and ecological protection, thereby boosting the economic and social benefits of agriculture. These factors collectively form a solid foundation for new quality productivity in agriculture, promoting high-quality agricultural development across multiple key areas.

## 2. Mechanism of New Quality Productivity to Empower High-quality Agricultural Development

### 2.1. Modern Agricultural Technology Innovation Promotes the Improvement of Agricultural Quality and Efficiency

Advanced biotechnology and digital technology have led to the development of plant and animal seed embryos with superior genetic traits. These embryos can adapt to harsher climates and ensure high yields, thereby enhancing both the quantity and quality of agricultural products. Intelligent agricultural machinery has replaced traditional labor, adapting to various geographical conditions and significantly boosting agricultural productivity. The widespread adoption of digital technology and bio-fertilizers has improved the precision of land use, water management, and fertilization, not only increasing the efficiency of agricultural resource utilization but also reducing pollution of soil, water resources, and the environment, thus enhancing the quality and competitiveness of agricultural production. Advances in biotechnology have facilitated the harmless and organic treatment of agricultural waste, enabling the recycling and reuse of waste materials, and promoting a new ecological model of agricultural resource conservation and recycling.

### 2.2. Smooth the Flow of Data Elements and Optimize the Allocation of Agricultural Production Factors

As big data, artificial intelligence, and other data-centric technologies increasingly integrate into various aspects of agricultural production, management, and marketing, the role of data in agricultural production has become increasingly significant [2]. The circulation of data across different industrial segments and sectors has formed an integrated agricultural big data information network, making it easier for resources such as land and capital to flow into new agricultural business entities like farmers' cooperatives, family farms, and leading enterprises. This helps to coordinate agricultural resources, streamline information flow, reduce costs, and enhance the

efficiency of the entire industrial and supply chains. Data elements help establish efficient and orderly market transactions, enabling agricultural business entities to better understand market dynamics. Additionally, data elements facilitate the integration of agriculture with other industries, enabling full-process visual management from farm to table, increasing supply chain transparency, meeting personalized consumer needs, enhancing competitiveness and customer satisfaction, and driving industrial structure upgrades.

### 2.3. Optimize the agricultural industrial structure and promote the upgrading of the whole agricultural industry chain

The innovative application of biotechnology, engineering technology, and intelligent technology has further expanded the spatiotemporal boundaries of agricultural production. New production methods, such as plant factories, vertical farms, and three-dimensional farming, have transformed the traditional reliance on natural resources in agriculture. Plant cultivation is no longer constrained by soil, sunlight, or seasonal changes; through intelligent regulation, precise management of multiple crop growth stages can be achieved, and soilless cultivation ensures food safety and environmental protection [3]. Technological innovations, such as desalination and soil formation from sand, have turned deserts, wastelands, and saline-alkali lands into valuable agricultural resources. Scientific and technological advancements have facilitated the three-dimensional utilization of marine space, combining surface aquaculture with artificial reef enhancement in deeper waters to create a 'blue granary.' E-commerce has not only transformed the way agricultural products are sold but also promoted the standardization and branding of agricultural production and sales. The application of digital technology has integrated the entire agricultural industry chain, from planting, processing, preservation, storage, and sales to services, enhancing the mechanism for connecting farmers and promoting the coordinated development of primary, secondary, and tertiary industries.

## 3. The dilemma of new quality productivity enabling high-quality agricultural development

### 3.1. Poor natural resource endowment, extensive use of resources and increasing pressure on resources

China's basic national condition is a large population with limited arable land, where the per capita arable land area is below the global average. The fertility of China's arable land is relatively low, and the organic matter content in the soil is lower than the global average. The spatial distribution of water resources and arable land resources in China is mismatched, and the process of increasing arable land in the north and decreasing it in the south has increased the pressure on northern water resources [4].

### 3.2. Insufficient Scientific and Technological Innovation Ability and Low Transformation Rate of Achievements

The original innovation capabilities in cutting-edge and emerging interdisciplinary fields of agricultural science and technology are insufficient, particularly in key areas such as synthetic biology, genomics, bioinformatics, agricultural machinery, smart agriculture, and green agriculture, where the ability to independently control core technologies is weak. Additionally, the industry-university-research system in the agricultural sector is not well integrated, leading to limited promotion and application of agricultural technologies and a low rate of technology transfer.

### 3.3. Shortage of Agricultural Talents and Insufficient Incentive Mechanism for Agricultural Talents

Overall, there is a shortage of agricultural talent in our country, with the number of agricultural professionals educated in higher education falling short of market demand. Due to limited career opportunities and low wages in agriculture, most graduates do not pursue careers in their field, leading to a brain drain. Universities' curriculum design and training systems for agricultural talent are not aligned with current industry needs, making it difficult for graduates to meet the demands of

agricultural production. The uneven economic development across regions exacerbates the brain drain in remote areas. Due to systemic issues, rural grassroots units do not place enough emphasis on rural talent, and the benefits and preferential policies for agricultural professionals are insufficient, lacking financial support and offering low compensation, which results in a lack of enthusiasm for innovation among agricultural professionals.

### 3.4. The agricultural product supply chain system is not perfect

Currently, small-scale and decentralized agricultural production methods still dominate in China, with over 90% of small farmers operating independently. The level of agricultural mechanization, scale, and intensification is low. Our country's agricultural production technology is outdated, and the rate of mechanization is low, leading to low production efficiency. The quality standards for agricultural products and brand building are lagging, and market competitiveness is weak. Our country's agricultural industry chain is relatively short, focusing mainly on planting, breeding, and preliminary processing. There is insufficient development in scientific breeding, deep processing, product sales, and brand management, resulting in low added value of agricultural products, which fails to meet market demands. Currently, China's agricultural market is primarily based on a multi-level sales model, which leads to disconnect between production and consumption. The coverage and circulation rate of cold chain logistics in China are low, making it difficult to ensure the quality of agricultural products. Information flow within the agricultural supply chain is poor, leading to instability in agricultural production, ultimately resulting in resource waste or price fluctuations. Additionally, China's rural credit system is underdeveloped, making it challenging for industries to secure financing loans.

### 3.5. The Regulatory Mechanism Guided by the Government and Led by the Market is not yet Sound

The development of the agricultural factor market system in our country is relatively lagging, with insufficient awareness of intellectual property protection and an underdeveloped market access mechanism. In the process of rural land transfer and trading, the relevant laws, regulations, and regulatory mechanisms are not yet robust, affecting the transparency and fairness of land transactions. Additionally, the management systems for technology transfer, technology trading, and technical services in rural areas are not well-established, hindering the promotion of agricultural science and technology innovation and application. Furthermore, the development of the data market in rural areas is also lagging, with inadequate norms and supervision for data collection, processing, and trading, which prevents the full realization of the potential value of rural data resources. Moreover, due to the lack of a comprehensive property rights relationship and protection system in rural production organizations, the autonomous and orderly flow and optimal allocation of agricultural production factors are affected.

## 4. Practical Paths for New Quality Productivity to Empower High-quality Agricultural Development

### 4.1. Strengthen the Trinity Protection of Cultivated Land Quantity, Quality and Ecology to Ensure Food Security

Maintaining the quantity of arable land and safeguarding the arable land red line is fundamental to ensuring national food security. We must protect black soil, manage saline-alkali land, enhance soil improvement, fertility enhancement, and restoration, and carry out comprehensive management and transformation to ensure every inch of arable land becomes fertile for a bountiful harvest. We should build high-standard farmland to comprehensively enhance the quality and production capacity of farmland. We must enhance the management of agricultural land conditions and production processes. By utilizing remote sensing, drones, and the agricultural Internet of Things (IoT), we can develop an intelligent monitoring platform for farmland irrigation, which will enable real-time monitoring of crop water needs and precise irrigation. Promoting the use of water-saving

irrigation techniques, such as sprinkler and drip irrigation, can reduce soil erosion, improve the growing environment for crops, effectively reduce water waste in agriculture, and enhance the efficiency of land use.

### 4.2. Innovate Agricultural Production Methods to Promote Green and Sustainable Development of the Industry

We need to develop green pest and disease control technologies to protect the ecological environment. We should use biotechnology, genetic engineering, and physical methods such as photonic, microwave, and radiation techniques to manage agricultural pests and diseases. We will establish automated and intelligent field monitoring networks to build a pest and disease monitoring and early warning system. By improving crop varieties, we aim to cultivate disease-resistant and pest-resistant superior varieties, thereby fundamentally reducing the occurrence of pests and diseases. While ensuring the yield and quality of crops, we will effectively reduce the use of chemical fertilizers in farmland, promoting the green and sustainable development of agriculture.

### 4.3. Improve the Quality of Agricultural Talents

Our country aims to establish a long-term mechanism for the cultivation and incentives of agricultural talent, fostering a favorable environment for innovation. We will enhance scientific and technological cooperation with top agricultural universities and research institutions both domestically and internationally, increase the cultivation and incentives for high-end talent in the agricultural sector, ensure researchers have excellent conditions for scientific research and innovation, and support breakthroughs in key areas such as breeding, bioengineering, and intelligent agricultural equipment. Our country needs to enhance higher education and technical training to address the shortage of high-quality agricultural labor. We should rely on agricultural universities and vocational education institutions, guided by the practical needs of agricultural production, to optimize course offerings and introduce important training content such as digital agriculture and agricultural production, thereby enhancing the practical skills of agricultural students. By utilizing the agricultural technology extension system, commercial enterprise training services, and lectures by university researchers, we can provide training in digital technology, intelligent applications, and agricultural techniques to small farmers, thus improving their agricultural production capabilities. Our country should also work with local governments to regularly conduct training sessions on digital management and operations for rural grassroots officials and new agricultural business entities, rapidly enhancing their production and management skills.

### 4.4. Optimize the construction of agricultural development systems and mechanisms to promote a virtuous cycle of scientific and technological innovation

Our country needs to further enhance the government's role in macro-guidance and improve the foundational systems for agricultural science and technology innovation. By establishing special funds, offering preferential policies, and enhancing mechanisms for scientific research and innovation, we should organize major research projects to accelerate agricultural innovation. We need to refine the land circulation mechanism, guiding land resources to new agricultural business entities in a fair and transparent manner, promoting diversified development models such as' new agricultural business entities + secondary industry 'and' new agricultural business entities + tertiary industry.' We should also formulate supportive policies to attract market financial capital, leveraging the capital aggregation effect to foster new agricultural business entities. By leveraging digital technology, we should improve the standards system for agricultural products, establishing a comprehensive quality and safety traceability system that covers raw material procurement, production processing, storage and logistics, and terminal sales, driving agricultural production towards higher-end development. Our country aims to enhance the connectivity between industry, academia, research, and application, ensuring smooth communication channels among stakeholders in the agricultural sector, including research institutes, universities, enterprises, and agricultural operators. We will promote a scientific research innovation mechanism that is guided by the actual needs of the agricultural industry, ensuring the effective implementation of scientific and

technological achievements and addressing major and critical issues in the development of the agricultural industry.

## 5. Conclusion

Different from extensive, inefficient and unsustainable traditional agriculture, the new quality productivity of agriculture with scientific and technological innovation as the core element will promote the quality and efficiency of agricultural industry by technological leap, optimize the allocation of key agricultural factors by upgrading factors, and promote the upgrading of the whole agricultural industry chain by industrial innovation, thus further promoting the high-quality development of China's agriculture. The development of agricultural new quality productivity should be driven by original, disruptive, and integrative technological innovations in agriculture, aimed at enhancing the overall quality of agricultural practitioners, improving the efficiency of land, labour, capital, and technology, innovating agricultural production organization models, optimizing the allocation of the agricultural industrial structure, and promoting high-quality agricultural development.

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