International Journal of Food Science and Agriculture, 2024, 8(4), 165-169
https://www.hillpublisher.com/journals/jsfa/
ISSN Online: 2578-3475
ISSN Print: 2578-3467

Improvement Strategy of Rice Industry Chain Efficiency Under the Perspective of Supply Chain Management

Yu Liu[1,*], T. A. Mahinda Pushspakumara[2], Yichen Mu[3]

[1]Faculty of Arts, University of Colombo, Colombo 01400, Sri Lanka.
[2]Department of Economics, Faculty of Arts, University of Colombo, Colombo 01400, Sri Lanka.
[3]College of Life Sciences, Henan Agricultura University, Zhengzhou 450000, Henan, China.

How to cite this paper: Yu Liu, T. A. Mahinda Pushspakumara, Yichen Mu. (2024). Improvement Strategy of Rice Industry Chain Efficiency Under the Perspective of Supply Chain Management. *International Journal of Food Science and Agriculture*, 8(4), 165-169.
DOI: 10.26855/ijfsa.2024.12.005

Received: October 31, 2024
Accepted: November 30, 2024
Published: December 31, 2024

Corresponding author: Yu Liu, Faculty of Arts, University of Colombo, Colombo 01400, Sri Lanka.

Abstract

As an important part of the agricultural economy, the efficiency of the rice industry chain is directly related to food security and farmers' income. At present, the rice industry chain has problems such as land fragmentation, aging processing equipment, rudimentary storage facilities, imperfect logistics network, and asymmetric information in the sales link, which restricts the enhancement of the efficiency of the industry chain. This paper employs a literature review method from the perspective of supply chain management and proposes strategies to enhance the efficiency of the rice industry chain. The suggested strategies include promoting land transfer and large-scale planting, strengthening agricultural science and technology innovation and dissemination, optimizing the technological upgrades and equipment renewal of processing enterprises, increasing the construction of warehousing facilities and intelligent management systems, integrating logistics resources and optimizing transportation routes, developing cold-chain logistics and logistics information technology, establishing an efficient supply chain information-sharing platform, and fostering core enterprises within the supply chain and logistics network. These strategies are aimed at enhancing the overall efficiency of the rice industry chain through the synergistic optimization of each link, guaranteeing food security, improving farmers' returns, and promoting sustainable agricultural development.

Keywords

Rice industry chain; supply chain management; efficiency improvement; technological innovation; synergistic efficiency

With globalization and changing market demands, the rice industry is facing fierce international competition and increasing efficiency requirements. The research report "2024-2029 China Rice Industry In-depth Development Research and "14th Five-Year" Corporate Investment Strategy Planning Report" by Zhongyan Puhua Industry Institute points out that the global rice production is expected to reach 539.2 million tons in 2024/25, which is a record high and an increase of0.9%, indicating that the global rice industry is growing steadily, putting higher demands on supply chain management. The rice industry chain covers many links from planting to marketing, and the efficiency of each link has an impact on the competitiveness of the whole chain. However, the current rice industry chain has problems such as land fragmentation, aging equipment, poor storage facilities, imperfect logistics network and asymmetric market information, which restricts the improvement of the efficiency of the industry chain. Therefore, it is of great significance to explore strategies to improve the efficiency of the rice industry chain from the perspective of supply chain management in order to guarantee food security and improve agricultural competitiveness.

1. Composition and Characteristics of Rice Industry Chain

1.1 Division of links in the rice industry chain

The rice industry chain covers several links. The planting link is the foundation, including activities such as seed selection, sowing, and field management, the quality of which affects subsequent processing. The processing link involves cleaning, hulling, and milling of paddy, which transforms paddy into finished rice. The warehousing segment is responsible for storing paddy and rice to ensure the continuity of product supply [1]. The transportation link consists of various means of transportation to move rice between production and marketing areas. The sales link is the end of the industry chain, including wholesale and retail, to bring the products to the market. The links are interrelated and affect each other, constituting a complete rice industry chain.

1.2 Industrial characteristics of the rice industry chain

The rice industry chain has obvious seasonality. Restricted by the growth cycle of crops, planting is concentrated in specific seasons, and post-harvest processing, storage, and other links also show seasonal peaks. Geography is also more prominent, its growth on the soil, climate, and other natural conditions have requirements, the varieties of different regions, yield, and quality differences. The rice industry is decentralized, and the main body of planting is mostly farmers, with a small scale of operation and wide distribution. The processing enterprises are also more dispersed, which increases the difficulty of industrial management and synergy.

2. Internal Efficiency Constraints in Each Link of the Rice Industry Chain

2.1 Land fragmentation and scale bottlenecks in the planting process

In the context of modern agricultural development, the efficiency improvement of the planting link faces many challenges. On the one hand, land fragmentation is a serious problem. As a result of historical and practical factors, land has been divided into many small pieces and dispersed in the hands of various farmers. The fragmentation has made it difficult for agricultural machinery to operate on a large scale and increased production costs. On the other hand, there are bottlenecks in large-scale cultivation. Large-scale cultivation requires a large amount of capital investment for land consolidation, infrastructure construction, etc., which is a huge burden for individual farmers or small-scale agricultural cooperatives, restricting the expansion of cultivation scale, which in turn affects the efficiency of the cultivation process. The land transfer rate in Jiangdu District, Yangzhou City, Jiangsu Province, has reached 73%, but the fragmentation of arable land greatly restricts agricultural output and technical efficiency. Jiangdu District, Putou Town, Wangzhuang Village, large farmers Wang Jia Chi introduced himself from the village of 9 natural groups transfer of 630 acres of land, of which the largest plot is 3 acres, the smallest is only 0.4 acres, the fragmentation not only a waste of high-quality arable land resources is not conducive to the promotion of the application of large and medium-sized agricultural machinery operations, but also a substantial increase in the application of fertilizers, irrigation, and other field management costs

2.2 Aging equipment and insufficient technological innovation in the processing chain

The processing link of the rice industry chain faces some dilemmas. The problem of aging equipment is prominent. Many processing companies have equipment that is old and deteriorating in performance. Aging equipment is prone to failure during processing, leading to production interruption. China Energy News pointed out that agricultural science and technology research and development funds are "fragmentation", low allocation efficiency, agricultural science, and technology research funds are allocated in a fragmented manner, resulting in agricultural science and technology resources "fragmentation". On the one hand, enterprises lack the motivation for technological innovation, due to insufficient market competition, some enterprises are satisfied with the existing processing technology and products. On the other hand, technological innovation requires professional talents and financial support, while processing enterprises often difficult to attract high-quality technical personnel and limited funds, unable to carry out large-scale technology research and development activities, resulting in slow updating of processing technology, low value-added products, it is difficult to meet the market demand for high-quality, diversified rice products.

2.3 Storage link facilities simple and loss control problems

Warehousing link efficiency constraints are prominent, reflected in the poor facilities and loss control problems in two aspects. Facilities, part of the storage facilities are old, the building structure and internal facilities are simple, moisture-proof, insect-proof, fire prevention and other functions are missing, the degree of automation is low, loading and unloading handling by manpower, low efficiency and easy to damage the goods. In terms of loss control, due to limited storage

conditions and management, the natural loss of rice is difficult to control. When the rice is stored, it breathes and generates heat, and it is easy to heat up and mold when ventilation is not timely. Pest control is also difficult, traditional chemical control affects the quality of rice, biological control, and other green technologies are not widely used, and many factors lead to high losses in storage. National Grain and Material Reserve Bureau data show that, although through the implementation of the "grain safety project" and other measures, grain storage link loss was significantly reduced, the loss of food after production is still a long way to go. At present, China's grain in the storage, transportation, and processing links, has annual losses of about 70 billion pounds.

2.4 Imperfect transportation network and difficulty in capacity deployment in the logistics segment

People's Daily Online in "adjusting the structure and promoting reform, improve the operational efficiency of the logistics system (authoritative release)" pointed out that the infrastructure network is imperfect, multimodal transportation connection is not smooth, and the modern supply chain system is not sound and other issues affecting the efficiency and cost of logistics. In the logistics chain, the imperfect transportation network and capacity deployment difficulties significantly constrain efficiency. Producing areas are mostly in rural areas with poor transportation, such as mountainous areas where roads are narrow and rugged, making it difficult for large vehicles to travel, and only small vehicles can be used for multiple means of transport, resulting in long transportation times and high costs. Capacity deployment, rice transportation seasonal, and harvest season demand increased dramatically, but the transport enterprise capacity reserve is insufficient. And the lack of coordination mechanisms in the transport market, asymmetric information between enterprises, capacity distribution imbalance, part of the region surplus, part of the region is insufficient, it is difficult to deliver rice to the market in a timely manner, seriously affecting the efficiency of the industry chain, it is urgent to build a more perfect transportation network and optimize the capacity allocation system.

3. Strategies for Improving the Efficiency of Rice Industry Chain Under the Perspective of Supply Chain Management

3.1 Efficiency improvement strategies based on cultivation links

3.1.1 Promote land transfer and large-scale planting

The government takes the lead in land transfer, improves relevant policies and regulations, and builds a transfer service platform integrating information releases, transaction facilitation, and contract signings, such as constructing an online database to record land details for easy inquiry and strengthening transfer supervision to protect farmers' rights and interests. Agricultural enterprises and professional cooperatives are leading the large-scale planting, integration of land transfer, the introduction of precision agriculture technology, according to soil fertility and crop growth precision operations, and training to enhance the skills of farmers, in order to achieve planting efficiency and cost reduction [2].

3.1.2 Strengthen agricultural science and technology innovation and popularization and application

Scientific research and universities have increased R&D investment, such as exploring gene editing to improve varieties, cultivating new products with high quality and high yield that are resistant to pests and diseases, and researching and developing precision agriculture technologies such as satellite positioning, sensing, and big data analysis. At the promotion level, to build a diversified system, the government has set up a special promotion agency, sent staff to provide in-depth guidance and training in the field, and pushed the technology and variety information with the help of modern information technology such as agricultural science and technology promotion APPs, and through the results of the exhibition and demonstration bases to let the farmers intuitively feel the advantages of the new technology to accelerate the transformation of the results, and to enhance the planting level and efficiency of science and technology.

3.2 Efficiency optimization measures for processing links

3.2.1 Promote processing enterprise technology upgrade and equipment update

Technology upgrading, processing enterprises need to strengthen the collaboration with scientific research institutions, common research deep processing technology, such as the development of rice nutritional health care products and rice bran oil efficient extraction technology, at the same time the introduction of intelligent manufacturing technology, the deployment of sensors and automation control system in the production line, real-time monitoring of the temperature, humidity, pressure and other parameters, to protect the product quality and stability [3]. For equipment updates, enterprises should plan a reasonable plan, the government can introduce policies to give financial subsidies or tax incentives, and enterprises according to their own scale and market demand for advanced equipment, such as energy-efficient hullers, and rice milling machines improve processing efficiency and reduce energy consumption.

3.2.2 Promote processing technology standardization and product diversification

On process standardization, industry associations take the lead in organizing experts to formulate operational specifications and quality standards covering raw material acceptance, cleaning, hulling, rice milling, etc., to clarify the removal rate of impurities from paddy cleaning, and the completeness rate of brown rice after hulling, etc., so that processing enterprises can produce according to the standards to ensure the consistency and stability of product quality. The government will strengthen supervision and inspection and penalize the non-compliant enterprises in a synchronized manner. Product diversification level, enterprises to increase R & D investment, according to market demand and consumer taste preferences to develop products, such as soft rice for the elderly, children's nutritional fortification of rice, combined with the development of local characteristics of the culture of regional characteristics of rice products, standardization of technology and product diversification, not only to improve the processing efficiency, but also to meet the diversified needs and enhance the competitiveness of enterprises.

3.3 Warehousing and logistics efficiency improvement program

3.3.1 Increase the construction of warehousing facilities and intelligent management inputs

Facility construction, the government and enterprises to invest, the government to financial subsidies to attract enterprises in the production area, and sales area to build modern storage facilities, which should be moisture-proof, insect-proof, fire prevention and other functions, such as the use of new materials to build warehouses and install automatic ventilation and temperature and humidity adjustment system, and according to the output of the production area, the sales area is influenced by the demand for traffic convenience in the establishment of large-scale warehousing centers that are rationally distributed [4]. Intelligent management inputs, enterprises cited information technology, real-time tracking and monitoring of warehousing goods through the Internet of Things, installed sensors in each warehouse unit to collect temperature, humidity, inventory, and other information transmitted to the management system, and analyze the data with big data and artificial intelligence to predict the quality of the changes in the inventory demand, to achieve intelligent decision-making to improve the efficiency of warehousing and cargo security.

3.3.2 Integration of logistics resources and optimization of transportation routes

Integration of resources, the government and industry associations to coordinate, build logistics resources sharing platform, set logistics, warehousing enterprises, transportation vehicles and other resources. Such as off-season deployment of vehicles to maintain or carry out other services, peak season to concentrate capacity to meet the demand for transportation, and encourage business cooperation, through mergers and acquisitions to expand the scale and scope of services. Optimization of transport routes, the use of GIS and other technologies, the collection of production areas, sales areas of geographic and traffic information to build models, analysis to find the shortest, most economical routes, and improve the overall efficiency of logistics.

3.4 Efficiency enhancement strategies for sales

3.4.1 Expand diversified sales channels and e-commerce platform applications

Expanding offline channels, enterprises need to actively explore new paths, cooperate with large supermarkets, and convenience store chains, and direct the supply of products to the terminal, while carrying out community direct sales, reducing intermediate links directly to consumers. E-commerce platform application, enterprises should strengthen the platform construction, build their own official website to display product details, optimize the design to enhance the user experience to facilitate the purchase; stationed in well-known e-commerce platforms, with the help of its traffic and logistics system, to carry out promotions and cooperative promotions, to enhance product awareness and market share.

3.4.2 Establish market information monitoring and feedback mechanism

In the information monitoring link, enterprises and industry associations are involved in a coordinated manner. Enterprises set up internal research teams to collect information on changes in consumer demand and price sensitivity through questionnaires and interviews; industry associations organize professional organizations to monitor the national and even global rice market on a macro level, collecting information on production, consumption, price trends, etc., and issuing reports. Feedback mechanism, the construction of an information-sharing platform, enterprises upload the collection of information in a timely manner, and access to the content released by other subjects, analyzed and adjusted accordingly to the sales strategy, such as changes in the price of the product according to market demand or the launch of new products, to enhance the flexibility and efficiency of sales.

4. Conclusion

Improving the efficiency of the rice industry chain is a complex systematic project. Within each link, the planting link should continue to optimize land use and variety layout to meet market demand; the processing link should continue to

explore new technologies and processes to achieve value-added products; the warehousing link should strengthen the modernization of facilities and intelligent management; the transportation link should build an efficient logistic network; and the sales link needs to strengthen branding and market development. In terms of industry chain synergy [5], the benefit distribution and risk-sharing mechanism should be more detailed and perfect, the information-sharing platform should be continuously optimized, and the core enterprises and alliance organizations should play a greater leading role in order to promote the efficient and sustainable development of the rice industry chain as a whole.

References

[1] Wu BS. Optimized model of energy industry chain considering low-carbon development mechanism. Energy Sources, Part A: Recovery, Utilization, and Environmental Effects. 2020;42(21):2593-2602.

[2] Feng J, Geng LL, Liu H, Zhang XH. Efficiency evaluation of the high-tech industry chain with a two-stage data envelopment analysis approach. Operations Management Research. 2022;15(3-4):1071-1080.

[3] Guan HJ, Wang Y, Dong LY, Zhao AW. Efficiency Decomposition Analysis of the Marine Ship Industry Chain Based on Three-Stage Super-Efficiency SBM Model—Evidence from Chinese A-Share-Listed Companies. Sustainability. 2022;14(19):12155-12155.

[4] Fan HW, Tao K, Zhong WH, Hu XY. Spatial Econometric Analysis of Digital Economy Development to Promote Regional Industrial Chain Optimization and Upgrading—Empirical Study of Yangtze River Delta Central City Cluster Based on SDM. Academic Journal of Business & Management. 2023;5(13).

[5] Zhang YC. Regional economic dispatch analysis and industry chain optimization based on proximal strategy optimization algorithm. Applied Mathematics and Nonlinear Sciences. 2024;9(1).

[6] Peng X, Zhang X, Wang X, Li H, Xu J, Zhao Z, Wang, Y. Research on the Cross-Chain Model of Rice Supply Chain Supervision Based on Parallel Blockchain and Smart Contracts. Foods. 2022;11:1269.

[7] Peng X, Zhang X, Wang X, Xu J, Li H, Zhao Z, Qi Z. A Refined Supervision Model of Rice Supply Chain Based on Multi-Blockchain. Foods. 2022;11:2785.

[8] Ali I., Sadiddin A., Cattaneo, A. Risk and resilience in agri-food supply chain SMEs in the pandemic era: a cross-country study. International Journal of Logistics Research and Applications; 2022; 26(11):1602-1620.