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Industrial Insertion and Embeddedness to Local Cluster Network: A Path of China's Agricultural Machinery Industrial Cluster Upgrading

[1]Fang Chen, [1]Zheng Jianzhuang, [1]Jin Yuhan and [2]Zheng Wenyu
[1]Zhejiang University City College, Hangzhou, 310015, Zhejiang, China
[2]School of Economics and Administration, Shanxi University, Taiyuan, 030006, Shanxi, China

Abstract: In the background of export orientation, high outward currency appreciation, ageism and rising labor cost it is significant to solve issues concerning local agriculture, countryside and farmers and double pressure caused by leading countries and underdeveloped economies. The study takes example of Anji bamboo machinery cluster to discover the new upgrading path of agricultural machinery industrial cluster based on industrial embeddedness and insertion in local cluster network or the IEU model.

Key words: Agricultural machinery industry, industrial embeddedness, local industrial cluster network, industrial upgrading

INTRODUCTION

Although, developing agricultural machinery industrial cluster plays an important role in agriculture, countryside and farmers it is confronted with the background of export orientation, currency appreciation, ageism and rising labor cost as the other traditional industrial clusters. Since the early 80s, China implements the strategy of export growth, the ratio of sum export to GDP increased from 10.6% in 1980 to 24.92% in 2012; since the year of 2008's international financial crisis, threatened by American's 'double deficits', the currency appreciate 9.20% in the short 4 years; the proportion of the people 65 or over of the total population rise 5.60% in 1984 to 9.10% in 2012.The staff average monthly income increases from 458.3 yuan in 1995 to 47593 yuan in 2012. In the meanwhile it's extremely urgent that traditional low generation of processing gradually move into "cost depression", such as India and Vietnam and high-end, green and intelligent manufacturing appeals and regresses to America, developed country, research the agricultural machinery industrial cluster's new direction of transformation and upgrading. The paper takes example of Anji bamboo machinery cluster to discover the new upgrading path of agricultural machinery industrial cluster which is insertion in local cluster network as a transition way.

LITERATURE REVIEW

Presently, researches of industrial cluster upgrading path mainly concerns internal industrial upgrading and embeddedness in global value chain. In terms of industrial upgrading, industrial cluster network changes during different phases (i.e. emergence, growing, maturity and declining period) (Zhong, 2006). As network evolves, companies within the cluster affect each other through three levels of network, or to be specific, core network, facilitative network and interactions between internal-external environments (Lei *et al*., 2004). During this period, resource inflow and cluster innovation changes over time (Romanelli and Khessina, 2005), while the industrial upgrading can be influenced by connections between network nodes, roles of leading firms within the network, the network structure extension (Wang and Zhang, 2010; Wang and Wang, 2012); therefore, the specialization and cooperation, core firms introduction and fostering, as well as internal knowledge transfer are critical to industrial upgrading within a cluster.

Global Value Chain (GVC), on the other hand, is an extended network compared with local cluster network, to which the local cluster insertion mode changes over the cluster life cycle. The embeddedness mode four stages: Original Equipment Manufacturer (OEM), or mutual beneficial cooperation, turn-key project, exportation and Merger and Acquisition (M andA). The details are shown in Table 1.

As can be seen from Table 1, the advanced economies, attributed to the core technology and advantageous marketing network have been governing the primary stream of value chain for a long period which has hindered the transition from market to network mode and further transitions of leading firms in developing economies. In the light of that, local cluster insertion to

Corresponding Author: Zheng Jianzhuang, Zhejiang University City College, Hangzhou 310015, China

Table 1: Cluster characteristics, governance and upgrading

	Cluster life cycle			
Parameters	Emergence	Growth	Mature	Decline
Characteristics				
Enterprises introduction	Few	Accelerated	Stable	Reduced
Internal connection	Few	Strengthened	Intensive	Loose
Enterprises' scale	Small sized enterprises-centered	Median- sized enterprises-centered	Enterprises of different sized coexisted	Large-sized enterprises descending
Growth rate	Rapid	Accelerated	Stable	Stagnated or recessive
Governance				
Mode of value chain embeddedness	OEM	Turn-key project	Exportation	M and A
Mode of value chain governance	Market→Network→Quasi hierarchal→Hierarchal			
Upgrading	Process upgrading→Product upgrading→Functional upgrading→Chain upgrading e.g. OEA[1]→OEM→ODM→OBM			

Adapted from Wang and Zhang (2010)

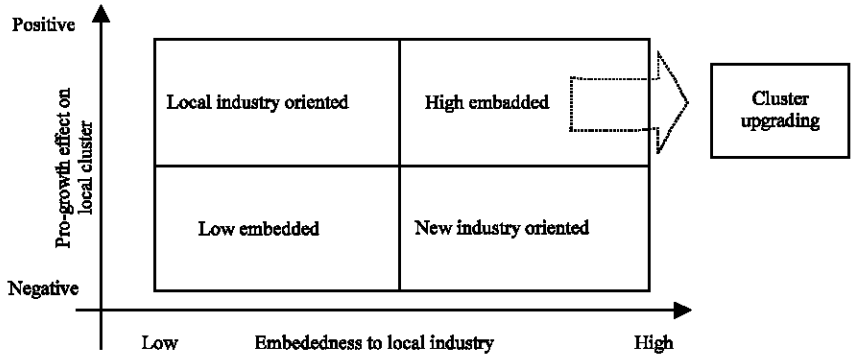

Fig. 1: Embededness and pro growth effect. Adapted from Ou-Yang (2008)

GBV can be achieved by cluster market share expansion via embeddednes in local industrial chain and upgradingvia specialization, core firm fostering and internal knowledge transfer. Based on cluster embeddedness to local industry or other clusters and the pro-growth effect (Ou-Yang, 2008), there are four cluster embeddedness types: (a) New industry-oriented, (b) Local industry oriented, (c) High embedded, (d) Low embedded (Fig. 1). The forth type is the favorable type for cluster upgrading it closely links to the upper and down stream enterprises and positively influences local cluster on employment rate of labor force, resource utility rate and sustainability[2].

BAMBOO PROCESSING MACHINERY CLUSTER: CURRENT SITUATIONS AND PORBLEMS

Ever since 1970s, when reform and opening up policies initiated, China's economy has experienced three phases, that is, mechanism transition (1979-1989), market orientation (1989-1999) and rapid growth (1999 to present) (Yang, 2008). Agricultural machinery, a traditional industry in China, developed at high pace during economic transition. The industrial product rose by 60 times from 5.422 bilion yuan in 1977-338.24 billion yuan in 2012 and China has become the second agricultural machinery manufacturer after the USA. The effects of industrial cluster has manifested itself and representative clusters can found in Shandong, Henan, Hebei, Jiangsu, Zhejiang, Jilin, Sichuan, Beijing, Tianjing and Chongqing. For instance, there are paddy rice planting equipment manufacturing cluster in Central and Southern China; the typical are Luqiao planting and protection machinery cluster, Jiaojiang spray and irrigation equipment cluster, Guanyun rotary cultivator manufacturing cluster and Chongqing small sized cultivating equipment cluster (Liu, 2012; Yang *et al*., 2007).

However, compared with the advanced economies, four problems can be observed in the domestic agricultural machinery manufacturing clusters. First, the overall technology level, especially the intelligent control technology, falls behind 20 to 30 years. Second, despite

[1]OEA:Original Equipment Assembly

[2]Employment rate of labor force in this case means the proportion of local employed labor force to the whole labor forced employment of the cluster inserting in local chain. Resource utility rate is the ratio of local resource for production to the whole production resource. Sustainability is calculated by comprehensive environment improvement costs

large number of enterprises, the industrial scale is too small to foster some leading firms or alliances that are internationally competitive. Third, the degree of specialization, consummate productive ability and value chain extension require improvements. Last but not least, there is regional imbalance in cluster development. As has been mentioned above, the research on Zhejiang cluster aims to explore the upgrading path which is of guidance and pragmatic significance.

Bamboo industry in Anji, Zhejiang grew rapidly in past 7 years. In terms of number of enterprises, the figure increases from 1882 in 2005 to 2427 in 2012; whereas the total product climbs from 5.4 billion yuan in 2005 to 15.8 billion yuan in 2012 at the annual growth rate of 16.58%. Bamboo processing machinery manufacturing industry is a traditional and characteristic industry in Zhejiang which is involved in the whole stage of bamboo processing from timbering to fine machining and strongly supported the bamboo industry. The cluster development can be dated back to late 1980s when the increasing growth of bamboo industry requires more machinery. In 1988, the first two bamboo processing machinery manufacturing joint ventures was established and mainly dedicated to bamboo mat production machines. In 1993, Xiaofeng Chiwu agricultural machinery manufactory innovatively product the first local machinery based by learning from Taiwan joint ventures. Xiangling, Tiangong and Jitai manufacture were founded successively in Xiaofeng Town, Anji and Xiaofeng cluster becomes domestically competitive in this area. Up to 2012, there are 26 main firms and some 50 private owned peripheral firms, contributing 0.67 billion yuan annual total product (Table 2). The products entail whole processing machinery of toothpicks, bamboo mat, bamboo skewers, chopsticks and bamboo floor. Additionally it has developed hydraulic press and accessories for reconsolidated bamboo floor production which covers 80% of market share.

In spite of the industrial growth displayed in Table 2, the cluster is faced wirh product homogeneity, low technology and shortage of supporting factors. Specialization coordination is not fully prevailed. For instance, within the 26 firms, only three that is, Tiangong, Yukang and Jianlin respectively focus on painting, hydraulic press and weaving machinery production. In contrast, more than half firms wire drawing machine, Bamboo planer and slicer. This persecutes economic scale and reduces product qualities. In terms of technology, the cluster majors the middle stream of the value chain and does not perform well in R and D. The products only cater for the need of micro-sized firms instead of large scale enterprise, the deteriorating cycle on one hand increases small scale and low end production; on the other hand it inhibits automation and informationalization. In addition, most products are tailored to the local bamboo species, hence cannot be applied to other regions with different species of bamboo. Furthermore, the region lacks universities, research institutions, government and intermediaries to support the cluster's long term development. As the cluster is originated from town, the inconvenience increases living costs and makes it less attractive to talents. As the upper stream of the value chain transfers to districts (e.g. Jiangxi, Hunan and Fujian) with lower labor costs, these emerging regions are likely to be the future competitors of Anji bamboo machinery manufacturing cluster.

UPGGRADING PATH OF THE CLUSTER

The present market's saturation indicates that market expansion cannot simply limit to traditional bamboo processing machinery market. According to strategy of embeddedness to local cluster (Chen and Zhang, 2012), we regard Anji's local clusters (i.e. bamboo industrial cluster, bamboo processing machinery manufacturing cluster and chair industrial cluster) and external wood processing machinery manufacturing cluster as a overall system (Fig. 2). We suggest that the industry closely

Table 2: Anji bamboo processing machinery manufacturing industry, an economic indices (2006-2012)

Indices	2006	2007	2008	2009	2010	2011	2012
Total product (100,000,00 million yuan)	2.90	3.20	2.00	2.10	2.20	2.04	2.60
Net profit (100,000,00 million yuan)	0.13	0.14	0.07	0.09	0.1	0.11	0.12
No. of employees	410	420	350	370	375	380	400
No. of enterprises	22	22	22	22	22	22	22
Sales (10,00 thousand yuan)	26000	29000	16000	18000	19000	21000	23000
Gross profit (10 thousand yuan)	1650	1800	1000	1200	1300	1400	1600
Total value added (10,00 thousand yuan)	5200	5700	3600	3800	4000	4300	5000
Production (set)	4200	4500	3100	3500	3600	3800	4000
Gross profit growth rate (%)		9	-44	20	8	8	14
Output growth rate (%)		10	-38	5	5	9	8

Source: Anji bureau of bamboo industry development

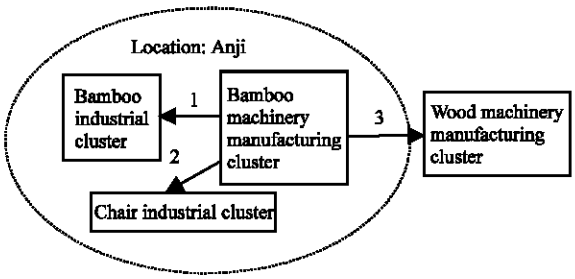

Fig. 2: Bamboo machinery manufacturing cluster's insertion to local cluster network

inserted to the internal cluster and that foster wood processing machinery manufactures to expand the market share.

Path 1: Insertion to bamboo industrial cluster: The closerelationship between bamboo processing and its equipment demonstrates that spatial expansion and value chain extension can increase the market share. According to the investigation, 65% of the machinery firms have more than half of their customers outside Zhejiang and with the emergence of bamboo industry in other province, the demand may increase. Additionally, more heterogeneous products can be developed as required by the local bamboo industry to prevent vicious competition.

Path 2: Bridging to local chair industrial cluster: As the headquarter of China's office chair industry, Anji has 758 firms reaching 26 billion yuan at sales in 2012, 33.2% (or 12.4 billion yuan) of which are achieved by enterprises of more than 20 million yuan annual sales. Two-third of the municipal tax is attributed to the industry and there were 283 export firms which had business relationship to 190 countries I nternationally, gaining export value of 1.47 billion USD.

Nevertheless, the chair industry confronts the rising labor costs pressure resulted from inflation, the minimum wage standard and higher income expectation. Hence, machine submitting labor force is inevitable in long term, thus offering the chance for bamboo machinery manufacturers to develop machines that can promote In the case of market upgrading, although the cluster has a lion share market and to some extent the reputation within the industry nationally, efforts sill need to be made in brand strategy, channeling and marketing. automation of chair production. For instance, the two leading firms of chair industry, Henglin and Yongyi, have cooperated with Jianlin Bamboo Machinery in R and D of automatic welding machine. It is reckoned that there will be 0.3 billion (45% of the present output value) extra annual earnings if bamboo processing machinery industrial cluster inserted to the chair industry.

Path 3: Extension to wood processing machinery industrial cluster: Although, there are differences between wood and bamboo, the principle of processing is similar; in particular, the painting and electric abrasive finishing are similar. Compared with bamboo machinery industry, the wood machinery industry covers larger market which created 10 to 1.2 billion yuan output value in 2012, almost four times the size of the bamboo market. Apart from that, the former industry's profit rate is 2-5 times the size of the latter. Hence it is promising for the bamboo machinery firms to penetrate to wood machinery industry based on their premier knowledge. Actually, some firms in the cluster have attempted to wood machinery and 20% of the cluster's business went from wood machinery products in 2012, according to Anji Bamboo Processing Machinery Industry Association. The embeddedness strategy catalyzes mutual benefits and synergetic effects in that the bamboo machinery firms absorb knowledge from the wood industry and actualized the goal of economics of scale and internal upgrading.

DISCUSSIONS

To summarize, industrial insertion and embeddedness to local cluster network are the sine qua non of upgrading (IEU model); nonetheless, there are two paths for technological and market upgrading.

In terms of technological upgrading, when inserting to the local cluster network, enterprises can cooperate with local leading firms and MNCs by attaining information inflow and knowledge spill in order to enhance innovative capability. Taking the leading firm (Xiangling) in the cluster as an example, the company started R and D in reconsolidated bamboo products from (1997) and succeeded after 7 years of trial and errors. The advantageous competitiveness in higher efficiency, utilization rate and lower labor costs have drawn attention of other firms represented by Huabeng, Yukang and Huafeng to follow the step in technological progress. Up t 2012, 20% of the cluster's total sales owed to reconsolidated bamboo machinery production.

Taking brand awareness as an example, there is only one firm that was awarded the municipal level of 'Famous Trademark Honor' in 2006. Those can be enhanced by establishing intermediary institutions that provide consulting, training, certifying, assessment, testing, designing and accounting services.

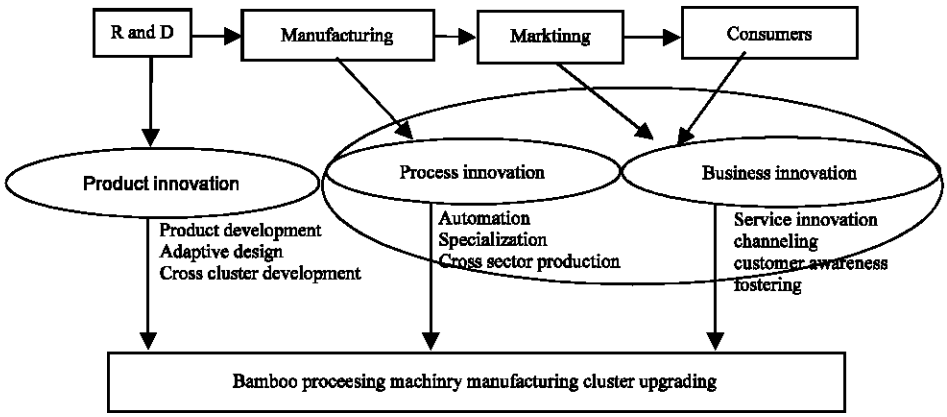

Fig. 3: Bamboo processing machinery manufacturing cluster upgrading technological and market improvements. Adapted from: Chen and Zhang (2012)

As has been discussed above, we recommend the synergic innovation stage of bamboo processing machinery manufacturing cluster based on technological and market improvements (Fig. 3).

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