Agricultural Clusters in China

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1. Introduction

Even a cursory examination of the agricultural sector and rural communities in China today reveals evidence that industrial clustering is taking root in that country. Structural changes are clearly taking place in the agriculture and food industries, led by the so-called "dragon-head" enterprises that serve as integrators of production, sales, distribution and processing functions in the sector. The major dragon-head enterprises have established close cooperative relations with government arms and agencies, universities and other research institutes, as well as with players in the agricultural materials, food manufacturing, and food distribution industries. This has allowed them to operate highly diverse businesses, invest resources into research and development, drive innovation, and thereby gain competitive advantages. Furthermore, the advent of dragon-head enterprises has meant a new and ongoing accumulation of human, material, and financial resources, and not only from rural communities and surrounding areas, but from overseas as well. This phenomenon is the very essence of the formation of clusters, which have been defined as "geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (for example universities, standards agencies, and trade associations) in particular fields that compete but also co-operate" (Porter, 1998). In the same vein, agricultural and rural policies that seek to create "agriculture development zones" and attract dragon-head enterprises can be seen as cluster policies or cluster initiatives of a sort.

The purpose of this study is to assess the potential of clustering in the development of agriculture and rural communities in China. We shall examine in detail the food industry, which is the link in the food chain that propels the industrialization of agriculture, and identify instances of industrial agglomeration and business collaboration. Next, we shall analyze the externalities (i.e. spillovers) of clusters, demand conditions in cluster formation, and the effectiveness of business collaborations.

2. Existing research and the methodology used in this study

2.1 Research on agricultural clusters

Relatively little research has been done on clusters as they relate specifically to the agricultural and food sectors. There are some notable examples of studies, including Lagnevik, Sjöholm, Lareke and Östberg (2003), Hauknes (2001), Bertolini and Giovannetti (2003), and the European Monitoring Centre on Change (2006). However, the body of research into the role that agricultural cluster formation plays in the economic development of agriculture and rural communities is still small.

2.2. Research on cluster formation and regional development

Porter (2003) found that clusters affect regional employment, wage, and innovation levels to a great degree, which strengthened the theoretical foundations for the notion of regional development through cluster formation. There are also a number of studies that examine the role of clusters in regional development. For example, Rosenfeld (2002) and Porter, Ketels, Miller and Bryden (2004) analyzed clusters from the perspective of regional development in economically advanced countries, while Ketels, Lindqvist and Sölvell (2006), OECD (2005), Bojar and Olesiński (2007), Kuchiki and Tsuji (2005),

Sonobe and Otsuka (2006), Kuchiki (2007), and Ding (2007) took the same perspective but studied developing countries and East European countries. Another pertinent example is Puppim de Oliveira (2008), the thesis of which is that the key to innovation and dynamic economic development is "social upgrading" among SMEs and clusters in developing countries.

2.3 Research on cluster initiatives

Most conventional studies on industrial clusters do not explicitly state who or what drives cluster formation and translates the benefits of clusters into real economic results, nor the way in which such results are achieved. The development and competitiveness of clusters rely largely on organized campaigns called cluster initiatives (CIs), which seek to advance precisely these goals for those organizations that have ties to the relevant companies, the government, and research institutions within the region. Given this trend, one method effective for analyzing clusters is to focus not on the clusters themselves so much as on these cluster initiatives, taking into consideration the broad spectrum of circumstances in which these clusters were formed, and assessing them within the framework of cluster initiative models, i.e. examining what sort of influence factors such as initial conditions, purposes, and processes have had on the results. In the field of CI research, once the initial conditions, purposes, processes, and results are known, comparative analyses can be performed which measure the effects of those initial conditions, purposes, and processes on the results. In fact, a large-scale international CI survey project is currently underway by the Global Cluster Initiative Survey (GCIS), and as part of the project, studies by Sölvell, Lindqvist and Ketels (2003) and Ketels, Lindqvist and Sölvell (2006) have clearly identified the importance of CIs in cluster formation.

2.4 Research on the economic effects of clusters

Most existing research on the economic effects of clusters tends to focus on industrial agglomeration. Theories of economic growth in recent years have recognized that innovation is essential for sustained growth, that knowledge (or technology) spillover is the root of such innovation, and that industrial agglomeration contributes to economic growth by promoting spillover. Therefore, it is possible to think of an economy of agglomeration as a manifestation of a dynamic external economy. The external economic effects of what we know as "spillovers" were noted by Marshall (1890), formulated by Arrow (1962), and applied to endogenous economic growth models by Romer (1986). According to Glaeser et al. (1992), dynamic external economies can be classified according to differences in the locations and market climates in which spillovers occur. Spillover can occur within a single industry or among different industries. It can also be spurred on by monopolistic/oligopolistic markets on one hand, and competitive markets on the other. Marshall (1890), Arrow (1962), Romer (1986), and Porter (1990) focused on spillover within a single industry, and theorized that regional specialization in an industry contributes to economic growth. Marshall (1890), Arrow (1962), and Romer (1986) speculated that monopolistic market structures facilitate spillover, but Porter (1990), in contrast, holds that competition promotes spillover. Jacobs (1969), on the

other hand, places an emphasis on spillover among different industries, asserting that the agglomeration of diverse industries drives the creation of ideas and facilitates innovation. By extension, industry diversification contributes to economic growth.

It should be noted that because it is practically impossible to measure spillover directly, most empirical research relies on analyses of the relationship between industrial agglomeration and economic performance. For example, Glaeser et al. (1992) use an employment growth approach to perform an empirical analysis that explicitly adopts the notion of dynamic external economies through industrial agglomeration, while Beeson (1987), Dekle (2002), and Henderson (2003) take total factor productivity approaches to the same. However, as McCann (2008) points out, there are problems inherent in economic analyses of industrial agglomerations posed by understandings of the agglomerations themselves. Specifically, industrial agglomerations may make it easier for spillovers to occur, but that does not mean that spillovers necessarily *do* occur because of industrial agglomeration. When examining agglomeration economies, it is at least necessary to know the extent of business collaborations. However, exhaustively ascertaining all business collaborations among companies would require a study of massive proportions involving micro-level data. As is clear from the above, many issues remain for the study of the economic effects of clusters.

2.5 Methodology employed in the present study

Porter's (1998) Diamond Model, arguably the best-known model of industrial clusters, analyzes industrial clusters through interactions among factor conditions, demand conditions, related and supporting industries, and corporate strategy, structure and rivalry. Hence, a synthesis of research into the structures and formal mechanisms of industrial clusters and quantitative research is necessary. For this reason, in this study, as Figure 1 shows, we look at clusters from a comprehensive standpoint, focusing chiefly on business collaborations but also taking into account the factors that define those collaborations and their relationships to economic performance. First, case studies are used to clarify issues involving cluster initiatives and business environments. This is followed by quantitative analyses of economic effects. Two analytical methods are used. The first applies a method for analyzing industrial agglomerations to rural economies. The second method consists of quantitatively analyzing the relationship between business collaborations among companies and economic performance. Collaborations and resulting economic performance levels were ascertained using questionnaire surveys targeting the food industry, the industry which drives the formation of agricultural clusters. The relationship between the two is derived from the surveys.

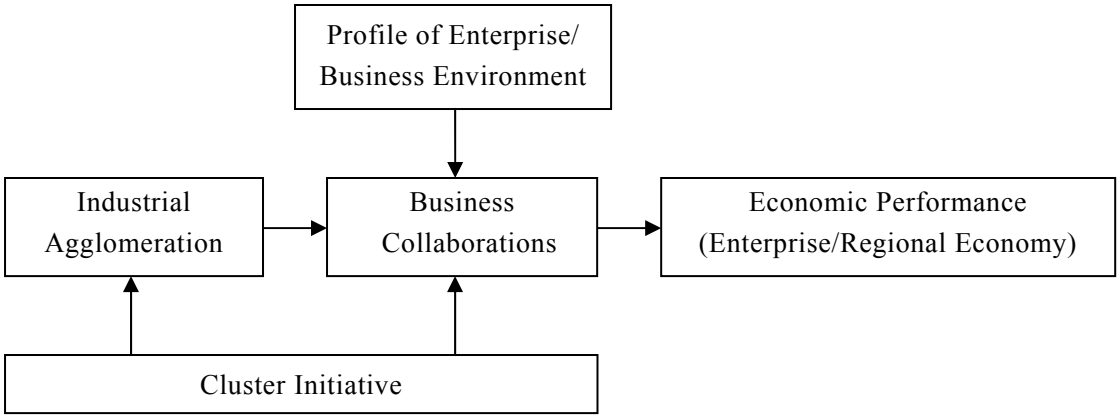


Fig. 1 Analytical Framework in This Research

3. Analysis of agricultural clusters

3.1 Overview of the agricultural clusters

It is quite difficult get an exhaustive picture of agricultural clusters in China, but we have so far conducted several surveys of representative agricultural clusters in that country (Kiminami and Kiminami, 2009b). The present discussion will focus on a dairy cluster in Inner Mongolia and a hops cluster in Xinjiang.

3.1.1 The dairy cluster in Inner Mongolia

A dairy cluster has formed in Inner Mongolia, led by dairy companies.[1] There are 110 dairy companies in Inner Mongolia, and almost all of them have contracts with dairy farmers for procuring raw milk. In 1994 the Yili Group began construction on a dairy resource base. At present it has five large resource bases, located in Hohhot and the Hulunbuir Prairie in Inner Mongolia, and the Dorbod, Xi'an, and Jin-Jing-Tang regions in Heilongjiang Province, where they have 300,000 head of dairy cattle and produce 300,000 tons of milk annually. Mengniu Dairy is a private company established in 1997. Mengniu has dairy resource bases spread out around the country, in Inner Mongolia, Heilongjiang Province, Hebei Province, Henan Province, Shanxi Province, and Qinghai Province. It produces 1,500,000 tons of milk annually, and has certifications in standards such as ISO 9001, ISO 14001, OHSAS 18001, CMP and HACCP.

3.1.2 The hops cluster in Xinjiang

The Xinjiang Uyghur Autonomous Region is known for its production of hops, and is in fact the largest hops-growing area in China. At the center of Xinjiang's hops production and processing operations and the core of the hops cluster is Xinjiang Sapporo Agricultural Science & Technology Development Co., Ltd. (hereinafter "Xinjiang Sapporo"), located in Fubei. Xinjiang Sapporo was joint venture created in 1987 through investments by the Suntime International Economic Cooperation (Group) Co. Ltd. (contributing 50%), Sapporo Breweries (45%), and Toyota Tsusho (5%). Of

[1] Dagula and Kiminami (2009) offer a comparison of corporate-led dairy farming, dairy farming relying on government assistance, and traditional dairy farming.

these three companies, Suntime is under the administration of the 222nd regiment of the Xinjiang Production and Construction Corps (XPCC). The Japanese side supplied cash and the Chinese side supplied the land. The funds invested amounted to six million yuan, and from 1987 the registered capital of the company had risen to over 40 million yuan.

Hops production began on a trial basis in 1987, and was expanded in 1992. Production levels peaked in 2002. A subsequent supply-side surplus drove prices down, so from 2002 to 2004 production levels were cut, but since 2005 they have been on the rise again.

Tracts of 800 × 800 meters are the standard size for hops fields operated by Xinjiang Sapporo, which are in two main locations. One is a 3,500 *mu* field where hops destined for Europe are grown. The second is a 1,600 to 2,000 *mu* field, of which the top third of the yield in terms of quality is exported to Japan. Pesticide levels for hops to be exported to Germany and the United States comply respectively with EU and U.S. standards, while hops to be exported to Japan are grown without pesticides. Experiments on different hops varieties are conducted using varieties developed exclusively by Sapporo Breweries. The development of hops varieties ordinarily takes about 20 years. Once the hops are harvested, they are either dried, pulverized and made into pellets, or made into a paste-like hops essence by extracting the bittering ingredients and oils. The hops processing procedures were certified as compliant with ISO 9002 in 1998, and with ISO 14001 and HACCP standards in 2006. Sapporo Breweries is the only importer in Japan, but there are several buyers in the Chinese domestic market, some of which have Japanese investors not related to Sapporo Breweries.

3.2 Business collaboration

Business collaboration in the dairy cluster involves cooperation between production businesses and processing businesses. The Yili Group and Mengniu Dairy both employ the same business model, which we might call the "company-farmer" model. In this company-farmer model, the companies contract with farmers in the community. The companies provide technologies, services, and capital to the farmers, who in turn supply the companies with milk. Dairy cattle are raised in stalls and given feed three to four times a day. The feed used is mainly silage, corn stalks and feed blends. The companies give technical guidance to dairy farmers according to their contracts. The scale of these farming operations, however, is quite small, averaging about five head of dairy per household.

Business collaboration in the hops cluster also takes the form of cooperation between producers and processors, but it is cooperation among three "parties": the beer industry, the XPCC, and farmers. Most hops production is contracted out to farmers. In fact, only about 5% of all farming land is managed directly by the company. The farms themselves, which are leased out by the XPCC, were originally used to grow wheat and rapeseed. Contracts are formed on a 12 *mu* per farmer basis. If there are more farmers in a farming family that can invest more labor, the contracted area increases. Technical assistance is provided by the company, and farmers work according to standards prepared by the company. Whenever farmers choose to borrow funds, the company serves as a loan guarantor. Farmers usually assume the costs of production under the contracting methods employed. However, the building of relationships between these two very different

entities, i.e. a company and farmers, is said to be very difficult. One solution that could be effective in overcoming this difficulty is to create a cooperative that acts as an intermediary and deals with issues between the company and the farmers.

In both cases described above, business collaboration is largely in the form of the procurement of raw materials by food producers, and is therefore characterized by little collaboration with parties in different industries or operating different types of businesses. Generally speaking, agricultural clusters are dominated by regionally specialized clusters of companies in the same line of business. Such clusters are highly efficient and possess much growth potential, but at the same time they face problems in the area of new product development. In terms of technological development, priority tends to be placed on the improvement and stable use of existing technologies.

3.3 The economic performance of the studied clusters

Both the dairy cluster and the hops cluster have grown. Each of them has produced considerable economic results.

In the dairy cluster, the yearly net returns for farmers per milking cow are over 1,300 yuan. Silage and corn stalks are purchased from non-dairy farmers, including those in poor households. The sale of corn stalks and other materials for feed therefore also contributes to higher incomes among poor households.

In the hops cluster, company sales in 2005 amounted to 37 million yuan, and operating profits were 14 million yuan. The cluster has gained the reputation of being one of the most profitable industrial agriculture operations. Hops farmers, for their part, earn 3,000 yuan per *mu*. This is a high level of profitability for both parties, attesting to the enormous economic benefits derived from the cluster. It should also be noted that land devoted to hops production does not account for a very large ratio in terms of area within the community's agricultural economy. The 222nd regimen of the XPCC runs 9,380 hectares of farmland, of which only 470 to 540 hectares is used for growing hops. Hops, however, accounts for 10% of the overall income of area farmers, making it the most economical and stable crop among those grown by the XPCC.

3.4 External diseconomies of agglomerations

Industrial agglomeration can cause not only external economies of scale, but also external diseconomies as well. In the dairy cluster taken up here, for example, disposal of excreta from dairy cows has become an increasingly pressing problem with the increase of contracted farmers. Many farmers either use dung from dairy cows for fuel and fertilizer, or they discard it as waste. The large volumes of discarded dung pose environmental and health risks, specifically the dangers of contaminating the environment and spreading harmful bacteria. In 2006, in an effort to prevent environmental contamination and put excreta to use, the Yili Group began biologically reprocessing excreta from livestock areas into methane.

3.5 Clusters and CSR

Core companies in clusters often have corporate social responsibility campaigns. In the Inner Mongolia dairy cluster, these companies have poverty assistance programs for

impoverished regions and the poor in general. Unlike measures to fight poverty undertaken by the government, the poverty assistance programs of the Yili Group and Mengniu Dairy are comparatively small in their respective scopes. That said, most of the assistance provided through these anti-poverty activities is done so *gratis*. Assistance from the companies has become invaluable to areas not covered by analogous government programs, poor students, those with disabilities, and other disadvantaged people.

Also in the hops cluster, the XPCC has constructed housing for farmers. In addition to providing subsidies for construction costs, the XPCC also does construction work for essential services such as running water, etc.

3.6 Clusters and market competitiveness

The respective competitive environments of the agricultural clusters dealt with in this study differ in that the dairy cluster is relatively competitive, while the hops cluster is relatively monopolistic. In the diary cluster, intense competition over dairy resource bases has given rise to large discrepancies in the purchase price of raw milk among the companies. This has led to the problem of farmers selling milk to a company with which it does not have a contract out of a desire to maximize their selling prices. Furthermore, the phenomenon of "over-commitment" on the part of farmers has become a problem. For example, in some areas, there are two milking facilities owned by two different companies within the same village and the total demand for milk by the two companies ends up exceeding the production capacity of that village due to conflicting commitments. The ultimate cause is the fierce competition between the two companies over the milk supply, yet the result is that the profits of the companies and farmers alike are destabilized, and business sustainability suffers on the part of both the farmers and the companies. For this very reason, alternative business models that would stabilize the supply of raw milk resources are currently being explored.

These phenomena suggest that there is no unique relationship between market competitiveness and cluster development. They imply that cluster development is facilitated by competitive markets in some cases, but facilitated by monopolistic markets in others. A further observation is that the dairy cluster appears to conform to the external economies hypothesized by Porter, while the hops cluster corresponds to the external economies of Marshall, Arrow, and Romer.

3.7 Clusters and regional characteristics

Both the dairy cluster and the hops cluster are largely dependent upon the natural conditions specific to the respective areas. This is a major feature of agricultural clusters. For this reason, the cluster models discussed here are not necessarily reproducible in a generalized way. Instead, in the agricultural sector, clusters must be created in a manner that makes the most out of the advantageous features of each region.

3.8 Cluster initiatives

Table 1 shows a comparison of the dairy cluster and the hops cluster analyzed by cluster initiative models.

Table 1. Summary of Cluster Initiatives

Sector		Dairy Farming	Hops
Region		Inner Mongolia	Xinjiang Uyghur
Setting	Production Base	Within Province	Within City
	Level of Regional Economic Development	Low	Low
	Capital of Core-Organization	Domestic Corporation	Joint Venture Corporation
	Products Market	Domestic	Foreign > Domestic
	Demand	Expansion	High Quality, Differentiation
	Functions of Research and Development	Domestic	Foreign
	Related Policy	Model Project of Technology Research and Industrialization on Dairy Industry Poverty Reduction Policy	Basic Policy on Economic Development of The 11th 5 year Plan for Xinjiang Uygur Autonomous Region Economic Development
Objectives	Research and Networking	Milk Association	Joint Venture Corporation (Japanese Corporation)
	Commercial Cooperation	Solving Environment Problems	Promotion of Regional Economy
	Innovation and Technology	Stable Procurement of Raw Materials	Stable Production Technology of High Quality Hop
	Cluster Expansion	Procurement of Raw Materials	Foreign Capital Introduction
Process	Initiation and Planning	Corporation	Xinjiang Production and Construction Corps + Foreign Capital
	Governance and Finance	Corporation	Xinjiang Production and Construction Corps + Foreign Capital
	Framework	Provincial Level	City Level
Performance	Innovation	Organization	Process
	Improvement of Competitiveness	Domestic	International (Export to Japan, U.S. and Europe)
	Cluster Growth	New Farm Formation	Increased Employment
	Goal Fulfillment	Growth of Farmers' Income	Growth of Farmers' Income Improvement of Living Environment

3.9 Demand conditions for cluster formation

Porter's Diamond Model proposes demand as a condition for clustering and hypothesizes a relationship in which the pressure of customers with high levels of demand drives corporate innovation. Demand conditions have an effect on the transition from low-quality products and services that are easy to imitate to competitiveness rooted in differentiation, and with the advent of globalization the demand within a particular region dictates a shift in importance from large-scale volume to quality. It should be mentioned here that, generally speaking, once per capita income increases as a result of economic growth, food consumption does increase, but with that increase there is an accompanying trend in which consumption of relatively higher-quality goods increases, while consumption of lower-quality goods decreases. In addition, once a certain income level is exceeded, the quality in food consumption becomes more important than quantity. One can see evidence of this changing pattern of food consumption in China as well, as

the country continues on its path of economic growth. In Kiminami and Kiminami (2009a), the authors used the example of rice to conduct a survey by questionnaire in Shanghai targeting consumers of different income levels in order to determine which factors consumers base their choices on when purchasing food products. The six criteria presented as choices in the questionnaire for the purchase of rice were: price, taste, brand name, place grown, milling date, and cultivation methods.

Table 2 indicates consumer criteria in order of importance and according to income brackets when purchasing rise. While consumers in all income brackets listed "taste" as the most important factor when buying rice, the importance of price fell with the rise in income levels, and conversely the importance placed on brand (brand name/ place grown), quality (milling date) and safety (cultivation methods) rose. Put differently, we are witnessing a gradual shift in consumer behavior in rice consumption in Shanghai from the conventional emphasis on low-cost products, to brand-affiliated, high-quality, safety-conscious products.

Table 2. Order of Criteria in Purchasing Rice (Grouped by Income Level)

	First	Second	Third	Fourth	Fifth	Sixth
Total (N=301)	Taste (4.41)	Brand (4.32)	Price (4.22)	Area of Production (3.38)	Cultivation Method (3.16)	Date of Rice Milling (3.00)
Less than 50,000 yuan (N=219)	Taste (4.38)	Price (4.30)	Brand (4.28)	Area of Production (3.32)	Cultivation Method (3.08)	Date of Rice Milling (2.85)
50,000-100,000 yuan (N=43)	Taste (4.35)	Brand (4.26)	Price (3.88)	Area of Production (3.75)	Date of Rice Milling (3.55)	Cultivation Method (3.38)
Over 100,000 yuan (N=18)	Taste (4.65)	Brand (4.35)	Cultivation Method (4.18)	Date of Rice Milling (3.82)	Area of Production (3.78)	Price (3.71)

Note: Respondents who answered 'important', 'slightly important', 'have no preference', 'not so important', 'not important' are scored for 5, 4, 3, 2, 1 respectively.

Group interviews likewise yielded interesting results. The wealthier sectors of society indicated high levels of brand-consciousness and expressed dissatisfaction with rice currently produced in China, specifically with regard to the trustworthiness of quality, safety, product description and related claims. These groups also tended to rely on word-of-mouth reputations and their own purchasing experiences, and therefore desires for high-quality rice and rice packaged in small-quantity volumes were observed. In addition, since these higher-income groups are regularly exposed to Japanese products (including food products), the high-quality and sense of luxury that comes with imported Japanese rice not only meets their needs for rice, it is also in line with a style of consumption that is viewed as a means of achieving their ideal lifestyles. Ordinary rice consumers, on the other hand, place higher values on flavor and price, and tend to favor rice of a certain level of quality that is sold at reasonable prices. Also, since this

demographic is highly responsive to television and newspaper ads, the varieties of Japanese rice grown in Northeast China, whose flavor is close to that of rice grown in Japan but are sold at one tenth the cost of imported Japanese rice, not only meet their requirements but also seem to fit well with their patterns of consumption, which adheres to clearly defined objectives.

The analyses above show that, rice in China has become a product differentiated by place of origin, brand, variety, cultivation, and similar factors, that there is a strong demand for higher quality as consumer needs diversify, and that the consumer market for rice is in the process of transformation into a segmented one. At the very least it can be concluded that there is a base of customers with high demand levels in major Chinese metropolises such as Shanghai, the kind of customer base that facilitates the formation of clusters in the food industry. Furthermore, as China's economy grows, the number of areas fulfilling the demand conditions for clustering is bound to increase.

4. The economic effects of industrial agglomeration

It is difficult to clarify the economic effects of agricultural clusters statistically. Kiminami and Kiminami (2009b) analyzed the effects of industrial clustering on rural development in China through the estimation of production function.

Index of agglomeration of TVEs (IA) is defined as follows.

$$IA = NTVE / NTV \tag{1}$$

Where, NTVE is the number of TVEs, and NTV is the number of towns and villages

The Cobb-Douglass production function of TVEs is estimated by using the data of 31 provinces from *China Agricultural Statistics 2005*.

$$\log V = a_1 + a_2 \log L + a_3 \log K + a_4 \log IA \tag{2}$$

Where, V is the average value added of TVEs (10,000 yuan), L is average number of employee of TVEs (person), and K is the average net value of fixed assets of TVEs (10,000 yuan).

The result of estimation (2) is as follows.

$$\log V = -0.480 + 0.743 \log L + 0.533 \log K + 0.174 \log IA$$
$$(2.70)\ *\ (2.97)*\qquad (3.45)*\qquad (3.18)*$$
$$\text{adj.}R^2 = 0.947$$

The number in parenthesis is t-value, and * denotes significance statistically at 1% level.

The result of the above estimation shows that the parameter of IA is positive and statistically significant. It means that the higher rate of agglomeration of TVEs brings the higher value added of TVEs, which clarifies that the agglomeration improves the economic performance of TVEs.

Secondly, we shall clarify the effect of the growth of TVEs on farmer's income by estimating the formula as below.

$$log\ Y = b_1 + b_2\ log\ (\ TV / N\ ) \qquad (3)$$

Where, Y is per capita annual income of farmers (yuan), N is Population of rural areas (10,000 person), and TV is total value added of TVEs in each province (10,000 yuan).

The result of estimation (3) by using the data of 30 provinces[2] from *China Agricultural Statistics 2005* is as follows.

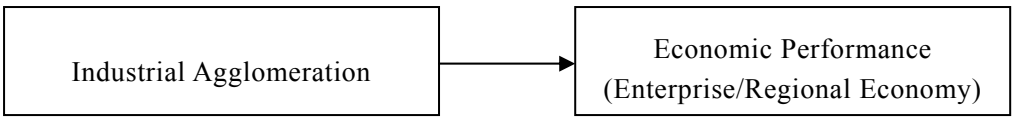
$$log\ Y = 2.067 + 0.392\ log\ (\ TV / N\ )$$
$$(12.93) * (9.09)*$$
$$adj.R^2 = 0.738$$

The number in parenthesis is t-value, * denotes significance statistically at 1% level.

The result of the above estimation shows that the parameter of TV/N is positive and statistically significant. It means that the higher per capita value added of TVEs brings the higher farmer's income which clarifies that the growth of TVEs increases farmer's income.

Figure 2 indicates the relationship between the index of industrial agglomeration and economic performance in the above mentioned analysis. The result shows that agglomeration of enterprises in rural area improves the performance of enterprise and increases in farmer's income as well. Therefore, it is considered that the strategies of industrialization through agglomeration economy are effective for rural economy.

Fig.2 Analytical Framework for Economic Analysis of Industrial Agglomeration



5. The economic effects of business collaboration

5.1 Analytical methods

Collaborations can be broadly defined as concrete activities undertaken by a company jointly with another company or companies for the purpose of pooling managerial resources that can be shared while still maintaining that company's own identity, i.e. without resorting to capital alliances, mergers, etc. Generally, business collaborations are thought of as ways of allowing companies to enjoy economies of scale and scope as well as synergies of which they would otherwise be unable to take advantage. Business collaborations among companies are noted for their potential to realize synergistic effects, namely by making use of networks outside a particular company and combining that company's own managerial resources with those of another company.

The area under investigation here is China's Heilongjiang Province, but we also conducted a similar survey in Japan's Niigata Prefecture. Heilongjiang and Niigata are not only close in a geographic sense, the two have a sister prefecture/province relationship. The cities of Harbin and Niigata are also "friendship cities" (akin to sister

[2] Tibet is excluded from the analysis because of the lack of farmer's income data.

cities), and because of these ties there is a considerable level of interaction between them, not to mention direct flights connecting the two cities. There are other reasons for choosing to compare China and Japan. One is to clarify the effects that differences in lifecycle phases in the foods market have on clusters. Another reason is that collaborations do not always end with other companies within a particular country; in the case of China they do in fact involve companies in other countries in the Northeast Asia. In order to clarify the extent of business collaboration among companies, a survey was conducted by questionnaire. The relationship between the features characterizing the business collaborations and their economic results were quantitatively analyzed. The survey upon which the analysis is based was conducted between June and October of 2008 and targeted food-related companies in Heilongjiang Province and Niigata Prefecture.

With the help of the Heilongjiang Province Agriculture Committee (via the Foreign Affairs Office of the Heilongjiang provincial government), the questionnaires for companies in Heilongjiang were distributed on July 3, 2008 and collected on August 15 of the same. Of the 100 food-related companies to which questionnaires were sent, 34 companies responded (response rate of 34%).

Companies within Niigata Prefecture to be sent questionnaires were sampled from those companies listed in "2008 Niigata Prefecture Company Directory" issued by the Economic Research Center of Niigata (companies with paid-in capital of 10 million yen or more that have 30 or more employees and responded to the survey). The numbers of sample companies by industry were as follows: four in agriculture, two in forestry, one in fisheries, 118 in the food production industry, 79 in the food wholesale industry, and 21 in the food retail industry. The number of companies sent questionnaires was 225, 79 of which responded (response rate of 35.1%). Questionnaires sent through the mail on June 26 of 2008, and the response deadline was July 31 of the same. The persons responding in the larger companies in the prefecture tended to be general affairs managers and mid-level business control managers, while the respondents from smaller companies were generally company presidents.

Tables 3 and 4 illustrate the profiles of the surveyed companies in Heilongjiang Province and Niigata Prefecture, respectively. A simple comparison of Heilongjiang and Niigata reveals that companies in Niigata tend to be older and on average have fewer employees.

Table 3. Profile of Surveyed Companies

	Number of Companies	Average Years of Operation	Average Capital Amount	Average Number of Employee	Average Capital Amount per Employee
	Companies	Years	1,000 yen, 1,000 yuan	Head Count	1,000 yen/person, 1,000 yuan/person
Heilongjiang Province	36	7.2	17,590	244	14
Niigata Prefecture	79	49.5	9,797	125	1,285

Table 4. Major Business Sector of Surveyed Companies (Unit: %)

	Agriculture	Fishery	Food Manufactur-ing	Wholesale Distributer of Food	Food Retailing	Others	Multiple Businesses
Heilongjiang Province	27.8	0.0	61.1	0.0	0.0	11.1	0.0
Niigata Prefecture	1.3	2.5	50.6	30.4	5.1	3.8	6.3

5.2 Business collaborations among food companies

The following is an analysis of companies whose major businesses fall under the categories of food production, food wholesale, and/or food retail. There were 73 companies in Niigata Prefecture (with five companies responding that they had multiple lines of business) and 22 companies in Heilongjiang Province that fit this description.

Table 5 represents the business performance of the target companies measured by changes in sales volumes and profit ratios over the past five years. Companies in Niigata exhibit an overall downward trend in business performance and large disparities between profitable and unprofitable companies. In contrast, nearly all of the companies in Heilongjiang show improvements in performance. Table 6 categorizes the surveyed companies according to whether they have business collaborations with other companies, universities, other research institutions, etc. and whether they intend to pursue such collaborations in the future. About 30% of companies in Niigata reported having business collaborations, while 70% reported no collaborations, and over have of those indicated no desire to pursue them in the future. On the other hand, about 60% of companies in Heilongjiang responded that they not only have business collaborations at present but intend to expand them in the future. Even the companies in Heilongjiang with no collaborations at the time of the survey responded that they were considering the matter.

Table 5. Changes in Sales Volumes and Profit Ratios over the Past 5 Years (Unit: %)

	Changes in Sales Volumes				Changes in Profit Ratios			
	Increase	No Change	Decrease	N.A.	Increase	No Change	Decrease	N.A.
Heilongjiang Province	90.9	4.5	0.0	4.5	90.9	0.0	4.5	4.5
Niigata Prefecture	22.8	21.5	46.8	1.3	12.7	15.2	62.0	2.5

Note: Highest scores of respondent ratio are marked respectively

Table 6. Situation of Business Collaborations with Companies, University, Research Institute (Unit: %)

Business Collaborations at Present	With Business Collaborations			Without Business Collaborations	
Business Collaborations in Future	Expansion	Keeping at Same Level	Contraction/ Cancellation	Considering	No Consideration
Heilongjiang Province	73.7	0.0	0.0	26.3	0.0
Niigata Prefecture	10.0	22.9	0.0	28.6	38.6

Note: Excluded the Companies (3 in Heilongiang and 3 in Niigata) with No answer or Null answer

Table 7 presents an overview of the business partners of the companies that either have business collaborations at present or are considering them (43 companies in Niigata and 19 companies in Heilongjiang). Many business partners in Heilongjiang are domestic purchasers of the companies' products or domestic companies in the same line of business, but a considerable number are also domestic research institutes, universities, and overseas companies. Domestic companies in the same line of business accounted for the largest number of partners of companies in Niigata, followed by domestic suppliers of raw materials and domestic purchasers of the companies' products.

Table 7. Partner of Business Collaborations (Unit: %)

	Domestic					
	Company in the Same Business	Supplier of Raw Materials	Purchaser of Products	Company in the Different Business	University	Research Institute
Heilongjiang Province	42.1	26.3	26.3	5.3	47.4	47.4
Niigata Prefecture	41.9	34.9	34.9	14.0	16.3	23.3
	Foreign					
	Company in the Same Business	Supplier of Raw Materials	Purchaser of Products	Company in the Different Business	University	Research Institute
Heilongjiang Province	31.6	0.0	15.8	0.0	0.0	15.8
Niigata Prefecture	7.0	7.0	2.3	0.0	0.0	0.0

As for the types of activities undertaken by partners in business collaborations, research and development topped the list in Heilongjiang Province, while production was the most prevalent in Niigata Prefecture (Table 8). Companies that have business collaborations (23 in Niigata and 14 in Heilongjiang) rate them as having certain positive effects and view them as especially beneficial for business stability and new product development (Table 9). However, responses from Heilongjiang were characterized by large numbers of applicable benefits listed per company, with many companies pointing to increased efficiency in their businesses.

Table 8. Types of Activities in Business Collaborations (Multiple Selection, Unit: %)

	Production	Sale	Purchase	Logistics	Research and Development	Receiving of Orders	Advertisement	Informatization
Heilongjiang Province	10.5	36.8	10.5	10.5	52.6	26.3	5.3	5.3
Niigata Prefecture	39.5	37.2	27.9	11.6	37.2	14.0	9.3	7.0

Table 9. Effect of Business Collaborations (Multiple Selection, Unit: %)

	Improvement of Business Efficiency	Expansion of Business	Stabilization of Business	Development of New Technology	Development of New Product	No Effect
Heilongjiang Province	71.4	35.7	71.4	35.7	64.3	0.0
Niigata Prefecture	13.0	34.8	47.8	26.1	47.8	0.0

As demonstrated above, business collaborations are not only more prevalent and more actively pursued in Heilongjiang Province than they are in Niigata Prefecture, but they are also more innovative in nature, and it can be inferred that this difference in the degrees of collaboration has an effect on business performance.

5.3 The relationship between business collaborations and corporate performance

Next, an ordered logit model is applied to the questionnaire survey data from Niigata Prefecture and Heilongjiang Province. The determinants of corporate performance and the effects of business collaborations on corporate performance are quantitatively identified. The estimation model is represented by the following formula:

$$\textit{Corporate Performance} = \alpha + \beta_1 \textit{(Company Attributes)} + \beta_2 \textit{(Business Collaborations)} + \beta_3 \textit{(Regional Dummy Variables)} + \varepsilon_i$$

All variables consist of categorical data obtained from the questionnaire responses. Categories were set as shown in Appendix Table 1, and the distribution of companies per region was normalized (cf. Appendix Table 2). Corporate performance was assessed using changes in sales volumes, which represent the scale of business activities, and profit ratios as a measure of profitability. Maximum likelihood was the method used for estimation.

Table 10 represents a model using changes in sales volumes (over the past five years) as the dependent variable. According to the results of estimation (1), among company attributes, the number of employees is positively significant, while the age of a company is negatively significant. The Heilongjiang Province dummy variable is positively significant, which is consistent with the fact that almost all companies in the province have seen increased sales volumes. Even when the AIC value is minimized through variable selection, the number of employees is still positively significant, and company age is negatively significant. Estimation (2) adds the presence (or absence) of business collaborations with food-related companies to the model as an independent variable, which produces an outcome in which the number of employees is positively significant, while the age of a company is negatively significant. Furthermore, of the business collaboration variables, the “presence of business collaborations with food-related companies” is positively significant. Accordingly, companies which show increasing sales volumes are likely to be relatively young and have many employees, and collaborations with food-related companies contribute to increased sales volumes.

Table 10. Estimation on Determinant Factors of Company's Performance (Changes in Sales Volumes)

	Dependent Variable: Changes in Sales Volumes(0-2)							
	Estimation 1		Variable Selection Model		Estimation 2		Variable Selection Model	
	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Profile of Companies								
Years of Operation	-0.488	-2.32 **	-0.433	-2.31 **	-0.407	-1.87 *	-0.377	-1.98*
Scale of Capital Amount	-0.333	-1.44			-0.238	-1.05		
Number of Employee	-0.655	2.79 ***	0.485	2.69 ***	0.530	2.24 **	0.397	2.13 **
Business Dummy (Food Manufacturing)	-0.458	-0.77			-0.458	-0.78		
Business Collaborations								
Business Collaborations	0.840	1.37	0.762	1.44				
Business Collaborations with Foreign Partner	0.923	0.92			0.674	0.66		
Business Collaborations with Food Related Companies					0.961	1.68 *	1.096	2.11 **
Regional Dummy								
Heilongjiang Province	4.008	3.56 ***	3.977	3.60 ***	3.921	3.45 ***	3.802	3.46 ***
Intercept								
0|1	-0.350	-0.38	0.421	0.53	-0.363	-0.34	0.286	0.32
1|2	0.897	0.95	1.623	1.98 *	0.983	0.91	1.600	1.75 *
No. of Obs.	83		83		74		74	
AIC	139.907		137.249		130.861		126.739	
log likelihoood	-60.953		-62.624		-56.431		-57.369	
LR chi2	50.550		47.217		42.162		40.285	
Pr chi2	1.12E-08		1.37E-09		4.84E-07		3.78E-08	

Note: '***', '**', '*' indicates statistically significant at 1%, 5%, 10% respectively.

Table 11 represents a model with changes in profit ratios (over the past five years) as the dependent variable. According to the results of estimation (3), among company attributes, the age of a company is negatively significant. Of the business collaboration variables, the "presence of business collaborations with overseas companies" is positive, and the regional dummy variable (Heilongjiang Province dummy variable) is positively significant. In addition, the outcome after variable selection yielded a higher level of statistical significance than the full variable model. Estimation (4) is a model that adds the presence (or absence) of business collaborations with food-related companies to the model as an independent variable, but the results are roughly identical to estimation (3). Accordingly, companies which show increasing profit ratios are likely to be relatively young, and business collaborations with overseas companies potentially contribute to higher profit ratios.

Table 11. Estimation on Determinant Factors of Company's Performance (Changes in Profit Ratios)

	Dependent Variable: Changes in Profit Ratios(0-2)							
	Estimation 3		Variable Selection Model		Estimation 4		Variable Selection Model	
	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Profile of Companies								
Years of Operation	-0.400	1.84 *	-0.404	-1.92 *	-0.472	-1.98 *	-0.434	-1.96 *
Scale of Capital Amount	-0.190	-0.82			-0.178	-0.74		
Number of Employee	0.135	0.59			0.078	0.33		
Business Dummy (Food Manufacturing)	-0.319	-0.53			-0.195	-0.32		
Business Collaborations								
Business Collaborations	-0.304	-0.44						
Business Collaborations with Foreign Partner	1.994	1.81 *	1.635	1.86 *	2.113	1.85 *	1.697	1.90 *
Business Collaborations with Food Related Companies					-0.306	-0.47		
Regional Dummy								
Heilongjiang Province	5.048	4.28 ***	4.741	4.26 ***	4.963	4.09 ***	4.728	4.16 ***
Intercept								
0|1	-0.578	-0.58	-0.218	-0.35	-0.870	-0.74	-0.289	-0.45
1|2	0.575	0.56	0.918	1.42	0.312	0.26	0.883	1.31
No. of Obs.	83		83		74		74	
AIC	126.539		119.947		115.421		108.259	
log likelihoood	-54.269		-54.973		-48.711		-49.130	
LR chi2	54.367		52.959		48.522		47.684	
Pr chi2	1.99E-09		1.87E-11		2.814E-08		2.49E-10	

Note: '***', '**', '*' indicates statistically significant at 1%, 5%, 10% respectively.

In view of theories of dynamic externalities, it can be concluded that business collaboration within an industry contributes to a company's growth, and collaborations with companies in other industries or companies overseas contribute to profit ratios. This means that the kind of collaboration effective for economic growth varies depending on the lifecycle of the products' market. During the market's growth phase, increased sales lead to increased profits, so collaborations with companies in the same industry are effective. However, once a market enters its mature phase, product differentiation and similar steps are required to raise profit ratios; therefore, in this case, more diverse collaborations are likely to be effective.

6. Conclusions

The results of analyses of agricultural clusters in China in this study suggest that clusters do achieve certain positive results in the way of development in the agricultural sector and rural communities. We believe that part of this is attributable to the fact that policies of agricultural industrialization, the creation of agriculture development zones,

and other such policies in China share much in common with the country's industrial cluster policies. Furthermore, utilizing the potential benefits with regard to the development of regional economies through external economies of industrial agglomeration is promising as a method for rural development. However, mere industrial agglomerations are not enough to sustain regional economic growth. There must also be cluster initiatives in place to facilitate clustering, as well as industrial development policies that promote business collaborations among different companies.

China's economy continues to grow at a high rate. With the higher income levels and broader income gaps that come with this growth, food demand is both increasing in volume and diversifying. As a result, there is stronger competition in the food sector, competition that is rooted in product diversification. This development represents an ongoing transition in China's food market from a period of expansion to a period of maturity. On one hand, this means that a broad range of demand conditions for cluster formation will be met. Therefore, this transition has the potential to facilitate cluster formation. On the other hand, however, it also means that a shift from intra-industry to inter-industry business collaboration will be necessary for the sustained development of those clusters.

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Appendix Table 1. Explanation of Variables

	Variables	Value	Descriptions	
Performance of Companies	Changes in Sales Volumes	0-2	2: Increase 1: No Change 0: Decrease	
	Changes in Profit Ratio	0-2	2: Increase 1: No Change 0: Decrease	
Profile of Companies			Heilongjiang(China)	Niigata (Japan)
	Years of Operation	1-5	5: 12 years and above 4: 11 years and below 3: 8 yeas and below 2: 5 years and below 1: 3 years and below	5: 61 years and above 4: 60 years and below 3: 51 years and below 2: 45 years and below 1: 35 years and below
	Scale of Capital Amount	1-5	5: more than 35,000,000 yuan 4: 35,000,000 yuan and below 3: 10,000,000 yuan and below 2: 6,000,000 yuan and below 1: 4,000,000 yuan and below	5: more than 87,000,000 yen 4: 87,000,000 yen and below 3: 50,000,000 yen and below 2: 30,000,000 yen and below 1: 11,000,000 yen and below
	Number of Employee	1-5	5: 301 and above 4: 300 and below 3: 210 and below 2: 160 and below 1: 116 and below	5: 100 and above 4: 99 and below 3: 52 and below 2: 34 and below 1: 21 and below
	Business Sector	0-1	1: Food Manufacturing 0: Others	
Business Collaborations	Business Collaborations	0-1	1: Yes 0: No	
	With Food Related Companies	0-1	1: Yes 0: No	
	With Foreign Partner	0-1	1: Yes 0: No	
Regional Dummy	Heilongjiang Province Dummy	0-1	1: Location of Heilongjiang Province 0: Location of Niigata Prefecture	

Appendix Table 2. Distribution of Variables on Profile of Companies

Distribution on Years of Operation						
Variable of Years of Operation	Total		Heilongjiang		Niigata	
5	15	(18.1)	4	(21.1)	11	(17.2)
4	16	(19.3)	3	(15.8)	13	(20.3)
3	17	(20.5)	4	(21.1)	13	(20.3)
2	18	(21.7)	4	(21.1)	14	(21.9)
1	17	(20.5)	4	(21.1)	13	(20.3)
Distribution on Scale of Capital Amount						
Variable of Scale of Capital Amount	Total		Heilongjiang		Niigata	
5	15	(18.1)	4	(21.1)	11	(17.2)
4	14	(16.9)	3	(15.8)	11	(17.2)
3	20	(24.1)	4	(21.1)	16	(25.0)
2	17	(20.5)	4	(21.1)	13	(20.3)
1	17	(20.5)	4	(21.1)	13	(20.3)
Distribution on Number of Employee						
Variable of Number of Employee	Total		Heilongjiang		Niigata	
5	16	(19.3)	3	(15.8)	13	(20.3)
4	16	(19.3)	4	(21.1)	12	(18.8)
3	17	(20.5)	4	(21.1)	13	(20.3)
2	16	(19.3)	4	(21.1)	12	(18.8)
1	18	(21.7)	4	(21.1)	14	(21.9)