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# The Construction and Competitiveness of Operation Model of Agricultural Industrial Cluster

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**Abstract** Through reviewing the viewpoints of former scholars, the connotation and features of supply chain of agricultural industrial cluster are introduced. The agricultural industrial cluster model constituted by core network and supporting network is constructed. Three operation models of this kind of supply chain is described: the model takes wholesale market of agricultural products as the core; the model take pillar industries of agricultural industrialization as core; model takes the chains of retail enterprises as core. The competitiveness of agricultural industrial cluster is researched. The research assumes that the competitiveness of supply chain of agricultural industrial cluster is mainly represented to make the agricultural industrial cluster to acquire more capabilities in terms of innovation and knowledge sharing capability, resource allocation capability, agile market adaptability and distinct value creation capability.

**Key words** Supply chain of agricultural industrial cluster, Operation model, Competitiveness, China

Cluster supply chain is a new enterprise network organization form and the combination of industrial cluster and supply chain<sup>[1]</sup>. In recent years, the theory on cluster supply chain becomes mature gradually. Through empirical analysis, LI Ji-zi *et al.*, proved the industrial cluster of the theory to textile industry<sup>[2,3]</sup>, industrial cluster of optics and optoelectronics industry<sup>[4]</sup>, industrial cluster of IT industry<sup>[5]</sup> *et al.* The theory has displayed an important role in improving the competitiveness of industry. In the field of agricultural economy, the single research on agricultural industrial cluster and the supply chain of agricultural products has become mature. However, due to the geographic limit of agricultural production and popularity of consumption on agricultural products, season of agricultural production and annual period of consumption on agricultural products; limitation of agricultural production and global features of consumption on agricultural products, the contradiction of time and space between agricultural production and consumption on agricultural products is caused<sup>[6]</sup>. In view of the overall situation, the industrial cluster development of Chinese agriculture has not fully displayed its competitive advantages and innovative advantages. In Chinese agricultural industrial cluster, the work division and cooperation are absent; the internal structure of cluster is similar to that of enterprises<sup>[7]</sup>, and the excessive competition exists<sup>[8]</sup>. The traditional supply chain of agricultural products is in accordance with the economic developmental level at low level. Under such supply chain, the quality of agricultural products and the capital collection problems of small and medi-

um-sized enterprises in rural areas become serious<sup>[9]</sup>. In recent years, some scholars begin to analyze the agricultural industrial cluster problems from the perspectives of supply chain management, the internal connections between industrial cluster and supply chain are analyzed from macro perspectives<sup>[10]</sup>, the concept and organization model of agricultural supply chain cluster is put forward<sup>[11,12]</sup>. So far, no scholar has analyzed the operation model of supply chain of agricultural industrial cluster combining the different features of agricultural products. The research on the internal structure and competitiveness of the new organization of agricultural industrial cluster supply chain from the micro perspective is absent. Through comparing the features of agricultural industrial cluster, supply chain of agricultural products, supply chain of agricultural industrial cluster, the connotation, structure and operation model of agricultural industrial cluster supply chain are analyzed. On the basis, the competitiveness of supply chain of agricultural industrial cluster is evaluated.

## 1 Connotation and features of supply chain of agricultural industrial cluster

As for the supply chain of agricultural industrial cluster, there is no unified definition of it in academic circle. YI Zhenglan (2009) thought that in specific place of agricultural industrial cluster, many research and development institutions, suppliers, manufactures, processing enterprises, wholesalers, retailers and even end-users *et al.*, revolving around agricultural industry and different sections of related industrial value chain are connected by "suppliers-customers" relations and the informal and formal "trust and credit" contract, to form the supply chain of agricultural products on the basis of local integration. The non-uniqueness of core enterprises in supply chain of agricultural products and similarity of production in the cluster cau-

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ses the multiple single-chains and similar production in supply chain of the area. That is to say,in the cluster supply chain of agricultural products, every enterprise in the single chain of agricultural products cooperates with each other; enterprises from different single-chain cooperate with each other. Besides, there are many small and medium-sized enterprises, which separate from single-chain of supply chain, but have professional supporting equipments, supplement the production of single-chain supply chain<sup>[11]</sup>. ZHU Jing-li (2009) thought that agricultural supply chain cluster is that in a certain area, there are many economic main bodies on the basis of agriculture and related industries. These economic main bodies constitute a interactive supply chain network. Taking the network as a core, multiple enterprises and affiliated enterprises constitute a collection of enterprises. These enterprises exist the division cooperation among enterprise at upper stream and downstream on the basis

of value chain<sup>[12]</sup>. The scholars have given different definitions of supply chain of agricultural industrial cluster from different perspectives, but the essences are all the same. In the area of agricultural industrial cluster, agriculture or the enterprises related to agriculture are the main bodies and the value chain is the basis. In the cluster, the vertical enterprises have advanced work division and cooperation and horizontal enterprises have relatively complete network of structure system of supply chain.

According to the above definitions, the paper analyzed the features of the three organization models covering agricultural industrial cluster, supply chain of agricultural products, supply chain of agricultural industrial cluster( Table 1 ). The results assume that agricultural industrial cluster supply chain has the features of flexible organization, smooth information and the advanced cooperation of clustering enterprises.

**Table 1 Comparison of agricultural industrial cluster, supply chain of agricultural products and agricultural industrial cluster supply chain**

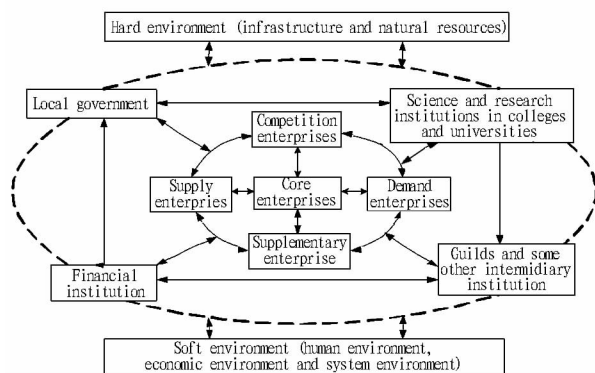
Items	Agricultural industrial cluster	Supply chain of agricultural products	Supply chain of agricultural industrial cluster
Geographic restriction	There is geographic restriction	There is no geographic restriction	It can not only satisfy the demand of agricultural production on geography, but also has the supply chain features of global agricultural products consumption
Core enterprise	There are multiple pillar enterprises	There is a pillar enterprise	There are multiple pillar enterprises
Information among enterprises	Asymmetric and unsmooth information among enterprises	Asymmetric but smooth information among enterprises	Symmetric and smooth information among enterprises
Organization institution	the organization includes governmental department, science and research institution, intermediary organization, financial institution and related supporting institutions	the organization does not include governmental department, science and research institution, intermediary organization, financial institution and related supporting institutions	the organization includes governmental department, science and research institution, intermediary organization, financial institution and related supporting institution
Relations of competition and cooperation	Ignoring the competition and co-operation relations of different supply chain among cluster enterprises	Ignoring the trans-chains competition and cooperation relations among supply chain	laying stress on the competition and co-operation relations of different supply chains of enterprises

2 Structure and operation model of agricultural industrial cluster supply chain

**2.1 Structure of agricultural industrial cluster supply chain** In fact, agricultural industrial cluster supply chain is composed by core network and supporting network, which is represented on Fig. 1. Core network is composed by vertical network ( core enterprises in value chain, supply enterprises in upper stream and demand enterprises in downstream ) and honrizotal network ( core enterprises, supplementary enterprises and competitive enterprises );supporting network is composed by social institutions in cluster( including science and research institutions in colleges and universities , financial institutions, local governments, guilds and some other intermediary institutions ),hard environment ( including infrastructure situation and natural resources) and soft environment( including human environment, economic environment, system environment ). Core network is the source for agricultural industrial cluster supply chain to creat values. Its pillar enterprises display not only the organization and control role in the whole network, but

also reflect the core competitiveness of network. Supporting network plays an important role in agricultural industrial cluster supply chain. It provides not only the system, infrastructure, human environemnt and some other hard and soft protection mehcanism demanded by core network, but also creates favot-able innovation mechanism for its development.

**2.2 Operation model of agricultural industrial cluster supply chain** Various kinds of agricultural products in agricutlural industries have different features. According to core enterprises, the paper divides agricutlural industrial cluster supply chain into three kinds of core models-the model taking whole-sale market of agricultural products as core; model taking pillar enterprises of agricultural industrialization as core and model taking retail enterpriess as core. The degree of industrilization, deep process level and circulation efficiency are the key factors that affect the selection of operation model of agricutlural indus-trial cluster supply chain; different models have different advan-tages and disadvantages; the same model may fit for multiple kinds of agricultural products and the same agricutlural products



**Fig.1 The structure of agricultural industrial cluster supply chain**

may select different models according to different external environment and science and technology level, so the operation model should be selected according to actual situations and by using the dynamic way. In the process of constructing the operation models of agricultural industrial cluster supply chain, the paper includes logistics into core network. The introduction of logistics may effectively overcome the time and space difference of agricultural products consumption and production and solve the contradiction of geography of agricultural production and global feature of agricultural products consumption.

**2.2.1** The model takes wholesale market of agricultural products as a core. The wholesale market of agricultural products is the trade center for a batch of primary agricultural products. It often selects the places, which have convenient transportation, are close to industrial basis and locate in cities and towns. The cluster supply chain and its core network, which take wholesale market of agricultural products as a core, are connected by the agricultural products supply chain on the basis of local conditions formed by suppliers of agricultural products, rural households, wholesale market of agricultural products, logistics enterprises, retailers, end-users. From the perspectives of the features of agricultural products, the major agricultural products in the operation model, which takes wholesale market of agriculture products as a core, are grain and cotton, which are the primary agricultural products with large yield and do not need deep processing. These agricultural products, such as grain and cotton, have long guarantee period and they will not go bad even without special packing and processing, so in the process of selling them, the rapid circulation is not the major target. In addition, these products do not need to add their value through deep processing. The value of these products after deep processing is not necessarily larger than the primary products. Besides, these agricultural products have wide and dispersed planting area, so the selling market is wide as well<sup>[13]</sup>.

**2.2.2** The Model takes agricultural industrialized pillar enterprises as core. Agricultural industrialized pillar enterprise is the one, which has reached a certain standard in terms of scale and operation and has been approved by relevant governmental departments. The pillar enterprise collects rural households through various interests and motivates rural households to enter market, so as to promote the organic integration and mutual pro-

motion of production, processing and marketing of agricultural products. The cluster supply chain and its core network, which take agricultural industrialized pillar enterprises as a core, are composed by the supply chain of agricultural products on the basis of local integration formed by suppliers of agricultural products, rural households, processing and manufacturing enterprises of agricultural products (agricultural industrialized pillar enterprises), logistics, distributors, end-users. From the features of agricultural products, the guarantee period of agricultural products in this model have short guarantee period and are easy to go bad, and the process of transportation may cause great losses, so they need processing and packing to elongate guarantee periods and improve transportation capability. From the perspective of consumption, the further processing of this kind of products can reflect the inner quality of the products and can well satisfy consumers' demands. so, these products should be processed to improve their inner value. From the perspective of industrialized degree, the planting scale of these kinds of agricultural products is smaller than or similar to that of the agricultural products in the above mentioned models. The production of these kinds of products are relatively concentrated and the demand of deep processing is the priority, so the purchasing demand is integrated by processing enterprises<sup>[13]</sup>.

**2.2.3** The model takes retail enterprises as a core. With the continuously expanded scale of agricultural products operated by retailers and the multiple and widely distributed branches owned by big chain supermarkets, different customers have different demands of the quality, variety and quantity of agricultural products. the cluster supply chain and its core network, which takes retailers as a core, is connected by the supply chains of agricultural products on the basis of local integration formed by suppliers of agricultural products, rural households, processing and manufacturing enterprises of agricultural products (agricultural industrialized pillar enterprises), guilds, logistics, retailers and end-users. From the perspective of the features, these kinds of agricultural products have shorter guarantee period than the former agricultural products, so even through deep processing, the products can not maintain its original quality, so the rapid logistics is needed to deliver the products to consumers as fast as possible. From the perspective of consumption, consumers have high demands on these kinds of agricultural products. They want both fresh and healthy agricultural products. Besides, compared with the former two kinds of agricultural products, the frequency of buying these kinds of products is more than that of buying other agricultural products, so the highlight is to satisfy the consumers' demands of convenience. From the perspective of the industrialized degree, the production scale of these kinds of agricultural products is relatively small and the intensity degree is higher than the two models mentioned above<sup>[13]</sup>.

With the development of agricultural industrial cluster, the labor division of cluster enterprises becomes more and more specific, the logistic connections among enterprises become more and more complex and the logistics outsourcing becomes

more and more frequent, so the construction of logistics organization system is necessary. At present, developing logistics organization system by using logistics enterprise model has become a trend<sup>[14]</sup>. The supply chain system of agricultural industrial cluster is a complex, open and dynamic system and its operation model evolves with the development of economy.

### 3 Competitiveness of agricultural industrial cluster supply chain

Agricultural industrial cluster supply chain is not the simple combination of agricultural industrial cluster and supply chain of agricultural products. the organic combination of the two can improve the competitiveness of agricultural industry. LI Ji-zi (2006) pointed out that cluster supply chain can realize the integration of marketing channels, logistics integration, cultural integration, technology integration and business process integration<sup>[15]</sup>. through concluding the opinions of the above scholars, it can be seen that the competitiveness of agricultural industrial cluster supply chain is mainly represented on that agricultural industrial cluster enterprises have strong innovation and knowledge share capability, resource integration capability, agile market adaptability and unique value creation capability.

**3.1 Innovation and knowledge-sharing capability** In the supply chain network of agricultural industrial cluster, the technological knowledge, demanding information, supply information, operation experiences are shared and disseminated, circling the agricultural material supply enterprises, rural households, processing and manufacturing enterprises of agricultural products, logistic enterprises, chain retailer enterprises and end-users of pillar industries and their complementary enterprises and competitive enterprises. The recessive knowledge needed in innovation processes should be learned from each other's experiences through face to face contact. Thus, the geographic location and business connection of enterprises should be connected. The enterprises should be close to suppliers and consumers to give convenience to communication. However, enterprises in agricultural industrial cluster are easy to realize the disseminating of recessive knowledge due to the short-distance geographic location, frequent business connection and cultural recognition and frequent move of staff, to get "knowledge spillover effects". Besides, the supply chain of agricultural industrial cluster can effectively promote the system and regulation of knowledge and technology, and eliminate the uncertainty and blindness of technology research behaviors. In all, agricultural industrial cluster supply chain can promote the technology communication and share among enterprises; obtain the overall knowledge and technology information needed by getting optimized overall efficiency; establish technology obtain, technology share, technology transformation and market and a series of mechanisms of each enterprises to form technology innovation system; improve technology innovation efficiency and success rate and maintain the continuous innovative motivation of cluster enterprises.

**3.2 Resource integration capability** Supply chain of agricultural industrial cluster can promote the trust and cooperation

among main bodies and create conditions for reaching mutual share and supplement of resources among main bodies. The resource integration capability is mainly reflected on the integration of logistics, capital flow and information flow.

**3.2.1 Logistics integration.** The logistics integration capability of agricultural industrial cluster is reflected not only on the effective integration of enterprises in vertical networks to logistics resources of upper stream and down stream enterprises. The supply chain can effectively launch the labor division and cooperation among members and provide high-quality logistics services according to the demanding features of logistics and the product supply conditions of each member in the supply chain. Besides, it can integrate the logistics equipments and resources of pillar enterprises, complementary enterprises, and competitive enterprises in horizontal network. Through scientific plan and reorganization, it can display the logistics equipment and service advantages of each enterprise and enlarge the scope of logistics services and space of goods distribution.

**3.2.2 Integration of information flow.** The frequent flow of staff from enterprises, relativity and geography of industry and business in the network of agricultural industrial cluster allow dual transmission of information among enterprises in cluster supply chain in short time, which ensures the symmetric information of each market main body in the cluster supply chain system and cuts down the costs of searching information and trade among enterprises.

**3.2.3 Integration of capital flow.** As a major channel for small and medium-sized enterprises in agricultural industrial cluster to collect capital, non-formal finance has alleviated the finance collecting restriction of small and medium-sized enterprises to a certain degree and played an important role in developing agricultural industrial cluster. However, with the demand of industrial upgrade, the capital demands of small and medium-sized enterprises have expanded rapidly. The private capital obtained by relying on social capital can not satisfy the capital collecting demands of enterprises. The agricultural industrial cluster chain takes the advantages in terms of location, human, industry, relatives and blood-related relations as ties, which is conducive to apply the capital collection model of supply chain of "N + N" model. The model is to realize the financial activities of "N" small and medium-sized enterprises motivated by the "N" pillar enterprises in the scope of the agricultural industrial cluster supply chain. The logistics enterprises play the role of agency and service providers for financial institutions to provide storage, distribution and supervision for loan enterprises to assist financial institutions to complete the capital collection of the whole pillar network enterprises. Enterprises in the supply chain of agricultural industrial cluster have symmetric and smooth information, so they can elongate their business chain to enterprises in the upper stream and downstream to integrate the capital flow in the whole chain. The integration of capital flow is conducive to widening the innovation space of rural financial institutions and forming rural finance with multiple levels.

**3.3 Agile market adaptability** The organization structure of agricultural industrial cluster supply chain is a dynamic, flat and

flexible structure, which can not only promote the expansion of enterprises in the cluster, but also abstract the alliance of enterprises without the cluster. Both the expanded enterprises and allied enterprises will enter the network automatically. The abstraction is not the simple combination of enterprises, but the flexible collection of enterprises on the basis of value chain. Furthermore, with the further specific labor division among enterprises of agricultural industrial cluster supply chain and the continuous improvement of professional degree, the cluster expands its scope along its industrial chain. Due to the continuous absorption of new information and new technology, enterprises can communicate with their employees timely; create a new network, which covers customers, suppliers and cooperative partners. Thus, their adaptability on external environment is intensified and they can master the market demand information to increase the flexibility of production model and management model within enterprises; well reflect the changes of external environment and market and intensify the overall competitiveness of agricultural industrial cluster supply chain.

**3.4 Capability of creating distinctive value** In the first place, in the cluster, pillar enterprises are easy to find the cooperative enterprises they need. It is conducive to letting pillar industries pay attention to their own central businesses and to let the third-party enterprises complete their non-central businesses. The elastic and targeted production way is conducive to pillar enterprises to make agile and timely response to uncertain external environment, and then reduce the surplus inventory in logistics process and cut down the costs of transportation and inventory. In addition, from the perspective of resource reliance, the supply chain of agricultural industrial cluster can realize the supplementary of various resources through horizontal connections among enterprises to provide a cooperative platform with shared resources and technologies for enterprises in the cluster. By using this way, the enterprises can share local assistant production, infrastructure and services, save of costs brought by supply of labor forces and training. In all, enterprises, which take agricultural industrial cluster as the platform, decreased the trade costs, cut down the operation costs of enterprises, elongated industrial chain and improved the added value of agricultural products, are contributed to the decrease of trade costs.

## 4 Conclusions

The geographic features of agricultural production are in accordance with the regional features of agricultural industrial cluster. The globality of consumption on agricultural products determines the supply chain network of agricultural products is trans-regional. In fact, if there is no supply chain in the cluster network of agricultural production, the products with same features and without differences in cluster will be caused, in the end, the vicious competition among enterprises in clusters will be caused. If the support of cluster with the features of network is absent, the supply chain system of agricultural products will become invalid for the lack of competition. Therefore, intensifying the combination of agricultural industrial cluster and the supply

chain of agricultural products can promote the development of regional agricultural economy and improve the competition of agricultural industry. But there are many uncertain factors in the operation process of agricultural industrial cluster supply chain. These uncertain factors may come from the external part of the supply chain system of agricultural industrial cluster, for example, the changes of market demand, uncertainty of policy environment; as well as internal part, for example, uncertainty of connection and coordination in each section of the chain. These uncertain factors may bring risks to the operation of cluster supply chain, at the same time, increase the hardship of management. Therefore, the effective risk management on agricultural industrial cluster supply chain should be implemented to fully display its competitiveness.

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