

Research on the Construction Mechanism of Agricultural Industry Chain Resilience in Daqing City with Economic Empowerment

Quanfu Pan

Heilongjiang Bayi Agricultural University, Daqing 163319, Heilongjiang, China

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Abstract: Under the framework of the Tenth Five-Year Plan, Daqing aims to build a pilot zone practicing the big agriculture and big food concept and realize the transformation from a major agricultural city to a strong one. As a resource-based city, Daqing shoulders industrial restructuring and agricultural modernization, yet its agricultural industrial chain suffers from weak digital foundations, poor coordination, and low risk resilience. Based on literature review, this paper sorts out theories on digital technology empowering agricultural industrial chain resilience and analyzes Daqing's agricultural chain. Daqing has established a "4+8+n" modern agricultural system with expanding scale, clustered leading enterprises, and booming smart, branded, and customized agriculture. However, it is confronted with a weak driving force of core enterprises, inadequate intensive processing, imperfect full-chain standardization and branding, plus bottlenecks in digital infrastructure and cold-chain logistics. This study proposes countermeasures by strengthening, supplementing, extending, and optimizing the industrial chain: consolidate leading enterprises and benefit linkage, fill intensive processing gaps to lift the value chain, expand agricultural multi-functions for green transition and brand appreciation, and upgrade digital infrastructure, cold chain, the seed industry, and sci-tech innovation. It expects digital new-quality productive forces to boost the quality, efficiency, and resilience of Daqing's full agricultural chain, safeguarding food security and supporting the agricultural transition of resource-based cities.

Keywords: Digital new quality productivity; Resilience of agricultural industry chain; The whole industry chain; Agricultural digitization

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1. Introduction

Among the twelve key tasks of economic and social development in Daqing during the "Tenth Five-Year Plan" period, the importance of stabilizing grain production and improving the comprehensive agricultural production capacity and quality benefits is emphasized. It is stressed that "we should continue to promote the construction of high-standard farmland, vigorously develop new agricultural productivity, promote agricultural

precision farming, intelligent breeding, and digital operation, and comprehensively improve the comprehensive agricultural production capacity and production efficiency.” we should also continue to extend the value chain of the agricultural industry, develop intensive processing in rice, corn, soybeans, meat and other fields, continue to integrate the development of meat processing, high-end dairy processing, and characteristic development of fruit, vegetable, and potato products, build a place to practice the concept of big agriculture and big food, and accelerate the realization of Daqing’s historic leap from a “big agricultural city” to a “strong agricultural city.” As a resource-based city, Daqing is facing the dual tasks of industrial transformation and agricultural modernization. Ensuring food security and the supply of important agricultural products requires a more solid and reliable agricultural industry chain. However, the agricultural digital transformation in Heilongjiang Province is still facing the challenge of low penetration of the digital economy in the agricultural field, which also exists in Daqing. Daqing’s agricultural industry chain has many problems, such as a weak digital foundation, low synergy efficiency, and insufficient risk response ability. It is urgent to enhance the resilience of the industrial chain through digital technology empowerment.

In terms of the integration of digital technology and smart agriculture, Wolfert *et al.* systematically sorted out the application scenarios and operation logic of big data in smart agriculture, and pointed out that data-driven approaches can effectively optimize agricultural production decisions and improve the efficiency of resource allocation, providing a basic analysis framework for enabling agricultural science and technology innovation by digital economy ^[1]. Thendral and Selva found that agricultural digitization and automation can not only improve production efficiency, but also enhance the ability of the agricultural system to cope with external shocks, which provides an important practical basis for promoting the development of green agriculture and ensuring food security through a comparative case study of low- and middle-income countries ^[2]. In terms of the construction of the resilience theory of the agricultural industry chain, the economic vulnerability and resilience theory proposed by Briguglio provides the core theoretical support for the agricultural industry chain to resist risks, recover quickly, and upgrade adaptively ^[3]. Belliggiano *et al.* took the dairy value chain as the research object, and further revealed the mechanism of digital technology embedding in improving the resilience of the agricultural value chain and promoting the sustainable development of regional villages. In the field of agricultural product quality and safety and brand building ^[4], Hobbs paid early attention to the impact of agricultural supply chain management innovation on quality control and industrial competitiveness, providing early theoretical reference for the development of quality agriculture and brand agriculture ^[5]. Costopoulou and Mwewa *et al.* respectively took the olive oil supply chain and the whole agricultural industry chain as the research objects, and confirmed that digital technologies such as blockchain and the Internet of things can realize whole-process traceability and information transparency of agricultural products, effectively improve the level of quality control and brand trust, and enhance the value creation ability of the whole agricultural chain ^[6,7]. At the level of the empowerment path, Xiao and Yang constructed the whole-chain empowerment mechanism of the digital economy and proposed that it could promote the collaborative upgrading of all links of the agricultural industry chain by relying on data-driven organizational restructuring and technology penetration ^[8]. Huang focused on rural digital construction and confirmed that it can indirectly strengthen the resilience of agricultural development by improving digital infrastructure and improving agricultural total factor productivity ^[9]. Zhang *et al.* started with segmentation technology and found that blockchain can improve the risk-mitigation ability of the agricultural product supply chain by relying on quality traceability and information sharing. Regarding constraints and regulatory effects, scholars focus on the hedging path of the real dilemma ^[10]. Hu

et al. proposed that the aging of the rural labor force will significantly inhibit the resilience of the agricultural industry chain, and the popularization of digital technology and the development of digital inclusive finance can effectively hedge this negative impact ^[11]. Jiang and Wu further pointed out that digital inclusive finance can enable the stable operation of the agricultural industry chain by broadening financing channels and optimizing the risk-sharing mechanism ^[12]. At the micro level, Huang *et al.* emphasized that the application of digital platform can optimize the operation efficiency of enterprises and help improve the resilience of the industrial chain ^[13]. In terms of heterogeneity, the research of Wang shows that there are regional differences and stage differences in the promotion effect of the digital economy on the resilience of the agricultural industry chain, and the enabling effect is more prominent in the main grain production areas, main sales areas, and the stage of digital real integration and coordination ^[14].

2. Development status and core characteristics of Daqing agricultural industry chain

2.1. Development status of agricultural industry chain in Daqing

2.1.1. Overall development trend: scale jump and transformation leap

Daqing's agricultural industry chain has completely gotten rid of the traditional single mode of "raw material production," and comprehensively accelerated the leap to "intensive processing, branding, and integrated agriculture," showing the distinctive characteristics of "strong scale foundation, long processing chain, obvious leading role, and simultaneous development of characteristics and leading industries." This transformation trend is supported by solid data. In 2024, the operating revenue of the Daqing agricultural products processing industry exceeded 25.17 billion yuan, indicating that the chain extension, chain supplement, and chain strengthening strategy has achieved remarkable phased results. Agriculture is becoming the core engine driving urban economic transformation and rural comprehensive revitalization.

2.1.2. Industrial layout structure: "4+8+n" multi-level system is fully formed

Daqing has abandoned the old road of single-crop expansion and built a hierarchical and complementary modern agricultural industrial system strictly guided by "food for the first, labor for the first, and meat for the second." In terms of strengthening the four leading industries, relying on Yili, Mengniu, Muyuan, and other leading enterprises, the whole industry chain covering the separation of milk source, meat breeding, and slaughter has been built. The output value of animal husbandry accounts for 42.3% of the total output value of agriculture, forestry, animal husbandry, and fishery, ranking first in the province. At the same time, relying on the water sources of the Songnen River and the Nen River, Zhaoyuan, Duerbote, and other places have formed large-scale processing zones for rice and corn, with an annual processing capacity of 1.45 million tons of rice. Corn lysine and other products are exported to more than 30 countries around the world. In terms of highlighting the eight characteristic industries, based on local resources, it focuses on the development of cold water fish, goose, traditional Chinese medicine, fruits and vegetables, soybeans, fresh corn, coarse cereals, etc. Zhaoyuan rice has become the first batch of products with mutual recognition of geographical indications between China and Europe, and Lianhuan Lake cold water fish and Zhaoyuan white goose have won a number of certifications. In terms of cultivating n potential industries, we will actively lay out emerging fields such as leather, meat rabbit, and edible fungi, continue to enrich the industrial ecology, and inject new growth momentum into the agricultural economy.

2.1.3. Core development momentum: Technology empowerment and mode innovation driven by two wheels

The deep remodeling of the Daqing agricultural industry chain is reflected in the comprehensive upgrading of production mode and business model. In terms of enabling science and technology to create new quality productivity, we will comprehensively promote no-tillage seeding, water and fertilizer integration, and intelligent environmental control systems, accelerate the construction of a municipal agricultural big data platform, and widely apply intelligent equipment such as UAV seedling transportation, Beidou navigation seedling transplanting, and mobile water and fertilizer hub vehicles, so as to promote agricultural production from “relying on manpower” to “relying on computing power.” In terms of model innovation, we will vigorously develop new models such as group customization, claim customization, and crowdfunding customization. In 2025, the output value of customized agriculture will reach 843 million yuan. Dongfeng Farm in the high-tech Zone, Duerbote “rice crab symbiosis,” and other bases have successfully transformed “selling agricultural products” into “selling services and selling physical tests.” At the same time, a collaborative system of “regional public brand + enterprise brand + product brand” will be built, with “black soil premium products” and “Qingxin agricultural products” as the traction, and relying on platforms such as live e-commerce and China Russia Expo, the characteristic popular products will be promoted to the national and international markets. In addition, Daqing adheres to ecological priority, regards black soil protection as the “No. 1 project,” and expands its capacity to 3.21 million mu, deepens agricultural reduction and efficiency, and opens up the whole chain of ecological defense from black soil management and protection to green planting and waste utilization through planting and breeding cycle and resource utilization of livestock and poultry manure.

2.2. Core characteristics of Daqing agricultural industry chain

High degree of agglomeration of leading industries: a rice planting and processing zone dominated by Zhaoyuan County, Duerbote County, and Lindian County, has been formed, with 31 rice processing enterprises above the designated size and an annual processing capacity of 1.45 million tons; A processing cluster area dominated by Duerbote County has been formed for corn. There are 10 corn processing enterprises above the designated size, and the leading enterprises play a prominent role in driving.

Complete animal husbandry processing chain: the dairy industry has formed a whole chain with Lindian County, Duerbote County, and the economic development zone as the core, covering milk source base, liquid milk, milk powder, and cheese; The pig industry has formed a “breeding pig breeding—standardized breeding—slaughtering and segmentation—intensive processing” system.

The driving force of leading enterprises is obvious: there are 171 municipal leading enterprises and 8 national leading enterprises in Daqing. Yili, Mengniu, Yipin, Shengquan, Muyuan, Jinluo, and other enterprises play a key role in the extension of the industrial chain.

Improvement of standardization and branding level: Zhaoyuan rice has become one of the first batch of China-EU mutual recognition geographical indications, and has released the whole industry chain standard system, indicating that Daqing agriculture is changing from “quantity expansion” to “standard leading and brand value-added.”

Attach equal importance to scientific and technological empowerment and green transformation: in recent years, Daqing has promoted the protection and utilization of smart agriculture, digital agriculture, high-standard farmland and black soil, and promoted the integration of water and fertilizer, intelligent irrigation, Beidou navigation agricultural machinery and other technologies, which has strengthened the modernization support of

the industrial chain.

The trend of industrial integration has increased: customized agriculture has developed rapidly, with an output value of 843 million yuan in 2025 and 400 million yuan in the first half of 2026, reflecting that Daqing agriculture is extending from the traditional production chain to order, experience, leisure, and service.

3. Problems in the development of the agricultural industry chain in Daqing

3.1. Strong chain dimension: Limited integration driving ability of chain owners and loose chain collaboration and interest connection

At present, although Daqing has formed a leading industrial chain of dairy products, meat, corn, rice, and so on, it is still in the transition period from primary processing to intensive processing and upgrading as a whole. The added value of some links is low, and the integration and driving ability of chain owners to the upstream and downstream still needs to be enhanced. At the same time, the pre-production, mid-production, and post-production links of the industrial chain are decentralized and fragmented. The connection between planting and breeding, processing and circulation, production and consumption is not smooth enough, and the interest linkage mechanism is relatively loose, which makes it difficult for the production areas to fully share the value-added benefits of the industrial chain. The foundation for collaborative development between upstream and downstream still needs to be further consolidated.

3.2. Chain supplement dimension: Prominent short board of intensive processing and weak support of scientific and technological innovation and seed industry

Daqing's agricultural products processing industry as a whole is still at the stage of upgrading from primary processing to intensive processing. There is more room for the value chain to climb, and the added value of some links is not high. It is urgent to shift to the manufacturing of high value-added end products. At the same time, the collaborative upgrading of seed sources, equipment, technology, and organizational models required by the modern agricultural industry chain has not yet been fully realized. The lack of agricultural R&D capability, key core technology research, and seed industry innovation is a key weakness restricting the resilience of the industry chain. The quality of the supply chain and the core competitiveness of the industry still need to be improved.

3.3. Chain extension dimension: The construction of standardization and branding lags behind, and green and low-carbon constraints are increasingly strengthened

Although Daqing has a geographical indication and regional brand foundation, the standard supply and collaborative governance of the whole industry chain are insufficient, the unified brand communication ability is weak, and the recognition of the high-end market needs to be improved, facing the common problems of the standardization transformation of the whole agricultural industry chain in China. In addition, there are problems in the processing and breeding of agricultural products, such as high resource consumption, high carbon emission intensity, and low processing conversion rate. Against the backdrop of the "dual carbon" goal, the pressure for green development will continue to increase in the future, and the ecological resilience and sustainable development ability of the industrial chain will face a severe test.

3.4. Optimal chain dimension: Digital infrastructure and data collaboration lag behind, and there are bottlenecks in the logistics cold chain system.

Daqing's agricultural data is scattered, the system is incompatible, and the sharing mechanism is weak. In addition, the lack of interdisciplinary talent makes it difficult for digital technology to form a closed-loop empowerment in production, processing, and circulation, and the landing of smart agriculture is blocked. At the same time, the organizational level of "the first kilometer" and "the last kilometer" of agricultural products is low, and the cold chain storage, transportation, hierarchical packaging, and distribution capacity is insufficient, which has become the key physical bottleneck restricting the overall operation efficiency of the industrial chain. There is still much room for improvement in the overall circulation efficiency and coordination efficiency.

4. Countermeasure analysis on the development of the agricultural industry chain in Daqing

In order to comprehensively improve the competitiveness, collaborative efficiency, and sustainable development ability of the agricultural industry chain, and effectively solve the bottleneck constraints in the current industrial development, it is suggested to focus on the four core directions of "strengthening the chain, supplementing the chain, extending the chain, and optimizing the chain," and make overall measures to systematically promote the high-quality development of the agricultural industry chain. Specific countermeasures and suggestions are as follows.

4.1. Strong chain: Strengthen the leading role and enhance the degree of industrial organization

Strengthen the core engine of the industrial chain and consolidate the foundation for collaborative development of upstream and downstream. On the one hand, continue to support Yili, Mengniu, Muyuan, and other leading enterprises to expand production and improve quality, give full play to their leading role as "chain owners" and drive the overall upgrading of the industrial chain; At the same time, vigorously introduce and cultivate a number of "specialized, special and new" processing enterprises to enrich the industrial chain ecology. On the other hand, the close cooperation mode of "company + cooperative + farmers" and "company + base + farmers" should be further promoted to effectively improve the degree of organization of upstream and downstream entities, enhance the tightness of interest connection, and realize risk sharing and benefit sharing.

4.2. Supplement the chain: Supplement the short board of intensive processing and promote the rise of the value chain

Focus on dairy, meat, corn, rice, and characteristic industries, and strive to improve the processing conversion rate and product premium ability. Focus on the development of high value-added products, such as functional food, prefabricated dishes, snack food, refined cut meat, cheese and dairy products, fresh corn and deep processing of coarse cereals. By extending the processing chain, we will promote the transformation of the industry from the production of primary agricultural products to the manufacture of high value-added end products, and comprehensively enhance the comprehensive benefits and core competitiveness of the industrial chain.

4.3. Chain extension: Expand multiple functions, deepen green and brand empowerment

Adhere to multi-dimensional efforts to expand the space for industrial value-added and efficiency. First,

promote the standardization of the whole chain, establish a unified standard system covering planting and breeding, processing, warehousing, logistics, and sales, strengthen quality and safety traceability and certification, promote the convergence of local, group, and enterprise standards, and enhance market credibility. Second, adhere to green, low-carbon, and recycling practices; promote black land protection, comprehensive utilization of straw, recycling of livestock and poultry manure, and water-saving and fertilizer-saving clean processing technology; reduce carbon emissions and enhance the resilience of the industrial chain. Third, vigorously develop brand agriculture and customized agriculture, use e-commerce platforms and regional public brands, promote the transformation to “order agriculture + experience consumption + brand premium,” and expand the market share of medium- and high-end products. Fourth, strengthen talent introduction and social services, improve the training mechanism for gaps in agricultural informatization, processing technology, brand marketing, and other fields, and improve the level of socialized services such as agricultural machinery operation, technical training, finance, and insurance.

4.4. Excellent chain: Optimize infrastructure and scientific and technological support, and improve collaborative efficiency

Strengthen technology and digital empowerment, and consolidate the underlying support of the industrial chain. First, speed up the construction of digital agriculture and smart supply chain, establish a unified data platform, break through the data barriers of agriculture, meteorology, water conservancy, market, logistics, etc., promote the integration of intelligent monitoring, output prediction, quality traceability, order management and cold chain scheduling, and significantly improve the efficiency of industrial chain coordination. The second is to improve the warehousing logistics and cold chain system, focusing on the pre-cooling of production areas, graded packaging, cold storage transportation, a county cold chain centralized distribution center, and a terminal distribution network to make up for shortcomings, reduce the circulation loss rate, and strengthen the whole process circulation efficiency of “from field to table.” Third, strengthen scientific and technological innovation and tackle key problems in the seed industry. In the soybean, rice, corn, and livestock and poultry seed industries, strengthen the breeding platform, improve the seed breeding base and industry-university research collaboration, improve unit yield, quality, and disease resistance, and consolidate the supply quality of the industrial chain from the source.

5. Conclusion

Against the background of Daqing’s Tenth Five-Year Plan, this study explores how digital new-quality productive forces empower the resilience of agricultural industrial chains. Existing literature confirms that digital technologies can optimize agricultural production decisions, enhance the risk resistance of agricultural systems, and realize full-process product traceability^[1–7]. Domestic scholars further verify that data-driven mechanisms, digital infrastructure, and inclusive finance help strengthen chain resilience, with heterogeneous effects among grain-producing regions^[8–14]. Daqing has formed a “4+8+n” modern agricultural system featuring industrial agglomeration, sound husbandry chains, and thriving customized agriculture. Nevertheless, it faces constraints including insufficient driving capacity of chain-leading enterprises, inadequate intensive processing, incomplete full-chain branding, and bottlenecks in digital facilities and cold-chain logistics. Accordingly, countermeasures from strengthening, supplementing, extending, and optimizing the industrial chain are proposed: consolidate chain owners’ leadership and interest linkage, develop deep processing to lift

value chains, promote whole-chain standardization, green transition and brand appreciation, and improve digital infrastructure, cold-chain logistics, and seed industry innovation. This research aims to advance Daqing's shift from an agricultural big city to a strong one, and provide references for food security and industrial transformation of resource-based cities.

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