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Study of the Stage Characteristics and Upgrade Strategy of the Development of Industrial Clusters in Henan Province, China

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Abstract: Based on the theories of industry cluster and regional innovation development as well as big data obtained by industry survey, this study discusses the stage characteristics of traditional industry cluster in Henan province and the representative industry clusters in the central and western region of China by means of inductive and deductive methods. The results are that the traditional industry clusters in Henan province are faced with series of challenges under the dual pressures of upgrading consumption structure and industrial structure though they have certain unique characteristics in their organization forms, industrial distributions and ways of competition. Therefore, in order to achieve sustainable development, SME should determine the appropriate upgrading strategy according to the characteristics of different types of clusters. Besides, the improvement of the regional and cluster innovation system also plays a crucial role in promoting the innovation and development of SME clusters.

Key words: Traditional industrial clusters, characteristics, the restraint elements, strategies, Henan, China

INTRODUCTION

Industrial clusters play an important role in promoting regional economic development, expanding employment and promoting the integration of urban and rural areas of China. Owing to the reform and opening policy, the industrial clusters of the coastal areas have experienced a rapid growth and the industrial clusters of the central and western regions have also made remarkable progress. Take Henan province for example, the number of the industrial clusters have achieved more than 100 million Yuan in the total industrial output value. And the industrial clusters have increased to 388 and gained 450.16 billion Yuan in industrial output value, provide 303.2 million jobs. Which according to the 2006 survey report come from Henan Survey Office of the National Bureau of Statistics (NBS). Besides, though the number of enterprise is of only 18% of the entire industry, the industrial output value these enterprises have produced accounts for 37.1%, the number of employees 35.0%, tax 42.1% and the value of export 37.3%. Since, 2006, the industrial clusters of Henan province have experienced a slow development. Similar to the industrial clusters in coastal areas such as Zhejiang and Guangdong province, the competitive advantage of Henan province comes mainly from the low cost of its product. However, Henan province depends excessively on the resource and endures greater development pressure compared with eastern areas because the industrial clusters in Henan province start late and mostly of them are small-scaled.

According to the theory of competitive advantage theory (Porter, 2002), industry cluster in Henan province stand approximately at the production-oriented stage and only a small number of clusters at the investment-oriented stage, whose basic characteristics are matched well with Potter's descriptions on the general cluster development stage. In the production-oriented stage, natural resources, cheap labor is a source of competitive advantage, price competition as the main means of competition; using regular traditional technology; overseas trade opportunities lies in the hands of foreign agents. Affected by industrial upgrading and resource constraints, the factors of production-oriented cluster faces a series of challenges. There are some research about factor-conductive in industry cluster upgrade stage. Knorringa (1999) survey India's industrial cluster and found that the cooperation in industry cluster of enterprises can gain higher performance despite the challenges facing different upgrade. According to Chinese industry cluster upgrade, most scholars study of industrial clusters in the coastal developed regions. Liu *et al.* (2013) studied on Shunde in Guangdong province electrical home appliances industry cluster, analyzing how informal contact effect on technological innovation (Liu *et al.*, 2013). Wang *et al.* (2013) constructs the knowledge network of industrial cluster in the four play a role in the dynamic elements in knowledge updating "four force" model and study in Yuyao in Zhejiang province lamps and lanterns industry cluster upgrade issue. Qian (2013) discussed upgrade traditional

manufacturing industry's main path based on national value chain of the Yangtze river delta. Most industry cluster are about the central and western regions, especially for a regional resource dependent industry cluster upgrade research is rare. Therefore, this research is of great significance.

The aim of this study was to, (1) Abstract and summarizes the general characteristics of all kinds of industrial cluster development in Henan province, (2) Find out factors restricting the development of industrial clusters and (3) According to main factors, in Henan province industry cluster upgrade strategy and countermeasures and suggestions are put forward.

RESEARCH METHODS AND RESEARCH OBJECTS

Research methods: This study adopted the following methods, one is the survey method. Through investigation 16 industrial clusters in five cities in Henan province, such as Zhengzhou, Xuchang, Xinxiang, Kaifeng, Luoyang, Nanyang .First, Using interview with the local government to the relevant personnel of the related Department of Information Industry, the business operators were investigated interview, has obtained the first-hand information. Second, using literature study method. Query the relevant literature about Chinese regional industry cluster development and get relevant information and data in Henan Province Small and Medium-sized Enterprise Services Bureau. Finally, summarized the general characteristics of industrial clusters of Henan province through inductive method.

Research objects: Academia increasingly focus on the question of the upgrade and innovation of industrial cluster. But most scholars in China's studied on the coastal regions such as Guangdong, Jiangsu and Zhejiang industrial cluster. While the study about regional characteristics of industrial clusters in Henan province are seldom. This study can offer some new enlightenment for the study of the industrial cluster theory. This study can also provide decision basis for local governments to formulate relevant policies.

Most industry in henan province belong to the resources industry and traditional industry processing, the basic factors of production in pilot phase. Few clusters entered the stage of investment orientation, natural resources, cheap labor is the source of competitive advantage, the price competition as the main means. Internal division of labor between enterprises clusters on a smaller scale, degree is not high, short industry chain, internal competition is intense. Innovation system is not sound, enterprise innovation ability is low. Henan

industry cluster mainly include resource development driving type, large enterprises driving type and small businesses cluster type, the different upgrade strategy needs to be designed.

In this study, the research of industrial clusters in Henan province are preliminary and need to further study the following issues: The main factors that restricting innovation development and the interaction between factors, issues of regional innovation system construction in Henan province.

ENTERPRISES CLUSTER DEVELOPMENT STAGE CHARACTERISTICS AND CONSTRAINTS

Size of the organization and structure: After the reform and opening up, a number of market-led (also hotshots driven and spontaneous growth) industry clusters have established in Henan, as well as industrial zones based on large-scale state-owned enterprises and bear the features of clusters. Most clusters began to form in the 1980s but hadn't formed until late 90s of the last century. After 2000, though developing rapidly, the majority of the clusters are still in their formative years, enterprises in them are lack of a high degree of division of labor and cooperative relations. Matured clusters are few which is consistent with the overall level of economic development of the central region. From the respect of size, the majority of the clusters in Henan Province are small, apart from some well-known foreign clusters they can not even be compared with those of Jiangsu and Zhejiang and other provinces. The difference is mainly in cluster size and average enterprise scale. The sizes of the first two key enterprise clusters evaluated by the Small and Medium-sized Enterprises Service Bureau in Henan Province are shown in Table 1.

Clusters of resource extraction and processing which are mainly large state-owned are bigger in size, such as the Wugang steel industry cluster whose output value is of more than 10 billion. Clusters of resource processing which are also mainly large state-owned enterprises with higher output value, are rather big but they are basically in the initial period, in which inter-firm linkages are loose. Clusters of mainly private enterprises such as those of spare parts, casting parts, construction machinery, vibrating machinery, textile industry, are small. Their

Table 1: Number and the status of the organization scale of key industrial clusters in Henan province

Scale	Number	Ratio (%)
Over 10 billion	7	9.2
Over 3 billion	32	42.1
0.3-3 billion	37	48.7
Total	76	100.0

SME service bureau in Henan province

output value is generally less than 5 billion Yuan. The output of traditional crafts industry cluster is generally less than 1 billion Yuan. For example, Lushan County including belt cluster, silk flower cluster, cluster of glass paintings, each has less than 35 member enterprises and their annual output value range from 300 million Yuan to hundreds of millions. Many member enterprises in these clusters are mostly composed of small micro-enterprises. Without a well developed cluster size and enterprise-scale, it is difficult to generate a high level of “agglomeration economies”. The main reasons are: (1) Effective division of labor within the cluster can not be established. Because of lack of the demand to some small scale of clusters, some enterprises of intermediate inputs, some support-service businesses, as well as R and D institutions which are unwilling to enter the cluster, market sizes of some cluster finally restrict the divisions of labor, (2) Products of a smaller cluster have low market share, thus can not form some kind of monopoly advantage due to many external competitors and (3) The relationship between cluster scale and agglomeration effects may follow the inverse-U shape (Chi *et al.*, 2012).

Industry distribution and resource endowments: Henan enterprise clusters are mainly distributed in the machining, non-ferrous metal processing, coking, flour processing, food processing, building materials, refractory materials, clothing, textile and traditional handicraft production industries. The industries related to the two key enterprises clusters identified by the Service Bureau of Small-and-Medium Enterprises in Henan Province are as follows: 23 mechanical and electrical enterprises, 16 agricultural and sideline products processing enterprises, 13 enterprises of metallurgy and building materials, 9 enterprises of clothing textile, 15 enterprises of papermaking chemical, household goods, toys, gifts, etc. Among them, the first four categories accounted for 78.7%. As shown in Table 2.

The majority of Henan clusters are dependent on the rich resources, combined with lower labor costs and thus featured with depending on primary factors of production to compete in the market. With the rich mineral resources, Henan province is one of the largest provinces having national mineral resources of which coal, oil and natural

gas are three energy mineral, of which molybdenum, gold, aluminum and silver are four main metal mineral and of which trona, salt, refractory clay, blue asbestos, perlite, cement, limestone, quartz sandstone are seven non-metallic mineral. With vast plain and moderate geographical and climatic conditions, Henan is the country's major production base of agricultural and livestock products. Its production of wheat, corn, cotton, oilseeds and tobacco crop plays an important role in the country. Associated with superior resources, metallurgy building materials, agro-food processing class and mining, textile and clothing clusters takes a large proportion, the total of which is 50.1%. Henan also has good mechanical and industrial conditions. Luoyang, in Henan, is based on machinery and other heavy industry, due to the effects of diffusion of the technology, a number of mechanical and electrical industrial clusters have developed in Luoyang. For examples, industry cluster of machinery manufacturing are located in the New district of Xin'an County, industry cluster of building machinery in Xingyang City, industry cluster of vibration machinery in Xinxiang County, industry cluster of three-wheeled motorcycle in Yanshi City and so on. Developing industry on the basis of comparative advantage is a rational choice for a nation as well as a region. As Porter (2002) argued, a basic competitive advantage in the international arena, at first basing on the cost of production factors, may be the driving force behind the formation of an industry cluster. But factors lead to the formation of a cluster can neither constitute a necessary condition nor a sufficient condition for its sustainable development, sometimes they may even work as the constraints. The clusters formed under excellent resource elements conditions are likely to breed innovation inertness, once resource conditions, factor conditions or market conditions deteriorate; these clusters are often the first ones to decline.

Division of labor and means of competition: Cluster is characterized with self-evolution which is manifested in the extension of industrial chain accompanying the growth in size. Seeing from the birth and development of Henan cluster, it is clear that it has the same characteristics as others do. For example, the Xinzheng Xindian building material cluster starts with cement tile manufacturing as core industry, boosting a series of related industries. Such as tile device fabrication, steel mesh weaving, tile nail manufacturing, cement, water-proof coil, new wall body material, PVC tubular product, GRP tile etc. Mover the booming of these industries has also promoted the development of transportation, components maintenance, catering industry and other service trade.

Table 2: Number and the status of the industry distribution of key industrial clusters in Henan province

Industry	Number	Ratio (%)
Electromechanical class	23	30.2
Agricultural products processing class	16	21.1
Metallurgy and building materials	13	17.1
Garment and textile class	9	11.9
Other (chemical, paper, household goods, etc.)	15	19.7
Total	76	100.0

Source: SME service bureau in Henan province

Some scholars hold that small businesses in a cluster could build into a sensitive and efficient regional innovation network by professional allocation, learning and imitation, independent development and joint development (Wei, 2006). The network enhances the vitality of the cluster in the environment where technology and market are changeable. More importantly, the technology innovation could be promoted within the cluster by mutual learning (Sternberg and Tamasy, 1999). Actually, not all clusters could develop into innovation network. It is in need of complicated prerequisites, at least the cluster businesses having an effective division of labor, thus forming complete innovation system.

Presently, most clusters in Henan province hasn't achieved efficient division of labor. Despite the largeness of the scale in coal mining, metal refinery and other natural resource industries, they congregate for the sole purpose of exploiting the common resource. As businesses in the clusters are actually competitors, they are in lack of real connections in between in such a short industrial chain. We may as well take industry cluster of Wugang steel for example. Although, a group of private businesses emerged in mining, steel processing, accessories manufacturing areas but they mainly locate in upper part of the industrial chain. Therefore, the cluster is poor in the relationship between its members, incapable of the characteristics of compensation and network. (Peng and Meng, 2008) In the processing cluster, members are mostly of the same type, lacking horizontal and longitudinal labor division. Enterprise with a high degree of similarity in the size of the organization, production processes, market positioning. Small but broad covering businesses are common seen, so are the phenomena of fighting on one's own. The cluster is short of intermediate products and equipment manufacturer and also lack of upstream development and design enterprises. Chang Yuan and Fengqiu, main cranes cluster of large scale, have up to up to 131 machine manufacturers but not high in the local matching business. The crux of the problem is not offsite supporting or group division but that the the cluster companies do not form a complementary mechanism. Within the cluster the product of the machine manufacturers are in the same grade, so price is the main means of competition. Because of the constraints of market prices of final products, prices of intermediate goods rather than product quality and technical content are concerned by a mass of manufacturers. Therefore, innovation activities of enterprises of intermediate goods are constrained.

Innovation system and resource: Innovation is the process subject to a variety of factors. Cluster innovation

system is constituted of innovation networks and institutions. These innovation networks and institutions continue to promote innovation output through their interaction. In addition to the core businesses, suppliers and other enterprise networks, the institutions of the innovation system, includes other enterprise clusters, including research institutes, universities, technology transfer agencies, industry associations, banks, investors and government departments (Cooke and Schienstock, 2000). Henan cluster innovation system is not high in the level of its development, mainly featuring that a mechanism of an effective division of labor hasn't formed, especially innovation support system not perfect yet. The main problems are: (1) Financial support is important external conditions for enterprises to innovate. But the cluster businesses are mainly small and medium-sized which are difficult to access to finance from the formal financial institutions due to the constraints of the internal and external conditions. Moreover, they are short of self-accumulation and formal financial support case, so even if the enterprise have desire of innovation, it is difficult to conduct an effective introduction of technology and R and D operations, (2) Industry Association is an important bridge of cooperation between enterprises, between enterprises and institutions but the majority of cluster industry associations are playing limited roles; Productivity Center, R and D center, quality inspection center, personnel training services institutions are still burgeoning, unable to provide effective technical support and innovative Eservices, (3) it is short of communication between Enterprise and knowledge sources. There is no interaction among local application research and development institutions, the direction of university research and the business clusters, therefore unable to meet the needs of the cluster development. Except for individual large-scale enterprises which have established a simple technical collaboration with universities and research institute, the majority of enterprises don't have the desire for cooperation with universities and research institutions and (4) Regional or cluster resource structure mainly includes four aspects of social capital, intellectual capital, economic capital and physical capital which together constitute the basis of the ability to innovate (Tura and Harmaakorpi, 2005). The cluster resource structure of Henan is difficult to meet the needs of cluster innovation.

RESULTS

Henan province industry cluster development characteristics and horizontal simple summary as below. As is shown in Table 3.

Table 3: Features and capabilities of Henan enterprise clusters

Enterprises and cluster	Development level and characteristics
Industry	General machinery and parts processing, agro-food processing, textile and garment processing, resource development and the building materials industry are rather mature industries
Location in the chain of value	Most clusters in low part of the value chain, such as raw material extraction and processing; some traditional products with a certain competitive advantage
Market structure	Cluster focusing on industries where barriers to entry low, micro-enterprises and family factory accounting for a big part, industry competition and competition within the cluster very intense, price competition the major one
Research and development capacity	Big enterprises have strong R and D intensity but the overall capability of independent innovation is weak, lack of core technology and its own intellectual property rights, weak in the development of new products
Level of labor division and network relations	The level of labor division in cluster is low. Though close are the businesses in cluster, they are not into cooperative innovation
Innovation system	Support systems are imperfect, lacking technical support and financial support

The upgrading strategies and paths

Basic strategies: There are many types of clusters in Henan. It includes the resource development type and resource processing type in terms of the industry chains of industries. It can also be divided into four types in terms of its organization structure: The big enterprise leading resource development type, the small and medium-sized enterprise resource development type, the bibcock enterprise driving processing type and the small and medium-sized enterprise processing type. The forming mechanism and competitive advantage is the result of the combination of characteristics of the industry itself and the environment, clusters adopt different development strategies according to their local conditions (Tianwei and Yu, 2013). Therefore, the key points of upgrade strategies are also different.

The development paths:

- The first type is resource development clusters. In Henan clusters, the resource development clusters and the clusters by pre-processing local resources have a large proportion. In the clusters of the large enterprise as the leading development resource, related industries are in a certain degree of development but this kind of cluster has problems of a short industry chain, a small amount of deep processing products, a weak enterprise innovation ability. Three paths are needed to realize the upgrade of the resource development clusters: One is to improve the technical ability of the enterprise continuously in order to gain a sustainable competitive advantage. The resource development clusters face the risks of the production reduction and the increasing cost of the exploration. However, if the enterprises occupies the high-end technology, the author can keep sustainable development through the advantages of processing technology and markets, even if lose raw material advantages. And if the author can improve the technical ability and product class and create a regional brand, its competitive advantage is due to maintain and to further improve by relying on the pre-processing

local resources. The second is to realize the horizontal and vertical industry development. Cluster enterprises should not only gradually occupy the high-end link and also spread the value chain to related industries for horizontal extension, so as to increase the structural stability and risk resistance capacity, promoting the clusters into a wider development space. The third is a small and medium-sized enterprise resource development cluster. With most enterprise production conditions behind, there exists problems of a waste of resources, high consumption, serious pollution and so on, thus the author need shut, eliminate the backward production capacity to speed up the process of restructuring and merging and optimizing organization structure

- The second type is the big enterprise driving processing clusters. In some processing cluster, a number of large enterprises or leading enterprises, has formed and occupied a central position with its resource capacity advantage in cluster network. As the main body of investment, innovation engine, successful model and regional brand spokesman of a cluster, it leads enterprises through investment, innovation, knowledge transfer, brand extension, etc. and practices various kinds of behavior to drive the clusters in other enterprise's development and to promote the whole cluster evolution and upgrade (Shenghua and Juping, 2007). At present, a common development strategy is to cultivate and support a large enterprise development, to give a full play to the demonstration and leading role of the local government. There are some conditional for a big enterprise to become a real leading cluster. First, the big enterprise needs to solve their own innovation ability, occupy the high-end technology as the premise of playing the leading role. Second, more communications need to be build between small and medium-sized enterprises and large enterprises which could drive the whole cluster upgrading and innovation. Third, leading enterprises concentrate on core businesses, with the related products and processing sideline isolated

- The third type is the small enterprise clusters. In most developing countries traditional industrial clusters is poor in innovation performance which maybe the lack of technical resources in small and medium-sized enterprises, thus hampering their external knowledge acquisition (Rothwell, 1994). Cluster as a whole, to improve the competitiveness is the foundation of its internal structure optimization. Structure optimization is in essence a self-organizing process but we can promote the conditional enterprise on the scale and level and change the cluster "atomistic" organization form, form the major and medium small enterprise mutual competition and cooperation pattern through a variety of incentive way. In the lack of ability of microeconomic foundation, to perfect the regional and cluster innovation system is a realistic choice to promote the small and medium-sized enterprise cluster innovation development. According to the present situation of Henan cluster development, to promote the cluster innovation and upgrade should be an effective innovation system and learning system (Wang, 2012) which includes knowledge source, innovation network connection, financial support and system and environment factors

CONCLUSION

The cluster of Henan Province, same as China's coastal areas, are product of the reform and opening up policy; differing coastal areas, the majority of cluster are formed for the resource endowments, therefore, having its own characteristics.

The group development path is not linear. In the long run, the cluster, same as other forms of business organization, is of relativity in its competitive advantage and is periodic in its development. Without innovation and change it is bound to face the risk of loss of competitiveness. It is particularly true with the cluster of Henan, a resource-dependent one which is faced with greater pressure to upgrade. Therefore, the implementation of effective upgrade strategy is the inevitable requirement for achieving sustainable development.

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