Study on the Dynamic Mechanism of Utilizing Industrial Cluster to Improve the Comparative Advantage of Chinese Grain

Hong-bing YOU$^{1,2,*}$, Shu-min MA$^1$ and Da-yan LIN$^{1,2}$

$^1$School of Economics & Management, Nanjing University of Science & Technology, Nanjing, P.R. China

$^2$Research Center for International Economy & Trade, Nanjing, P.R. China

*Corresponding author

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Abstract. Sufficient and stable supply of grain is the core of grain security. Since proposed, the industrial cluster theory has been gradually applied to the agricultural field. Since the reform and opening up, China's grain productivity has been substantially increased, but domestic grain supply is still inadequate. Although the agriculture in the optimized development area of our country is relatively developed at present, the grain production in the moderate development area and the protection development area are not optimistic. The major international grain export countries have formed the development model of grain industry cluster such as specialization and regionalization of grain production. China can draw lessons from their experience in many aspects, like providing advanced agricultural education, science and technology, and strong government security policy. Therefore, China should adjust the distribution of grain industry reasonably, actively guide the development of leading enterprises of grain industry, establish and improve the supporting policy of grain industry, and promote the development of grain industry cluster of our country across the board. All these will help lay a solid foundation for China's food security.

To the Country people is all-important, to the people foodstuff is all-important. Sufficient and stable supply of grain is the core of grain security. Nowadays, the constraints of domestic resources and environmental elements have been increasingly obvious and the productivity of agricultural technology have met with growth slowdown, leading to the cost increase of the domestic grain production and the labor. Grain import usually makes the grain price decrease, and the increased planting cost and decreased grain price are bound to substantively weaken the market competitiveness of the Chinese grain industry. As a result, China can’t realize adequate grain supply, which thus causes the of grain security. Therefore, the urgent tasks are to pay attention to the food security of our country, to improve the comparative advantage of our grain industry, and to enhance the competitiveness of the Chinese grain industry in the international market. Not only can the industrial cluster gain the benefits of scale economy and reduce the cost, it can also utilize the resources and exchange information and experience more efficiently, and then improve the competitive advantage of industries. In short, as a new way of organization, the industrial cluster can enhance the comparative advantage of the original industries and even create a new comparative advantage.

Literature Review

Up to now, there have been many successful cases of industrial clusters in many fields including industrial, commercial and high-tech industries, such as the Silicon Valley Information Industry Cluster in the U.S.A, the Toyota Motor Industry Cluster in Japan and the Manufacturing Industry Cluster in Italy, and so on. These successes gradually permeated and were extended to the fields of agriculture and forestry, such as flowers and nursery stock (Zheng Fengtian et al, 2006), scallions, wine, apples, vegetables and other agricultural areas (Bai Xiaozhong et al, 2012).

Foreign specialists have studied the dynamic mechanism of industrial cluster from the perspectives of both economics and biology. The supply of raw materials, convenient
transportation, professional talents and the spillover effect of technology are driving factors of the industrial cluster (marshall,1890); the interaction among factors of production, transportation cost and returns to scale leads to industrial clusters (krugman,1991).The industrial cluster is the main driving force of regional or national core competitiveness (porter,1990). Ahokangas(1999) pointed out that industrial cluster was a biological system with a complete life cycle, and that the evolution rule of survival of the fittest was also applicable to the process of industrial cluster.

For the dynamic mechanism of industrial cluster, foreign scholars have designed three classical models, namely diamond model, collective efficiency model and flexible specialization model. The flexible operation of the company is the dynamic mechanism of the industrial cluster, and the product difference from flexible operation is obviously beneficial to the technological innovation (donwells,2001). The demand accumulative effect of professional market has led to the rise of industrial clusters, providing a shared sales platform for the majority of SMEs (Yang Qixing, 2011); Learning, competition and cooperation, diffusion and spillover, organizations are the dynamic mechanism of innovation in industrial clusters (Peng Yuwen, 2012); Government encouragement and guidance, external economies, cooperative symbiosis, learning and innovation constitute the dynamic mechanism of the sustained growth of industrial cluster (Jiang Xia, 2014). However, the dynamic mechanism of industrial cluster varies in different development stages of the same industry and in different industries(Yang Hongyan, 2009).

With the passage of time, the perspective of industrial cluster research gradually extends to the agricultural field. The calling of natural resources, the gestation of social and cultural environment, the drive of leading enterprises and the policy support of the government are the dynamic mechanism of rural industrial cluster (Yang Tongwei et al, 2012). For agricultural industry clusters of planting, forest and fruit industry, aquaculture, processing industry, leisure and sightseeing industry, the main driving forces are the inducement of resource endowment, the extension of industrial chain , the drive of leading enterprise, the inheritance of agricultural culture, the calling of market environment and the advocacy of the government administration(Yan Zili, et al 2014). The dynamic mechanism of modern agricultural industry clusters stems from the self-induced mechanism, win-win cooperation mechanism, coordination mechanism and policy operation mechanism (Li Tongshan, et al, 2017).

Relevant research on the dynamic mechanism of agricultural industry cluster has enriched the theory of agricultural industry cluster, which provides a relatively detailed theoretical basis for promoting the development of agriculture, and is helpful for the academic circles to further study on the theory and practice. However, there are still little research on grain industry cluster and the dynamic of sustained growth in the field of agriculture. As an major agricultural country with large population, the sustainable development of China's economy is inseparable from agricultural development, and the agricultural industry cluster is of great significance to the stable food supply and the improvement of China's comparative advantage in grain industry. Therefore, it is very necessary to study the agricultural industry cluster.

Overview of the Development of China’s Grain Industry

Recent Development of China’s Grain Industry Cluster

China's economic growth is inseparable with the development of agriculture. The total grain output in China has increased from 113.18 million tons to 617.91 million tons from 1949 to 2017, with the average annual growth rate of grain output in China far exceeding the average growth rate of population in the same period. Thus, China's grain industry has made rapid progress since the founding of the people's Republic of China.

In recent years, China has launched a series of policies to develop agriculture. For example, in 2014, the CPC Central Committee and the State Council's opinions on comprehensively deepening rural reform and speeding up agricultural modernization (document No. 1 of the Central Committee) proposed that "China should constantly improve the national food security system, establish a long-term mechanism for sustainable agricultural development, and strengthen system of
agricultural support and protection, providing strong support for the development of China’s grain industry. Although China's grain production capacity has greatly improved, it is still difficult to meet the demand for grain. According to the 2018 Statistical Bulletin of the people's Republic of China on National Economic and Social Development, compared with that in 2017, China's grain planting area in 2018 decreased nine hundred and fifty thousand hectares, and the total grain output decreased 3.71 million tons, a decrease of 0.6 percent. Rapid economic growth gradually changes people's consumption and even eating habits, and it also alleviates pressure on food demand to a certain extent.

Main Problems in the Development of China's Grain Industry Cluster

At present, China’s grain industry is mainly based on the traditional household planting mode. With the development of science and technology, many developed countries have already adopted more cost-saving production mode and production technology, but China's grain planting hasn’t completely got rid of the traditional modes of planting, production and marketing. Compared with the developed grain exporting countries, China’s production cost of grain industry is bigger and the profit is less. Take the grain planting of an ordinary family in Jiangsu Province as an example. This family has about ten acres of farmland and 1 to 2 laborers. Climate in Jiangsu is suitable for two crops a year, rice and wheat. About 50 jin (1 jin= 500 grams) of urea fertilizer and 100 jin of compound fertilizer are needed per mu of land, with the total cost of chemical fertilizer amounting to 3300 yuan a year. Cost of pesticides is about 2000 yuan a year. However, the annual gross profit of grain is about 13000 yuan to 15000 yuan, and the net profit is very small. If the harvest fees and land management fees are included, it is easy to find that the planting cost of ordinary farmers (including material costs and manpower costs) is relatively high. Besides, planting and marketing mainly depend on manpower with low efficiency.

The development of grain industry cluster is inseparable from the support of government policy. Its development includes grain planting, production, processing and marketing and other links. Only by closely linking them together can a perfect and sustainable industrial cluster be established. Therefore, corresponding government policy support is needed at each link. However, China's grain industry cluster started relatively late and the actual situation and development environment of China are different from developed grain export countries, so how to make targeted policies is the problem that China must face in developing grain industry cluster.

Experience of Dynamic Mechanism of Grain Industry Cluster in Major Grain Exporting Countries

Specialized and Regionalized Production

The United States is rich in land and resources, and regional climate differences lead to differences in agricultural resource endowments. Therefore, the United States Respects agricultural production and provides scientific guidance for agricultural development in different regions, finally forming highly specialized and regionalized agricultural production. By 2017, the United States had established 10 specialized agricultural production zones, most of which are in the northern and central plains and along the Pacific Ocean. Regional distribution contributes to the formulation of America’s grain industry cluster and also makes food production more specialized.

Advanced Agricultural Education

The United States is short of labor force, which is less than 2% of the nation's population. Therefore, the United States attaches great importance to the development of labor- intensive modern agriculture featuring mechanization and informatization. The American government has always attached importance to the sustained investment in agricultural scientific and technological advancement. Advanced agricultural education enables agricultural practitioners to actively adopt industrial cluster, a new type of organization. Similar to the United States, Canada also attaches
great importance to agricultural education and research in agricultural science and technology, and establishes agricultural experimental bases throughout the country to better integrate scientific research with production and application.

**Advanced Science and Technology**

The rapid development of science and technology has undoubtedly injected new vitality into the grain industry of the United States, Canada and other grain exporting countries. For example, the combine harvesters equipped with satellite positioning system can reduce the waste of grain harvesting, and the spraying of pesticides and fertilizers by aircraft can substantively reduce the human capital in grain production. Therefore, advanced science and technology has played a great role in promoting the development of their grain industry.

**Highly Supportive Policies of the Government**

The governments of major grain exporters, such as the United States, Canada and Australia. They attach great importance to the sound development of agriculture and build a highly developed agricultural insurance system. They gradually increase the proportion of premium subsidies and establish insurance system covering a wide range of crops to ensure farmers' income, which enhances capacity to resist natural disasters and risks. At the same time, these countries track and evaluate the implementation of agricultural policies, and constantly revise and improve relevant policies according to the evaluation results, which greatly promotes agricultural productivity and profitability.

**Dynamic Mechanism of China's Grain Industry Cluster & Countermeasures**

**Factors Influencing the Dynamic Mechanism of China's Grain Industry Cluster**

**Internal Factors.** The diamond model theory enlightens us that the internal factors influencing the dynamic mechanism of the formation of China’s grain industry cluster are mainly resource elements or production elements. A country's production elements can be divided into two broad categories: low-end production elements and high-end production elements. Low-end production elements mainly include natural resources, climate, geographical location, population and so on. High-end production elements are a kind of soft power, including education and scientific research input for agriculture.

In terms of low-end elements, China has abundant natural resources, the climate and water resources of various regions are different. For example, the climate of the optimized development area is more suitable for planting food crops like rice, corn, wheat while the moderate development area is not suitable to grow rice, and more suitable for cotton, maize and so on due to the drought. The protection development area has distinctive plateau climate, which is not suitable for the grain crop planting and is beneficial to the development of animal husbandry.

Therefore, we can consider regionalized agglomeration of grain industry and give full play to the comparative advantage of the main areas of grain producing, which reflects the importance of high-end production elements. Through the analysis of the grain production experience of other countries, we can find that the popularization of agricultural knowledge and the scientific and technological production are one of the key factors in the development of grain production and even the whole agricultural development. Compared with other major agricultural countries, the popularization of agricultural education in China is insufficient, and the effect of spreading agricultural science and technology is not satisfactory.

**External Factors.** Based on the development experience of developed agricultural exporting countries s like the United States and Canada, the external factors influencing the formation of China's grain industrial cluster can be summarized into three aspects: the lead of leading enterprises, market demand and the support of government policies.
Countermeasures & Suggestions

**Rationally Adjusting the Grain Industry Distribution.** Different grain production areas should give full play to their regional comparative advantages. The optimized development areas are the main production areas of soybean, corn, rice, peanuts, wheat, oil, and milk. With superior natural conditions and rich land resources, the optimized development area can be turned into the reserve base of grain strategy and the production and processing base with competitive advantages. Due to their fragile ecology, moderate development area and protection development area should take improving grain quality as the primary goal, adjust production structure reasonably, and make great efforts to realize the sound development of grain industry.

**Actively Guiding the Development of Leading Enterprises in Grain Industry.** The sound development of leading enterprises will contribute to the formation of large grain production bases. As the main body of modern grain industry, leading enterprises will become an important force of stabilizing grain production and ensuring grain security. Thus, they should, in accordance with the requirements of high yield, high quality, high efficiency, ecology and security, establish standardized and large-scaled grain production bases and increase capacity of grain production and supply guarantee. The development of leading enterprises can also help make the grain production more organized. In order to galvanize the enthusiasm of leading enterprises, the government should differentiate agricultural policies to offer the leading enterprises some preferential conditions, such as easier access to loans and agricultural subsidies.

**Establishing and Perfecting the Supportive Policies of Grain Industry**

1. **Perfecting the fundamental construction of grain industry to reduce the cost of grain production**
   The government should give strong support to the development of chemical fertilizer, pesticides, agricultural film, agricultural machinery and other grain planting facilities, increase the subsidies for infrastructure so as to reduce the planting cost of grain industry. In addition, the government should take preferential and supportive measures in capital, tax and other aspects, accelerate the construction of a large number of grain planting leading enterprises and speed up the technological transformation of enterprises.

2. **Perfecting land use system to promote farm development**
   At present, the development mode of Chinese grain planting industry lacks diversity. The experience of the major agricultural developed countries in the world tells us that the production and operation of the farm mode can better help give play to the comparative advantages of industrial cluster. Although our country implements public ownership of land, it can provide stable material basis and conditions for the development of family farms by perfecting land use system, drawing up complete laws and regulations on land control, and distributing land interests reasonably.

3. **Establishing agricultural insurance system to improve the capacity of grain production industry to resist risks**
   International experience tells us that sound systems of agricultural insurance and disaster subsidies will improve the capacity of grain production industry to resist natural risks. China should speed up the construction of the pilot policy insurance and make strict regulation on the types of insurance and the scope of risks. China should also establish insurance companies for agriculture as soon as possible and support these insurers by providing them with necessary subsidies allowed by the WTO.

4. **Popularizing agricultural education to continuously improve the science and technology in grain production**
   The experience of major agricultural countries in the world shows that government’s investment in science and technology, education or infrastructure construction all can reduce farmers’ planting cost more or less. The development of agricultural modernization is separable from scientific and technological innovation. China should pay attention to the cultivation of agricultural scientific and technological personnel, increase the investment in agricultural scientific research and give full play
to the advantages of science and technology in optimizing agricultural production and operation and in reducing the production cost. Local governments can improve agricultural growers’ knowledge by regularly popularizing education in agricultural production and operation and introducing scientific and technological agricultural planting machinery.

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