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Research Paper

An empirical analysis of the factors influencing the formation of agricultural machinery industrial clusters in China

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ABSTRACT

China's agricultural machinery industry played an important role in boosting labor productivity and facilitating agricultural mechanization. The clustering trend in this industry is especially apparent. Based on this promising trend, this paper mainly analyzes the key factors affecting the formation of China's agricultural machinery industry clusters as production elements, innovation elements and policy elements. Factor analysis method is applied to perform a quantitative analysis on the formation process of agricultural machinery industry cluster. The outcomes of this study are as follows. The formation of the agricultural machinery industry clusters is mainly influenced by five factors: regional environmental factor, cluster power factor, innovation environment factor, industry element factor and industry cooperation factor. Based on eighteen (18) main factors corresponding to these five aspects and selection, this paper successfully constructs a block diagram model. Through meticulous analysis, three most significant elements which affect the cluster formation processes such as geographical environment, cluster radiation effect and innovation environment were discovered. Based on such a conclusion, relevant government departments and regulators should formulate effective policies targeting the three aspects to promote the formation and development of clusters.

Key words: Agricultural machinery, industry cluster, influencing factors, questionnaire survey, factor analysis.

INTRODUCTION

Along with the rapid agricultural development, the agricultural machinery industry in China has simultaneously grown into a mature industrial system, which provides a solid fundament of numerous high-quality machineries and equipments for the precision agriculture. In addition, it shows influences in many other aspects such as improving labor productivity, promoting agricultural mechanization process, accelerating diversification, increasing agricultural profits, raising farmers' income and enhancing ability to resist natural disasters.

Recently, the agricultural machinery industry in China has maintained a rapid growth with a top-ranking growth rate ahead of the world. According to statistics, in 2016, the general power of agricultural machinery industry reached 1 billion and 144 million kilowatts. And in 2015, the main business income of the agricultural enterprises above designated a size that amounted to 428 billion and 368 million Yuan, accounting for nearly half of the global agricultural output value.

After China's entry to the WTO, the internationalization trend of China's domestic market has become increasing significant and has become more and more difficult to compete in international market by simply relying on low prices. Industry clustering has become a common strategy around the world, followed by the most competitive industries in the international market. In the process of integrating into the world economic map, China's agricultural machinery cluster has also emerged. Currently,

batches of agricultural industry clusters are gradually being formed in the major grain producing areas and areas with solid base of manufacturing. For example, the fully-mechanized equipment cluster for rice cultivation has taken shape in Jiangsu and Zhejiang Province, while the micro-farming equipment cluster has emerged in Chongqing. Both of these two examples reflect that the development of agricultural industry cluster in our country has achieved its initial success (Liu, 2012).

Specialized agglomeration can not only provide external economies of scale for enterprises in the cluster, but also create opportunities to generate a rational division of labor mode through joint work, which in return increases enterprises' capabilities of innovation, technology communication and economic growth momentum (Ruan, 2014). Guiding and promoting the development of agricultural machinery industry cluster can be an effective measure to enhance the competitiveness and promote the transformation and upgrading of the agricultural machinery industry. Researches on factors influencing cluster formation can provide meaningful guidance for the development of agricultural machinery industry clusters in China. Evaluating each factor's influence degree by means of factor analysis can also lay a foundation for formulating development strategies of agricultural industry clusters.

Reviewing the development history of foreign relative theories, Marshall was the first to study the formation of industrial agglomeration. Since then, many foreign researchers have systematically studied the formation mechanism of clusters from various perspectives. Marshall is thus considered to be the founder of the external scale effect theory. His study thoroughly concluded the major causes of location aggregation, including externalities, information exchange and technical extension (Ruan, 2014). Based on the industrial location theory, Webb expounded the industrial agglomeration theory and the law of displacement of industrial location. By analyzing the agglomeration factors and scattered factors, he discovered that the agglomeration advantages and costs are the main consideration, while enterprises agglomerate and established the initial systematic theory of the agglomeration formation (Porter, 2002).

Pete focused mainly on the integration of innovation and agglomeration. He successfully explained the cluster agglomeration phenomenon from an innovative perspective and concluded that there was a two-way dependence and promotion relationship between innovation and the formation of industrial clusters (Gary, 2005). With the acceleration of industrialization, the study on industrial agglomeration mechanism is becoming more and more mature, while in domestic studies, scholars have also paid a lot of attention to the formation mechanism of industrial clusters. Based on the existing studies, the related problems associated with the formation mechanism of industrial cluster have been generalized, summarized and concluded from aspects of concept definition, structure method, mechanism of formation, evolution and development etc. Wang (2010), a pioneer in the research field of industry cluster systematically summarized the industrial agglomeration theory and industrial cluster innovation network. This system was eventually used to explain the inherent association between industry agglomeration effect and regional innovation.

From the dual perspective of mechanism and reality, Qiu (2003) took small enterprises as his research targets and analyzed the internal triggering mechanism and external motivation of small enterprises agglomeration from a historical and practical point of view. Based on the agglomeration economy and its release factors, Yang et al. (1994) put forward that the internal mechanism of the agglomeration economy was the key reason for the formation of innovative agglomeration, and concluded that the cluster phenomenon of industrial units was essentially the performance of urban agglomeration economy.

In summary, after more than a century of foreign research, the study of formation mechanism of industrial agglomeration reached an abundant, multi-level and multi-angle theoretical result, while domestic scholars, based on the rapid development of industrialization, have been able to innovatively apply multi-class cross over theories to explore the factors that led to industrial clusters. However, compared with the maturity of foreign studies, domestic relevant research is still on an exploratory stage. In particular, the construction of theoretical framework and the empirical study of formation mechanism remain immature. Therefore, there is still a long way in building a complete theoretical system in China.

RESEARCH DESIGN

Model construction

Considering the characteristics of each industry, the factors that influence the industry cluster formation are different and the impact of each factor will be different accordingly. Because the relevant data of agricultural machinery industry cluster is difficult to obtain directly, in this section, based on summing up the previous studies, we choose the influencing factors of manufacturing industry cluster as a broad representative affecting the formation of various industrial clusters. Combined with the current development situation of agricultural machinery industry, factors affecting its cluster formation were analyzed. As the research of agricultural machinery industry cluster formation is still a new perspective, we attempt to build a simple block diagram model with six kinds of factors as shown in Figure 1. These six sorts are respectively production factors, innovation factors, policy elements, market factors, location factors and industry factors. In the empirical study of this article, the relationships between these factors were further analyzed in depth and the initial

Figure 1: A simple block diagram model with six kinds of factors.

block diagram model revised and improved.

Analysis method

The main problems encountered while conducting the study include the lack of relevant research literature, the difficulty of obtaining statistical data and the feasibility of research work. In order to better combine the study with the development and specific characteristics of China's agricultural industry, we first implemented the descriptive statistical analysis for the initial screening, and then employed the factor analysis method to evaluate each influencing factor. Factor analysis includes exploratory factor analysis and confirmatory factor analysis (Guo et al., 2015). Due to the exploration of agricultural machinery industry cluster formation is still a new research field and there are neither ready-made theories nor empirical experiences for reference. Therefore, by learning from the experiences of existing literature, this paper selects

exploratory factor analysis which can use a minimum quantity of factor to reflect the important factors.

Data resource

While collecting relevant data, this paper mainly adopts a method of the combination of questionnaire survey and field interview. The use of Likert scale series in questionnaire survey is critical for higher reliability of results. Likert scale series believes that the larger the scales, the higher the reliability of the questionnaire surveys, but when series is larger than level scales, options are difficult to distinguish. Therefore, the level scales are most reliable and commonly used in several cases (Berdie, 1989). Numbers are used to weigh the influencing degree of each factor to the formation of agricultural machinery industry cluster. In this case, 1 stands for "unimportant", 2 stands for "less important", 3 stands for "important", 4 stands for "more important" and 5 stands for "very important". The participants were asked to evaluate each factor based on their practical experience and personal views.

Considering our research topic, the respondents were confined to senior managers or researchers of agricultural machinery industry. In order to ensure the representativeness and reliability of questionnaire, and to obtain a relatively comprehensive and objective evaluation and judgment, respondents' career covers as vastly as possible, varying from government departments and agricultural enterprises to institutions of higher learning and industry associations. Questionnaires were distributed broadly to institutions such as China Agricultural Machinery Research Institute, China Agricultural University, China Agricultural Machinery Industry Association, China Agricultural Machinery Circulation Association, certain agricultural machinery enterprises and other authoritative organizations. The content of the questionnaire covers the basic situation of experts, experts' grasping for the overall situation and experts' judgment of influencing factors. Finally, 196 valid questionnaires, which were relatively sufficient for this research were obtained.

EMPIRICAL ANALYSIS

Descriptive statistical analysis

The number of the questionnaire copies approximately meets the statistical requirements considering the large sample principle (usually about 200). Based on the description of the respondents earlier mentioned, it can be considered that the existing questionnaires were more representative and can be used to analyze and determine the primary influencing factors of the agricultural machinery industry cluster formation and to guarantee the validity and reliability of the questionnaire.

This paper uses SPSS 22.0 to statistically analyze these questionnaires. Table 1 shows relevant results. The influencing factors in Table 1 are subsequently screened as follows:

Determine screening criteria: The bigger the mean, the more important this factor is to the formation of agricultural machinery industry cluster. The variance reflects the dispersion degree of the data. In this questionnaire, the overall mean of the 28 influencing factors is 3.65, while the mean of the variance is 0.846. Therefore, the screening criteria can be determined as the mean higher than 3.65 and the variance lower than 0.846.

Factor selection: Primary factors are selected according to the aforementioned criteria. In Table 1, there are 14 factors with a mean higher than 3.65 and 17 factors with the variance lower than 0.846. Ten (10) factors satisfy both conditions simultaneously, while 9 factors satisfy only one condition, but there are also some exceptions. For example, "Energy consumption demand" meets the variance condition, but its variance is relatively small and just ranked ninth, while its mean is 3.61, only slightly lower than the average 3.65. Considering that the "energy consumption demand" is more important, it shall be reserved. The means of the six influencing factors, namely the degree of specialization of labor, agricultural machinery market demand, professional market, industry chain length, infrastructure and transportation costs, are all higher than 3.65, which indicate that all these six factors assume a vital role in the formation process of agricultural industry cluster. However, these factors' variances are higher, which shows that the experts' opinions largely diversified. Therefore, these six factors should be reserved temporarily for further discussion and factor analysis. Finally, to sum it up, we preserve the first 18 influencing factors in Table 1.

Exploratory factor analysis

Conditional test and reliability test

The treatise analyzes the conditions of factor analysis and obtains the Kaiser-Meyer-Olkin (KMO) test value of 0.863. Compared with the standard value of KMO statistics (value between 0.8-0.9 means suitable) (Berdie, 1989), there is a strong correlation between variables. The chi-square value of Bartlett's sphere city test is 1341.945, with the degree of freedom being 153 and a significance level of 0.000. It demonstrates that the correlation coefficient matrix is unlikely to be the unit matrix and the data obtained from the investigation can be analyzed by factor analysis.

The treatise employs Cronbach's coherence coefficient (alpha coefficient) to analyze data's reliability. While conducting this analysis, Cronbach's alpha value is usually

Table 1: Descriptive statistics of questionnaire based on mean and variance.

Order	Influence factor	Mean value (from largest to smallest)	Order	Influence factor	Variance (from smallest to largest)
1	Government policy support	4.10	1	Industry capital	0.599
2	Human resource	3.97	2	Innovation and entrepreneurship culture	0.626
3	Brand effect of cluster	3.97	3	Inter-enterprise Collaboration	0.655
4	Preferential policies of agricultural machinery industry	3.88	4	Brand effect of cluster	0.673
5	Leading enterprises drive	3.87	5	Shared assistive industry	0.732
6	Degree of specialization	3.86	6	Enterprise scale	0.736
7	Agricultural machinery market demand	3.82	7	Regional technological innovation level	0.736
8	Regional technological innovation level	3.82	8	Industrial relevancy	0.743
9	Professional market	3.82	9	Energy consumption demand	0.747
10	Inter-enterprise collaboration	3.79	10	Government policy support	0.775
11	Industry chain length	3.78	11	Leading enterprises drive	0.790
12	Industrial relevancy	3.78	12	Human resource	0.802
13	Innovation and entrepreneurship culture	3.78	13	University-industry cooperation	0.840
14	Enterprise scale	3.73	14	Preferential policies of agricultural machinery industry	0.845
15	Infrastructure	3.69	15	Professional market	0.853
16	Regional economic development level	3.68	16	Infrastructure	0.857
17	Transportation cost	3.67	17	Transportation cost	0.865
18	Energy consumption demand	3.61	18	Regional economic development level	0.884
19	Inter-enterprise imitation	3.59	19	Degree of specialization	0.898
20	Market volatility	3.58	20	Industry chain length	0.937
21	Shared assistive industry	3.58	21	Market volatility	0.940
22	Industry capital	3.57	22	Foreign investment	0.950
23	University-industry cooperation	3.55	23	Knowledge sharing and spillover	0.977
24	Agricultural machinery resources endowment	3.32	24	Inter-enterprise imitation	0.978
25	Knowledge sharing and spillover	3.27	25	Agricultural machinery market demand	0.998
26	Foreign investment	3.19	26	Shared labor market	1.003
27	Labor cost	3.15	27	Labor cost	1.071
28	Shared labor market	2.94	28	Agricultural machinery resources endowment	1.182
Mean value		3.65	Mean value		0.846

required to reach 0.7. In order to improve the reliability of the questionnaire survey, the relevant influencing factors are subdivided in the process of questionnaire design and the possible manifestations of influencing factors listed to reduce the evaluation error variation due to the single dimension. The Cronbach's alpha values of the aforementioned five main factors, which are obtained by SPSS 22.0, are respectively 0.840, 0.860, 0.759, 0.736 and 0.723. Hence, these factors' reliability basically reaches the acceptable level, the correlative factors are consistent and the internal structure is good.

Factor extraction and naming

Principal component analysis method is applied to the 18 factors earlier mentioned (variables) for factor analysis. According to the basic principles of factor analysis, the value of factor load should be higher than 0.4 (ideally greater than 0.5), the Eigenvalue is generally greater than 1,

Table 2: Rotated factor load matrix.

Influencing factors	Component				
	1	2	3	4	5
Government policy support	0.741	0.051	0.075	0.282	0.205
Enterprise scale	0.700	0.265	0.197	0.004	-0.074
Leading enterprises drive	0.655	0.384	-0.110	-0.021	0.019
Professional market	0.631	0.132	0.063	0.143	0.395
Brand effect of cluster	0.586	0.351	0.006	0.344	0.336
Transportation cost	0.574	0.431	0.159	-0.021	0.027
Innovation and entrepreneurship culture	0.094	0.753	0.113	0.251	0.088
Regional economic development level	0.149	0.748	0.184	-0.044	0.211
Regional technological innovation level	0.304	0.705	-0.040	0.239	0.233
Energy consumption demand	0.381	0.596	0.071	-0.361	0.115
Agricultural machinery market demand	0.500	0.544	0.089	0.065	-0.356
Human resource	0.152	0.040	0.760	0.038	0.166
Infrastructure	-0.067	0.305	0.687	0.148	-0.006
Preferential policies of agricultural machinery industry	0.463	-0.218	0.465	-0.020	0.046
Degree of specialization	0.108	0.059	0.130	0.820	-0.067
Industrial relevancy	0.396	0.364	0.049	0.467	0.235
Industry chain length	0.067	0.175	0.195	-0.068	0.694
Inter-enterprise collaboration	0.374	0.499	-0.066	0.160	0.506

Table 3: Eigenvalue, contribution rate and cumulative contribution rate.

Component	Initial Eigenvalues			Square sum of the rotation factor loads			Square sum of the factor load after rotation		
	Total	% of variance	Cumulative (%)	Total	% of variance	Cumulative (%)	Total	% of Variance	Cumulative (%)
1	6.398	35.543	35.543	6.398	35.543	35.543	3.611	20.064	20.064
2	1.431	7.948	43.492	1.431	7.948	43.492	3.378	18.767	38.831
3	1.276	7.090	50.581	1.276	7.090	50.581	1.476	8.198	47.028
4	1.161	6.451	57.033	1.161	6.451	57.033	1.420	7.891	54.920
5	1.010	5.613	62.646	1.010	5.613	62.646	1.391	7.726	62.646
6	0.892	4.954	67.600	/	/	/	/	/	/
…	-	-	-	/	/	/	/	/	/
18	0.203	1.128	100.000	/	/	/	/	/	/

Source: Calculated based on the questionnaire.

while the cumulative variance contribution rate is usually greater than 0.6 (can be reduced to 0.55). After comparing the results with all these standards, five new common factors are extracted eventually. Variance maximization factor rotation is used to obtain the factor load matrix (Table 2). Table 3 shows that the total degree of explanation is 62.646%. The five common factors basically cover all the information from the questionnaire data.

Factor score model

Following the standard of the load value greater than 0.4, it can be observed from Table 2 that F_1 has bigger loads on the factors of "government procurement policy", "enterprise scale", "leading enterprises driven", "professional market", "cluster brand effect" and "transport costs". Thus, F_1 is named "cluster radiation effect factor"; similarly, on the factors of "innovation and entrepreneurship culture", "regional economic development level", "regional technological innovation level", "energy consumption demand" and "agricultural machinery market demand", F_2 shows bigger load values and is therefore named "innovative environmental factor". F_3 has bigger loads on the factors of "human resources", "infrastructure" and "agricultural machinery industry

preferential policies", and is named "location environment factor", while F_4 has bigger loads on the factors of "professional division of labor" and "industry correlation", and is named "industry element factor". On the factors of "industry chain length" and "inter-enterprise collaboration", the load value of F_5 is bigger and is named "industry cooperation factor".

Table 4 shows that the factor score coefficient matrix was obtained using the regression analysis of factor analysis in SPSS 22.0. Based on analyzing the factor score matrix in Table 4, we can obtain the factor score model as follows:

$$F_1= 0.288X1+0.201X2-0.025X3+\ldots\ldots+0.028X18 \quad (1)$$

$$F_2=-0.201X1-0.031X2-0.073X3+\ldots\ldots+0.204X18 \quad (2)$$

$$F_3=-0.037X1-0.100X2+0.545X3+\ldots\ldots+0.009X18 \quad (3)$$

$$F_4= 0.120X1+0.169X2-0.042X3+\ldots\ldots-0.380X18 \quad (4)$$

$$F_5= 0.066X1+0.163X2+0.077X3+\ldots\ldots-0.005X18 \quad (5)$$

According to this model, the factor score can be calculated; the score of five factors are respectively 3.7788, 2.9206, 4.3313, 2.1409 and 1.8398. Thus, we can get the total factor score model given as:

$$F=3.7788F_1+2.9206F_2+4.3313F_3+2.1409F_4 +1.8398F_5 \quad (6)$$

Factor evaluation

From the analysis earlier mentioned, we can conclude that, in the formation process of agricultural machinery industry cluster, the importance of each factor is as follows: 1) Regional environmental factor is the most influential factor, with a factor score of 4.3313. This mainly includes human resources, infrastructure and preferential policies for agricultural machinery industry. Firstly, abundant human resource lays a foundation for the cluster formation. The highest score of these factors reflects that both the relevant government departments and enterprises within the cluster attach importance to human resources, preferential policies and infrastructures. The location differences also show a great impact on the agricultural industry cluster formation. According to the new economic geography theory, the contribution of human capital growth, such as the growth of knowledge and capacity to the economy development is higher than that of physical capital growth and increased labor forces. Human resource is of great significance in agricultural machinery production.

Agricultural machinery enterprises often choose to run in regions that ensure a large supply of skilled workers. This phenomenon occurs mainly because only the high-quality labor is able to grasp agricultural machinery technology quickly, reduce production costs, improve labor productivity and create benefits for the industrial clusters in the region.

Secondly, complete infrastructure matching is an important guarantee for cluster agglomeration and growth. The construction of infrastructures such as transportation and telecommunications, building of a bridge between the enterprises in the cluster and ensuring the smooth exchange of material, personnel and information within the region are also vital. The fulfilling of traffic technology can save costs generated in the process of materials and products transportation, and create conditions for the layout of related industries within the cluster.

Thirdly, considering the significant status of agriculture, the implementation of preferential policies has a huge impact on the development of agricultural machinery industry, and is undoubtedly considered as an important factor in the formation of agricultural machinery clusters.

The second important factor is the "cluster power factor", with a score of 3.7788. It consists of "the support of government policy", "leading enterprises drive", "professional market ", "cluster brand effect ", "enterprise scale" and "transport costs". Government's agricultural management departments maintain a deep collaboration with the clusters; while promoting agricultural industry cluster and implementing favorable policies, they can also be granted with the benefits. Under the guidance of the "invisible hands" of free market, government's support policies should be improved to promote cluster formation and sustainable development.

"Professional market" is related to the realization of product value and is the platform for clusters' revenue growth. "Leading enterprises drive" mainly occurs at the beginning of the cluster establishment during participation in the formulation of cluster policy. Relying on leading enterprises' radiation and components' demand matching, and related participants and components are attracted to invest and set up factories near leading enterprises. All the enterprises within the cluster are organized to develop industry standards, and the competitiveness of the entire industry chain within cluster is enhanced. The driving force of leading enterprises is essential to the rapid development of the cluster. "Enterprise scale" expansion first shows that the enterprises within the cluster attract business gathering by applying a relatively perfect organizational operation model. The increase in the number of enterprises and the greatly reduced transportation costs together leads to the labor division between enterprises, and thus promote the formation of agricultural machinery industry cluster.

Foreign industrial clusters tend to adopt uniform standards to quality levels and product names. For example, the Italian label of "Made in Milan" is given to the products with a uniform standard, which greatly promotes the marketing of the enterprise and improves the overall level of development within the cluster industry. Therefore, local governments is recommended to select the key enterprises and leading products according to the scale and

Table 4: Factor score coefficient matrix.

Influencing factor	Components				
	1	2	3	4	5
Government policy support	0.288	-0.201	-0.037	0.120	0.066
Brand effect of cluster	0.121	-0.031	-0.100	0.169	0.163
Human resource	-0.025	-0.073	0.545	-0.042	0.077
Preferential policies of agricultural machinery industry	0.239	-0.247	0.317	-0.090	-0.012
Leading enterprises drive	0.240	0.036	-0.155	-0.109	-0.110
Degree of specialization	-0.063	-0.030	0.047	0.651	-0.150
Agricultural machinery market demand	0.143	0.196	0.021	-0.012	-0.477
Regional economic development level	-0.076	0.238	-0.112	0.112	0.062
Professional market	0.209	-0.154	-0.045	0.003	0.253
Inter-enterprise collaboration	-0.013	0.083	-0.143	0.030	0.343
Industrial relevancy	0.017	0.029	-0.051	0.297	0.080
Industry chain length	-0.104	-0.032	0.093	-0.131	0.599
Innovation and entrepreneurship culture	-0.189	0.328	0.028	0.147	-0.063
Enterprise scale	0.273	-0.035	0.082	-0.099	-0.206
Infrastructure	-0.184	0.137	0.503	0.079	-0.096
Regional technological innovation level	-0.146	0.305	0.085	-0.112	0.061
Transportation cost	0.164	0.067	0.053	-0.116	-0.116
Energy consumption demand	0.066	0.204	0.009	-0.380	-0.005

Source: Calculated based on the questionnaire.

potential development, intensify the efforts to cultivate leading enterprises and give full play to the brand effect of the cluster in the process of forming the agricultural machinery industry cluster.

The third important factor is "innovation environment factor", with a score of 2.9206, which consists of "innovation and entrepreneurship culture", "energy consumption demand", "regional innovation level", "regional economic development level" and "agricultural machinery market". These five factors constitute the whole innovative environment of the industrial cluster from different angles. "Innovation and entrepreneurship culture" is from the corporate culture level. "Regional economic development level" and "agricultural machinery market" are from the market level. "Technological innovation level" and "energy consumption demand" are from the technical level. "Innovation environment factor" ranked the third among all the five components expresses that, in the process of cluster formation, only by constantly accepting new external knowledge and improving the enterprises 'innovative abilities can cluster and keep growing.

The fourth important factor is "industry element factor", with a score of 2.1409, which consists of "industry association degree" and "degree of specialization". Considering the relationship between the upstream and downstream enterprises in the industry chain, we can optimize the enterprises' levels and structures. And with the refinement of labor division, older labor can be rationally relocated and the integral labor productivity enhanced. In the meantime, establishing a close cooperation based on labor division can not only improve the competitiveness of both the enterprises and the industrial clusters, but also promote regional economic development. Taking Shandong Province as an example, there are lots of agricultural machinery enterprises. Large enterprises show advantages in capital, technology and other aspects, while small and medium enterprises conform to flexible operation and low management cost. Therefore, specialized labor division and cluster strategy should be quite suitable for the development of Shandong agricultural machinery industry.

The fifth important factor is "industry cooperation factor", with a score of 1.8398, which consists of "industry chain length" and "inter-enterprise cooperation". These two factors are all related to both exchange and cooperation procedure between enterprises within the cluster. This phenomenon is consistent with the characteristics of the formation period of the agricultural industrial cluster, the division and coordination between enterprises along with the industrial chain, process correlation and complementarity. The lowest score of this factor shows that in the formation of agricultural industry cluster, related parties fail to put enough emphasis on the cooperation between companies and the length of the industrial chain. In the existing agricultural industry cluster, competition conquers cooperation. But this is neither inevitable nor advocated by cluster strategy. From the long-term development point of view, the longer the industry chain is, the more specialized the division of labor becomes. The higher the degree of cooperation between enterprises is,

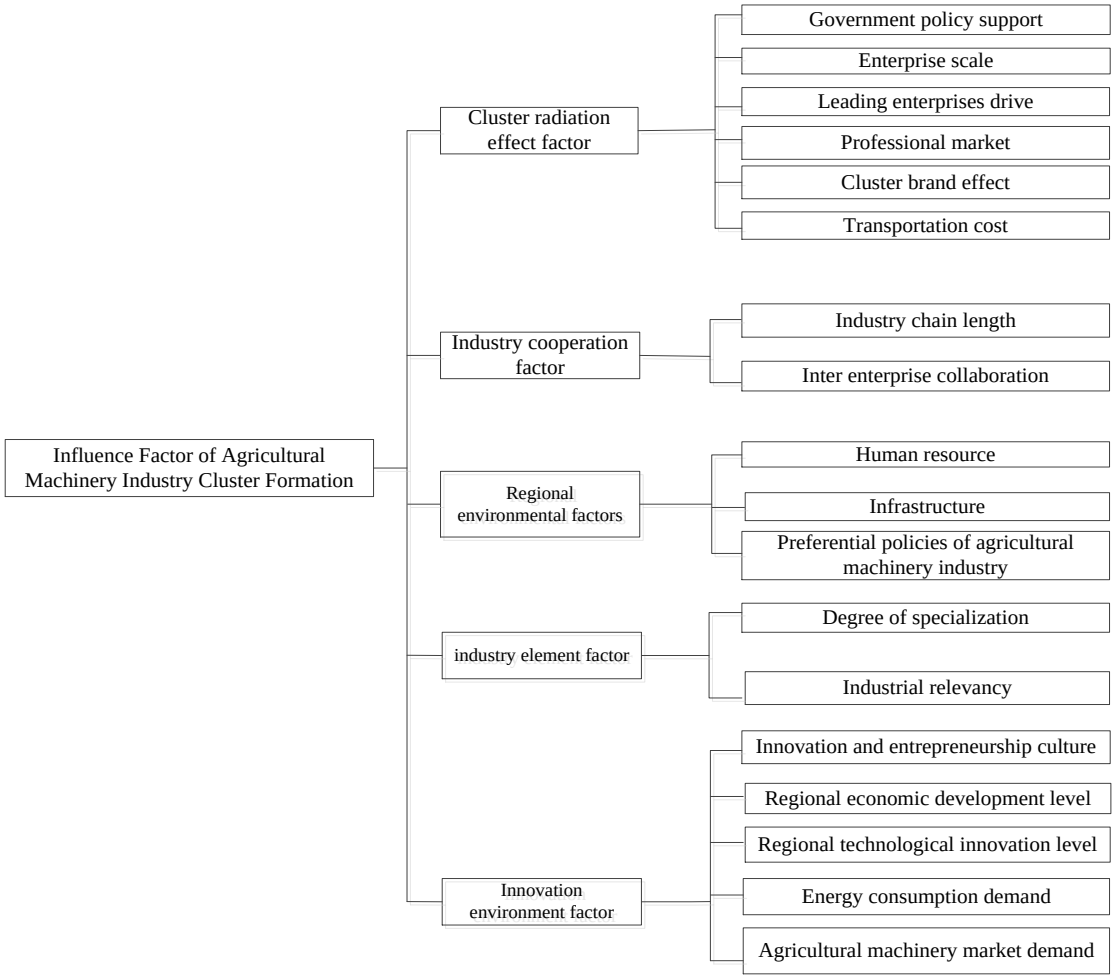

Figure 2: Block diagram of the optimized influencing factors of agricultural machinery industry cluster.

the easier the maximum interest within the cluster will achieve.

Model optimization

By observing the results of descriptive statistical analysis of the questionnaire, the 28 influencing factors were reduced to 18, and five main factors were extracted from these 18 influencing factors by conducting factor analysis. These five factors are cluster radiation factor, innovation environment factor, industry factor, regional environmental factors and industry cooperation factor. Figure 2 shows the new diagram model indicating the influencing factors of China's agricultural industry cluster after optimization.

CONCLUSION

Cluster development is an inevitable trend for the development of agricultural machinery industry. Cluster development emphasizes the agglomeration of enterprises in a certain area and the relationship between different industries. Based on the features of the agricultural machinery industry, this treatise chooses twenty-eight factors to construct a block diagram covering the influencing factors of the agricultural machinery industry cluster formation. All these factors were evaluated using factor analysis based on the statistical data collected from the questionnaire, which was carried out among experts from government departments, domestic universities, research institutions, enterprises and several other levels of the agricultural machinery industry. The result exemplifies that the formation of agricultural machinery industry cluster mainly depends on regional environment factor, cluster radiation effect factor, innovation environment factor, industry element factor and industry cooperation factor.

The formation of agricultural machinery industry cluster shows a strong regional characteristic, and the conclusion is consistent with China’s practice. In the formation stage of the cluster, the government should take the actual situation,

the regional factors and the innovation environments into consideration, so as to increase the infrastructure construction of the agricultural machinery industry, build a common technology research platform and increase the R and D investment to promote technological innovation. A reconstructed diagram composed of five main factors and eighteen sub-influencing factors was given as a reference for the government to formulate policies. It also provides a new approach for the study of the formation of agricultural machinery industry cluster.

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