

# The International Competitiveness of China's Agri-food Processing Firms: Driven by Digital Intelligence

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**Abstract:** Amid digital transformation, this study examines pathways to strengthen the international competitiveness of China's agricultural processing sector. It analyzes both the opportunities—including efficiency gains and market expansion—and persistent challenges in technology, data governance, and trade barriers. Using the Trade Competitiveness Index, the research identifies structural weaknesses in value addition, supply chains, and digital capacity. A five-pillar enhancement framework is proposed, integrating smart manufacturing, supply chain optimization, digital marketing, quality assurance mechanisms, and industrial ecosystem collaboration. The study concludes by delineating synergistic roles for government and enterprises to overcome existing bottlenecks and rebuild sustainable competitive advantages in global markets.

**Keywords:** Digital Intelligence, Agri-food Processing Firms, International Competitiveness

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## INTRODUCTION

Human society is transitioning into a digital- intelligent era, a shift that is reconfiguring global industrial competition and creating historic opportunities for modernizing traditional sectors in China. As a cornerstone of the national economy, the agricultural processing industry faces an urgent need to enhance its international competitiveness. This study examines how digital and intelligent technologies can empower agricultural processing enterprises to overcome existing bottlenecks and strengthen their global market position. By analyzing both opportunities and challenges within this evolving context, the paper proposes strategic pathways for digital and intelligent transformation, aiming to help these enterprises build sustainable competitive advantages in an increasingly intense international environment.

## 1 DIGITAL INTELLIGENCE IN CHINA'S AGRICULTURAL PROCESSING COMPETITIVENESS

### 1.1 Key Characteristics and Development Trends of Digital Intelligence

In the digital and intelligent era, data transcends mere operational record-keeping to become a core input driving decision-making, optimizing processes, and creating value. Its worth extends beyond basic applications, increasingly manifesting through secondary utilization and cross-integration<sup>[1]</sup>. Data elements, through their multiplier effect on other factors, are emerging as a new engine for economic growth<sup>[2]</sup>.

The core of digital intelligence lies in "intelligence." Internally, it enables seamless integration across R&D, production, marketing, and management. At the industrial level, it builds collaborative networks connecting farmers, cooperatives, processing enterprises, logistics providers, retailers, and end consumers, achieving efficient matching of information, logistics, and capital. This platform-based, ecosystemic organizational model constitutes the fundamental unit of competition in the digital economy era. Competition between enterprises is evolving into competition among their respective ecosystems<sup>[4]</sup>.

Companies can simulate and optimize production processes in virtual spaces, enabling rapid responses to the diverse and dynamic demands of international markets. It achieves interactive mapping and real-time feedback between the physical and information worlds, providing core support for flexible manufacturing. This enables agricultural processing enterprises to shift from standardized, mass production to customized, high-value-added products tailored for specific

regions and consumer groups <sup>[5]</sup>.

The value of digital intelligence is expanding beyond initial cost reduction and efficiency gains toward deeper technological innovation. Enterprises no longer settle for optimizing existing operations but leverage digital and intelligent technologies to pioneer entirely new business models. Examples include personalized nutrition subscription services based on consumer data and blockchain-based food carbon footprint trading. By catalyzing new industries, business formats, and models, digital technologies are reshaping value chains and revenue streams, becoming a vital engine for economic growth. Future digital and intelligent development must be built upon a foundation of trust <sup>[6]</sup>.

## 1.2 Opportunities for Digital Intelligence in Agricultural Processing Enterprises

The digital and intelligent transformation wave is reshaping the competitive landscape of the agricultural processing industry with unprecedented force, presenting historic opportunities for enterprises to break through traditional development bottlenecks and build international competitive advantages.

Digitalization significantly enhances resource allocation efficiency and operational control while enabling precise forecasting of raw material price fluctuations and market demand. This facilitates optimal procurement decisions and inventory level management, reducing capital tied up and storage losses. Additionally, intelligent scheduling systems optimize logistics routes, shorten delivery times, and accelerate response to international orders.

Digitalization serves as a powerful tool to address information asymmetry in agricultural product quality, elevate product value-added, and boost innovation capabilities. Enterprises can leverage big data analytics to deeply mine consumer reviews and search data from e-commerce platforms and social media, gaining precise insights into taste preferences, nutritional needs, and health trends across different countries and regions. This enables them to move beyond homogeneous price competition toward high-value-added competition. <sup>[8]</sup>.

Digitalization has fundamentally transformed how enterprises interact with global consumers, offering new pathways for brand globalization and market expansion.

## 1.3 Challenges of Digital Intelligence for Agricultural Processing Enterprises

While digital intelligence offers transformative potential, China's agricultural processing sector occupies a disadvantaged position in the global technological landscape, confronting systemic risks of marginalization in core technologies, data governance, and standard-setting. Excessive dependence on foreign digital platforms risks critical data asset outflows, impairing the sector's capacity to develop autonomous market insights and strategic foresight.

Concurrently, developed economies dominate the formation of international digital standards, creating potential incompatibility with China's systems and imposing external rules that may not serve local interests. Moreover, these nations are deploying digital intelligence to institute sophisticated and opaque trade barriers—posing compliance challenges in areas such as data regulation and sustainability, which could result in market exclusion or punitive tariffs. These multifaceted challenges ultimately reflect a structural deficit in China's influence within the evolving architecture of global digital intelligence governance.

# 2 CURRENT STATUS AND ISSUES OF INTERNATIONAL COMPETITIVENESS FOR CHINA'S AGRICULTURAL PROCESSING ENTERPRISES

## 2.1 Trade Profile and Position of China's Agricultural Processing Enterprises

Overall, China's agricultural trade is marked by high volume coupled with a significant trade deficit. Between January and October 2025, agricultural imports reached \$172.73 billion, overshadowing exports of \$83.56 billion. Imports were more than double exports, resulting in an \$89.17 billion deficit. These figures highlight China's role as a major global agricultural consumer and its substantial dependence on imported raw materials.

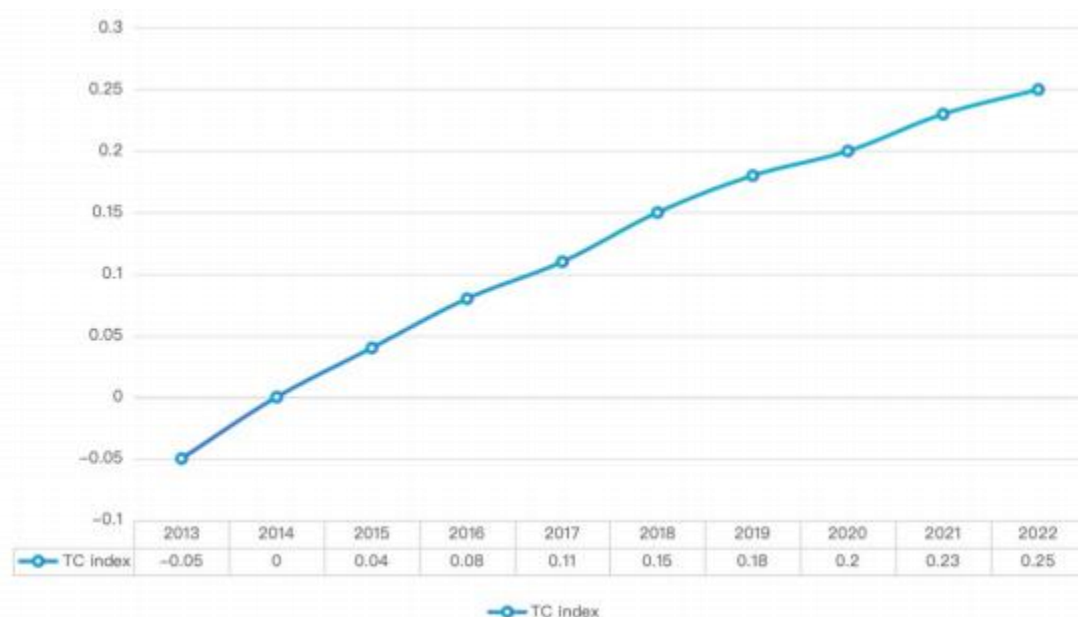


Fig. 1. Analysis of International Competitiveness of China's Agricultural Product Processing Enterprises, 2013 – 2022

Among exports, aquatic products and processed goods, along with vegetables, edible fungi, and related processed items, remain key traditional categories. Together, they account for over 35% of total agricultural exports. Although vegetables lead in export value, their earnings fell to \$13.88 billion in the first ten months of 2025, an 8.2% year-on-year decrease, signaling a decline in traditional competitive strengths.

According to the China Agricultural Industry Development Report 2024, the international competitiveness of China's processed agricultural products is moderate and weakening. Notably, since 2017, the Trade Competitiveness Index (TCI) has entered the uncompetitive range, while the Revealed Comparative Advantage (RCA) Index also reflects diminishing competitiveness. This indicates that, despite its scale, China's agricultural processing sector still requires substantial improvement to strengthen its global standing.

## 2.2 Analysis of the Current State of International Competitiveness Among China's Agricultural Processing Enterprises

In The Economics of Competitiveness, Jin Bo clearly states that the essence of international competitiveness lies in the ability of a nation's enterprises or industries to sell their products in the international market—an ability that must ultimately be validated through market performance [9]. The Trade Competitiveness (TC) Index directly quantifies an industry's net export capacity, making it an intuitive indicator of its competitive position in international markets. Therefore, this paper adopts the TC Index as the core metric to assess the international competitiveness of agricultural processing enterprises. It is calculated as follows:

$$\text{TC Index} = \frac{\text{Export Value} - \text{Import Value}}{\text{Export Value} + \text{Import Value}} \quad (1)$$

Export Value + Import Value

The TC Index ranges from -1 to 1. A value closer to 1 indicates stronger international competitiveness of the industry, whereas a value closer to -1 reflects weaker competitiveness.

Table 1 presents analysis based on the TC Index. The index gradually increased from a negative value in 2013 to 0.25 in 2022, indicating that the international competitiveness of agricultural processing enterprises has progressively shifted from a competitive disadvantage to a competitive advantage, with sustained growth in competitiveness. This reflects the process of enhanced export capacity and reduced import dependency among enterprises.

The sustained rise of the TC Index stems from the systemic impact of digital and intelligent applications—from boosting internal efficiency and building external trust to driving innovation and brand upgrading. It signifies that China's

agricultural processing enterprises, empowered by digital and intelligent technologies, are progressively embedding themselves into the mid-to-high-end segments of the global value chain, achieving a qualitative leap in international competitiveness.

### **2.3 Challenges in the International Competitiveness of China's Agricultural Processing Enterprise**

China's agricultural exports remain dominated by primary processed goods and low-value-added raw materials, with deeply processed, high-value-added products constituting only a minor share. Widespread lack of core technologies and proprietary formulations has led to significant product homogeneity. Moreover, supply chains demonstrate limited resilience and weak risk resistance in the face of unforeseen events such as trade disputes and logistical disruptions.

Most enterprises lack internationally recognized proprietary brands and primarily operate as OEM suppliers for foreign companies. Their international marketing relies heavily on traditional channels and trade fairs, with insufficient understanding of target market consumer preferences and cultural contexts, resulting in low marketing conversion rates. Although traceability systems have been introduced by some firms, issues such as inconsistent standards, vulnerability to data tampering, and incomplete information undermine their credibility, making it difficult to meet increasingly stringent international quality and traceability requirements.

Furthermore, while leading enterprises are accelerating digital and intelligent transformation, the vast majority of small and medium-sized processors face challenges in upgrading due to capital, talent, and technological constraints. This has exacerbated polarization within the sector, consequently undermining the foundational conditions for enhancing overall international competitiveness.

## **3 STRATEGIES FOR ENHANCING THE INTERNATIONAL COMPETITIVENESS OF CHINA'S AGRICULTURAL PROCESSING ENTERPRISES IN THE DIGITAL AND INTELLIGENT CONTEXT**

### **3.1 Promoting Deep Integration of Smart Manufacturing**

The core of competitiveness resides in the product itself. Digital and intelligent technologies offer a critical pathway for transforming basic outputs into value-driven innovations. By integrating information flows between planning and control layers, these technologies enable intelligent production scheduling, precise material allocation, and end-to-end quality traceability. This not only reduces labor costs and material waste but also ensures consistent product quality that meets international standards.

Through data-driven flexible production lines, enterprises can swiftly adapt to order fluctuations and shifting demand in global trade. Additionally, companies should establish specialized digital R&D centers. Leveraging AI and big data analytics to examine global consumer data, patent literature, and scientific outputs can help break away from homogeneous competition and build sustainable technological barriers.

### **3.2 Optimizing Supply Chain Systems**

Digital intelligence is pivotal for building agile, transparent, and resilient supply chains. It enables enterprises to develop integrated cloud platforms that connect suppliers, manufacturers, logistics providers, and overseas customers. By sharing real-time data on inventory, orders, capacity, and logistics, companies achieve full visibility, early warning capabilities, and process optimization from raw material procurement to final delivery. This significantly reduces inventory costs and enhances on-time order fulfillment.

For perishable and fragile agricultural goods, end-to-end monitoring throughout cross-border logistics helps preserve quality and strengthen customer trust. Moreover, authentic transaction, logistics, and credit data generated on the platform can be used to build precise credit profiles for SMEs. This facilitates their access to financial services—such as accounts receivable financing and warehouse receipt pledging—alleviating traditional funding constraints and enabling broader participation in international trade.

### **3.3 Promoting Digital Marketing and Brand Building**

Leverage major international social media platforms and search engines—such as Google, Facebook, and TikTok—to conduct targeted advertising based on user profiling. Simultaneously, actively manage cross-border e-commerce platforms (e.g., Amazon, AliExpress), using platform traffic data to optimize product listings, keywords, and marketing strategies, thereby transforming traditional marketing approaches. Create diverse multilingual content—including short videos, livestreams, and blogs—to vividly showcase product origin control, advanced manufacturing processes, cultural narratives, and health concepts.

Integrate user data from multiple channels, including official websites, e-commerce platforms, and social media, to build a unified customer profile. Through data analysis, segment customers and deliver personalized recommendations, repurchase reminders, and after-sales support, thereby enhancing customer loyalty and lifetime value.

### **3.4 Building International Quality Trust Barriers**

Trust is fundamental to international trade, and blockchain technology provides a powerful mechanism to build it. Industry alliances or leading enterprises should leverage digital intelligence to develop blockchain-based traceability platforms that span the entire supply chain. Key data from each stage—from cultivation, harvesting, and processing to inspection, warehousing, and logistics—can be immutably recorded, creating a permanent and tamper-proof record.

This traceability data can be transformed into a strategic marketing tool. By assigning a unique QR code to each exported product, overseas consumers can scan to access transparent details such as production environment photos, processing facility videos, and quarantine certificates. This approach not only demonstrates a commitment to quality but also helps combat counterfeiting, enhance brand value, and overcome trust barriers in developed markets.

### **3.5 Collaborative Industrial Ecosystem Empowerment**

Enhancing international competitiveness necessitates the cultivation of a vibrant industrial ecosystem. To this end, large internet companies and digital service providers should be encouraged to develop lightweight, modular, and low-cost SaaS applications specifically designed for the agricultural processing sector. Such tools would enable SMEs to rapidly acquire essential digital capabilities—such as ERP, CRM, and online marketing—thereby significantly lowering the barriers to digital transformation. Furthermore, by leveraging a shared platform, SMEs can engage in collaborative activities such as order sharing, capacity coordination, and joint R&D, collectively fostering a more integrated and synergistic industrial landscape.

Concurrently, it is essential to promote collaboration between universities and enterprises in cultivating interdisciplinary talent equipped with expertise in agricultural processing technology, data analytics, and business operations. In parallel, providing targeted digital transformation training for enterprise managers will help shift traditional mindsets and ensure the availability of skilled human resources, thereby laying a solid talent foundation for the effective implementation of competitiveness-enhancing strategies.

## **4 THE ROLE OF GOVERNMENT AND ENTERPRISES IN ENHANCING THE INTERNATIONAL COMPETITIVENESS OF AGRICULTURAL PROCESSING ENTERPRISES**

### **4.1 Government's Role in Strategic Planning and Policy Support**

To enhance the international competitiveness of agricultural processing enterprises, the government should adopt a macro-level role—leveraging policies, institutions, and public services to dismantle barriers and provide robust support for global expansion. This includes formulating a national strategy for digital transformation and internationalization to prioritize development areas and guide the efficient allocation of social resources. Fiscal support, such as direct subsidies or tax incentives, should be directed toward digital upgrades, R&D, international certification, and overseas branding.

The government should also actively pursue bilateral and multilateral trade agreements to lower tariff and non-tariff barriers. Streamlining export inspection, quarantine, and customs procedures will reduce operational complexities and costs for enterprises embracing digital solutions. Furthermore, interdisciplinary programs in agricultural digital

technologies should be promoted in higher education to develop versatile talent, while targeted recruitment of international experts will strengthen domestic expertise and innovation capacity.

## 4.2 Corporate Responsibility and Strategic Commitment

As key market participants and value creators, enterprises must lead their own transformation. Corporate leaders should treat digitalization as a strategic priority, committing to forward-looking investments in technology, equipment, and talent. Depending on scale and capability, firms can begin by digitizing core processes and gradually advance toward fully integrated, intelligent operations.

Enterprises should leverage data to drive product R&D and create differentiated value. Proactive use of digital tools can enhance collaboration across supply chains, building agile and resilient networks. Establishing dedicated digital marketing teams will enable deeper engagement in cross-border e-commerce and social media—shifting the business model from passive order-taking to proactive market development.

To sustain this shift, companies should reform organizational structures and management processes to align with digital operations, breaking down departmental silos. Regular training can enhance employees' digital proficiency, while competitive compensation and career development mechanisms help attract and retain versatile talent skilled in both technology and business management.

## 5 CONCLUSION

Amidst global competition in the digital and intelligent era, while China's agricultural processing enterprises demonstrate sustained positive momentum in international competitiveness, their further development remains constrained by deep-seated challenges: low product value-added, insufficient supply chain resilience, weak international brand influence, and difficulties in SME transformation. Digital and intelligent transformation is not merely a single-faceted technological upgrade but a comprehensive restructuring involving operational models, industrial chains, and commercial ecosystems.

In this systemic endeavor, governments and enterprises must fulfill their respective roles and form a synergistic force. Governments should create a favorable development environment through top-level design and public services, while enterprises must courageously assume primary responsibility and actively internalize digital and intelligent capabilities as core competencies. Under the digital and intelligent transformation, China's agricultural product processing enterprises will secure a more advantageous position within the global agricultural and food system.

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