

Research on the International Competitiveness of Chinese Agriculture from the Perspective of Low-Carbon Economy

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Abstract. As global climate change worsens, the traditional economic development model of prioritizing pollution and addressing it retrospectively can no longer meet the demands of modern society. In this context, the concept of a low-carbon economy has emerged and gained unanimous global respect as a development direction. Drawing upon Porter's Diamond Theory, this study examines the factors influencing China's agricultural competitiveness from a low-carbon economy perspective. It puts forward a series of strategic measures, including optimizing the production elements of low-carbon agriculture, fostering low-carbon awareness, devising a low-carbon agricultural development strategy, seizing opportunities presented by the low-carbon economy, and reinforcing policy support. The study aims to explore how to drive China's agriculture towards a low-carbon future amidst dwindling resources and escalating environmental pressures. This pursuit is aimed at achieving success in international low-carbon market competition while ensuring sustainability. These measures will facilitate China's agriculture in better adapting to the low-carbon economic development trend, ultimately resulting in a win-win scenario for both environmental conservation and economic prosperity.

Keywords: Low-carbon economy; Porter's diamond theory; Low-carbon agriculture.

1. Introduction

The exacerbation of global climate change is a direct consequence of humanity's industrialization, rendering the traditional economic model of 'pollution first, remediation later' inadequate for the contemporary needs of modern society. In this context, a global consensus has gradually emerged, advocating the concept of a 'low-carbon economy' as the future development direction. Countries worldwide have invested substantial financial resources and human capital into advancing clean energy technologies and researching energy-efficient materials. China, characterized by its vast expanse, large population, and rapidly accelerating industrialization, unequivocally ranks among the major contributors to high carbon emissions.

Nevertheless, despite the persistent promotion of low-carbon lifestyles, tangible improvements in actual carbon emissions remain elusive. Challenges persist in various facets, encompassing residential carbon emissions, automobile acquisition patterns, single-use shopping bags, and household waste management. These issues covertly impede the establishment of China's low-carbon economic paradigm. Among the myriad affected industries, agriculture occupies a prominent position with regards to high carbon emissions. As the foundational sector of China's national economy, agriculture must embark on a path of sustainable development in the low-carbon era and secure a competitive edge in the international low-carbon market. To attain this objective, agriculture must align with contemporary trends and cultivate market standards that prioritize low pollution, low energy consumption, and low emissions, thereby fostering low-carbon competitiveness and achieving a dual benefit of environmental conservation and economic prosperity.

As the concept of the low-carbon economy progressively permeates society, the evaluation of agricultural international competitiveness from a low-carbon perspective has emerged as a pivotal subject within academic discourse. In the 'post-Copenhagen era,' industrial competitiveness will be increasingly influenced by the dynamics of low-carbon markets and low-carbon competition. Consequently, this paper employs the 'Porter's Diamond Model' from standard competition theory to

comprehensively analyze China's agricultural international competitiveness through the lens of a low-carbon economy. This study endeavors to address the challenges posed by depleting resources and mounting environmental pressures, explore the developmental trajectory of China's agricultural decarbonization, and seek innovative and efficient strategies for the advancement of low-carbon agriculture, ensuring a robust and sustainable path toward agricultural decarbonization in China.

2. International Competitiveness of Chinese Agriculture from a Low-Carbon Economy Perspective

2.1. Production Factors of Low-Carbon Agriculture

Low-carbon agriculture encompasses primary and advanced factors that constitute its production elements. In terms of primary factors, China boasts an extensive total land area, yet the available arable land for cultivation is comparatively limited. The rapid urbanization witnessed in recent years has precipitated land losses and irreversible transformations in land usage, becoming a principal driver behind the diminishing resources of arable land. Concurrently, challenges emerge as land erosion and desertification curtail suitable areas for low-carbon agricultural practices, accounting for a mere 7% of the nation's arable land. Another challenge arises in land quality, with nearly half of the land situated in regions experiencing annual precipitation levels below 800 millimeters. China's average land quality rating is a modest 4.76, with a mere 31% categorized within the top three grades, leaving over two-thirds designated as medium to low-yielding. Despite systematic agricultural advancements spearheaded by new farmers and bolstered by contemporary science, technology, and equipment, overall competitiveness remains comparatively weak.

In contrast, advanced elements reveal that China's agricultural infrastructure lags due to inadequate investments, resulting in outdated facilities ill-suited to support agricultural production, particularly in the context of low-carbon practices. Low-carbon agricultural technologies are also underdeveloped, encompassing limited agricultural mechanization, energy-efficient emission reduction techniques, and industrialization technologies. Notably, China records a lower rate of conversion for agricultural scientific and technological achievements, with only 30% to 40% applied in practice annually, a stark contrast to developed nations achieving conversion rates of 70% to 80%. Furthermore, a significant segment of China's agricultural workforce exhibits lower cultural qualifications: 20% are illiterate, 40% have completed only primary education, 29.5% have attained junior high school education, and merely 0.4% hold a college degree or higher. In comparison, some developed countries boast well-established research, education, and extension systems, fostering favorable conditions for the growth of organic farming. Thus, China's imperative lies in expediting the reform of its agricultural research and education system and establishing a research and dissemination system tailored to low-carbon agricultural technologies compatible with its unique conditions.

2.2. Demand for Low-Carbon Agricultural Products

Amidst the global progression of the low-carbon concept, the burgeoning demand for environmentally-friendly products devoid of harm to the environment or human health becomes apparent. Domestically, consumers exhibit a steady inclination toward green agricultural products, accompanied by a mounting desire for high-quality agricultural produce. Simultaneously, consumers in developed nations increasingly covet green agricultural products, culminating in green barriers centered around ecological and food safety considerations, which now constitute the principal non-tariff obstacles to China's agricultural trade. Green trade barriers encompass measures adopted by nations to restrict trade, either directly or indirectly, for environmental protection purposes. These obstacles, while obstructing China's general agricultural exports, concurrently open new avenues for the development of low-carbon agricultural products. However, China's current standing in low-carbon agricultural product exports reflects a relatively subdued competitive edge, with a market share lingering below the 1% threshold. Consequently, China necessitates further enhancing the

competitiveness of low-carbon agricultural products to meet the demand for green agricultural produce across domestic and international markets.

2.3. Related and Supporting Industries for Low-Carbon Agriculture

Issues pervade China's rural agricultural infrastructure, featuring pervasive inadequacies in agricultural mechanization, technological sophistication, and independent research and development capabilities. This state of affairs is compounded by a low rate of conversion for agricultural scientific and technological achievements, coupled with a workforce possessing modest cultural qualifications. Furthermore, a dearth of agricultural technology talent, alongside an aging demographic structure, poses constraints on the evolution of low-carbon agriculture. Conversely, developed countries tout well-structured research, education, and extension systems, underscored by advanced equipment, collectively cultivating an environment conducive to the development of modern ecological agriculture. Thus, China must address these challenges by bolstering its agricultural research and education system and establishing a low-carbon agricultural technology research and extension mechanism tailored to its distinctive conditions.

2.4. Enterprise Business Strategies

Enterprises, serving as the linchpin of agricultural production, wield substantial influence over the trajectory of low-carbon agriculture. China's agricultural landscape has witnessed a transition from decentralized rural operations to rural cooperatives, joint-stock cooperatives, and individual private enterprises, with nascent entities embracing low-carbon operational paradigms emerging on the scene. The presence of these novel low-carbon agricultural production entities promises to significantly invigorate the competitive standing of low-carbon agriculture. Nevertheless, the majority of enterprises, hampered by constrained economic returns in agricultural production, struggle to establish enduring partnerships with agriculture, resulting in a dearth of large-scale agricultural enterprises capable of contending with international agricultural brands in the global agricultural product arena. Thus, China must intensify its efforts to incentivize and support the development of new low-carbon agricultural business entities while concurrently fostering deep-seated cooperation between enterprises and farmers to enhance production efficiency and product quality.

2.5. Development Opportunities for Low-Carbon Agriculture

In the current global milieu characterized by the ascendancy of the low-carbon zeitgeist, China's low-carbon agriculture stands at the confluence of manifold opportunities. Firstly, there exists an escalating demand for green products, closely intertwined with the deepening low-carbon ethos and societal emphasis on environmental preservation and health. As the criteria for product selection increasingly encompass factors such as ecological integrity, environmental protection, energy conservation, resource management, and safety, the demand for low-carbon agricultural products is poised for continuous ascension. Secondly, the imposition of new green trade barriers by certain nations in pursuit of safeguarding their industries and environment, while challenging general agricultural exports, concurrently unfurls novel prospects for the export of low-carbon agricultural products. Furthermore, China's domestic market is in a state of ascendant demand, driven by economic expansion and heightened living standards, fomenting an ever-swelling desire for high-caliber, ecologically-responsible, and secure agricultural commodities. Lastly, as enterprises pivot their production paradigms towards prioritizing product quality and environmental conscientiousness, the production and dissemination of low-carbon agricultural products will experience gains. These emergent opportunities collectively furnish an auspicious backdrop for the advancement and deepening of low-carbon agriculture in China, promoting the maturation of innovative technologies and practices, augmenting product competitiveness, and expediting the sustainable evolution of low-carbon agriculture.

2.6. Policies Facilitating Low-Carbon Agriculture Development

In the pursuit of advancing low-carbon agriculture, China has formulated an array of ecological agriculture development policies, underscored by the establishment of a three-tiered national, provincial, and pilot county ecological agriculture management and promotion framework. This comprehensive policy structure confers essential support and safeguards to the realm of low-carbon agriculture. Nevertheless, when juxtaposed with developed nations, China remains poised at a juncture where further strides are necessary in the course of industrialization and development, notably in areas concerning legislative and regulatory frameworks, quality standards, law enforcement capabilities, and ancillary aspects

3. Countermeasures for Enhancing China's Agricultural International Competitiveness

3.1. Optimization of Low-Carbon Agricultural Production Factors

China's agriculture generates a significant amount of greenhouse gas emissions, posing immense pressure on the global environment. However, agriculture also has the potential to become a carbon sink. Therefore, the following measures should be adopted to optimize the factors of low-carbon agricultural production: To address ecological degradation, advanced and practical land optimization and transformation technologies should be gradually employed to reduce greenhouse gas emissions from arable land. This process should gradually transform arable land into high-yield and stable farmland to mitigate land resource loss. Implementation of arable land optimization and transformation techniques can help lower greenhouse gas emissions while increasing farm yields and stability, thereby combating land resource loss and ecological degradation. There should be a significant effort to cultivate various knowledge-based professionals essential for the development of low-carbon agriculture. This includes technical experts in low-carbon agricultural production, leaders in low-carbon agricultural technology innovation, and professionals in low-carbon agricultural product production, management, organization, and marketing. Emphasis should be placed on strengthening the optimization of support systems related to low-carbon agricultural development, such as environmental monitoring and quality testing systems. These improved support systems will effectively monitor and ensure the quality and smooth implementation of low-carbon agricultural production, including seeds, fertilizers, and process technologies required for low-carbon agricultural production. These measures aim to enhance agricultural production efficiency and resource utilization efficiency, thereby strengthening the international competitiveness of low-carbon agriculture.

3.2. Cultivation of Low-Carbon Awareness

From an international market perspective, there has been a rapid increase in demand for low-carbon products, particularly green food, in developed countries in recent years. However, many Chinese agricultural products fail to meet the stringent standards set by these developed countries, leading to rejection and trade barriers. To effectively address these barriers, there is an urgent need to promote low-carbon agricultural production: Stringent adherence to international standards and specific standards of several developed countries throughout the entire production-to-consumption process, including comprehensive monitoring, inspection, testing, and certification procedures, is essential to facilitate the entry of Chinese low-carbon agricultural products into international markets. On the domestic market front, awareness of low-carbon practices and green consumption concepts is steadily growing, resulting in a rapid increase in demand for green food. However, the market is inundated with substandard products masquerading as green food, severely undermining consumer confidence in genuine high-quality green food. Therefore, it is imperative to cultivate domestic low-carbon awareness. Agricultural product producers should be subject to strict supervision and management, and products sold within the country should undergo comprehensive monitoring, inspection, testing, and certification. Consumers should be encouraged to make scientifically

informed decisions when choosing low-carbon products, avoiding blind consumerism. Strengthening social discourse and guidance on the consumption of low-carbon agricultural products through various media campaigns is also essential.

3.3. Development of Low-Carbon Agricultural Strategies

In the era of the low-carbon economy, agricultural development should revolve around the "carbon structure" of the industry. Consideration must be given to the impact of the low-carbon economy on agriculture and the carbon structure of its competitiveness when formulating strategic objectives for agricultural management. China has made some progress in the construction of low-carbon agricultural bases and the development of ecological agricultural industry clusters: In the coming period, the competitiveness of Chinese agriculture will be directly influenced by the degree and level of the low-carbon structure. The low-carbon economy will present unprecedented challenges to China's existing agricultural development model. Timely adjustment of agricultural structure and competitiveness around the low-carbon structure is essential to avoid reducing its competitiveness. When formulating future agricultural development strategies, both agricultural structure and the structure of agricultural competitiveness should highlight the low-carbon structure to enhance agricultural low-carbon competitiveness.

3.4. Enhancement of Low-Carbon Agricultural Industry Competitiveness

Global demand for low-carbon products continues to rise, but some Chinese agricultural products face competitive pressure in international markets. To address this issue, agricultural enterprises need to leverage low-carbon economic principles: This involves enhancing product quality, establishing risk management systems, and adapting to changing market demands to increase the competitiveness of the low-carbon agricultural industry. Such efforts will help increase China's market share for agricultural products in international markets, thereby enhancing international competitiveness.

3.5. Exploration of Low-Carbon Economy Opportunities

The low-carbon economy poses both a new test and challenge for Chinese agriculture and a brand new opportunity. It can become a new economic growth driver for Chinese agriculture to enhance its competitiveness. In the context of global economic integration, Low-Carbon has become a critical market standard for any industry competing internationally: The internationalization of competition and the requirements of carbon standards force Chinese agriculture to address the inevitable link between carbon emissions and its own competitiveness. The existing agricultural development model faces difficulties in international competition. As a major exporting nation, China's agricultural exports frequently encounter green trade barriers. Therefore, China's agriculture should find new growth points by optimizing the low-carbon structure, low-carbon indicators, and meeting consumer demand with low-carbon agricultural products, ultimately expanding market share through low-carbon practices.

3.6. Reinforcement of Low-Carbon Agriculture Policy Support

As an emerging industry, the development of low-carbon agriculture relies on policy support and protection: Firstly, financial support is crucial, encompassing increased investment and diversified sources of capital: In addition to using public funds to support low-carbon agriculture's development, the government should actively encourage private capital and foreign investment in the sector. Financial institutions should provide special loans for low-carbon agricultural technologies and agricultural science and technology projects with promising development prospects. Various economic tools such as taxation, interest subsidies, and fiscal incentives should be employed to encourage and guide various forms of social capital to invest in low-carbon agriculture. Secondly, legal and regulatory support is indispensable: This entails establishing and improving a series of laws and related regulations to create a robust legal framework for China's low-carbon agricultural development. Institutional arrangements, including industry guidance systems, low-carbon

agricultural development planning systems, and ecological compensation systems, should be put in place to promote the healthy and orderly development of China's low-carbon agriculture.

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