

On Strategic Emerging Industry Cluster Development in Anhui based on the Perspective of Global Value Chain

-- Taking Bengbu Silicon Based New Material Industry as an Example

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Abstract: With the development of economic globalization, the role of strategic emerging industries embedded in global value chains (GVCs) as clusters to actively participate in the global industrial division of labor has become increasingly significant. The present situation and problems of strategic emerging industry clusters in Anhui are analyzed qualitatively from three aspects: dynamic mechanism, development mode and governance mode, and their status in GVC is inferred quantitatively by using GVC index. Secondly, Bengbu silicon-based new materials industry is used as an example for empirical research, and the GEM model and multiple linear regression model are used to build a data evaluation system and analyze the factors affecting the competitiveness of industrial clusters. Finally, we propose a scientific and reasonable upgrading path and policy suggestions based on GVC perspective, which can provide guidance and reference significance for promoting regional industrial economic development.

Keywords: Global Value Chain; Strategic Emerging Industries; Industrial Clusters.

1. Introduction

The report of the 20th Party Congress proposes to promote the development of strategic emerging industries in integrated clusters and build a new generation of economic and social growth engines, which is one of the important paths for China's economic and social development. Under the development of industry clusters, Anhui Province has been implementing the national innovation-driven development strategy and promoting the development of strategic emerging industry clusters, which has further developed by leaps and bounds. At present, three strategic emerging industry belts have been formed in Hefei, Wu-Ma-Tong economic belt and Beng-Chu economic belt, and the five cities of Hefei, Wuhu, Bengbu, Tongling and Huabei have obvious relative advantages in the formation of strategic emerging industry clusters. At present, the development of strategic emerging industry clusters in Anhui Province has taken shape, and the cluster effect has been gradually highlighted, and the trend of rapid development of clusters has been formed, such as the Hefei E-commerce Industrial Park, Wuhu National Robotics Industry Pilot Park, Bengbu Silicon-based New Materials Industry Cluster, Hefei and Wuhu New Energy Vehicle Industry Cluster, and so on. The overall development of strategic emerging industry clusters in Anhui Province has been good in recent years, but while going out for outward development, integrating into the global value chain, breaking the bottleneck of low-end locking and optimizing development, there are also problems such as unbalanced development, unreasonable market of industrial clusters, low added value of products, low level of synergy of three elements of clusters and insufficient effective power of cluster development.

Exploring the development status and problems of strategic emerging industry clusters in Anhui Province from the perspective of global value chain is conducive to explaining

how strategic emerging industries can better exert agglomeration effect and science and technology spillover effect, realize organic combination of talents, technology and capital and maximize benefits, and realize industrial upgrading at the end of global value chain in the context of present-day double-cycle, while the development suggestions derived from the empirical analysis of silicon-based new materials industry in Bengbu City. The recommendations from the empirical analysis of the silicon-based new materials industry in Bengbu are conducive to promoting the development of strategic emerging industry clusters in the region to create a new engine for regional economic development and promote industrial structure upgrading.

2. Literature Review

In recent years, the state has gradually emphasized the economic development approach of "promoting the development of strategic emerging industries with integrated clusters", and how to effectively exert the cluster effect of strategic emerging industries to promote industrial structure upgrading has been a topic of extensive attention by scholars and policy makers at home and abroad in the past decade or so. Shi Minghong et al. (2013) analyzed the development mechanism of cluster-based innovation of strategic emerging industries in China based on complex system theory and explored the inducing factors of their innovation development; Yu Dengke et al. (2016) proposed the concept of full factor network of strategic emerging industry clusters to promote the development of strategic emerging industry clusters by playing the synergistic role of factor network; Lu Lina et al. (2019) explored cluster differentiation development strategies by constructing a competitiveness evaluation index system for strategic emerging industry clusters; Arkadiusz Michal Kowalsk (2020) argued that strategic emerging industry clusters in Asia are mostly driven by foreign investment; Marta G9tz (2021) used German industry clusters as an

example to confirm the beneficial effects of clusters on industrial development in terms of services, information and efficiency; Wang Dan et al. Wang, Dandan et al. (2022) study the linkage and influence of the complex decision-making behavior of government, core enterprises, and supporting enterprises in the process of synergistic development of strategic emerging industry cluster ecosystem.

In summary, scholars at home and abroad have conducted rich research on the development of strategic emerging industry clusters in the past decade or so, and most of the research focuses on how to cultivate the development of strategic emerging industry clusters and effectively play the role of each direction, but there is a lack of interpretation of the effect of strategic emerging industry clusters from the perspective of global value chain. This topic provides a comprehensive analysis of the development and upgrading path of strategic emerging industry clusters from the perspective of global value chain, and provides new policy suggestions for regional economic development.

3. Results and Analysis of Empirical Research - Bengbu City Silicon Based New Materials Industry as an Example

3.1. Quantitative Analysis of the Competitiveness of Silicon-based New Materials Industry Cluster in Bengbu City

3.1.1. Selection of Indicators for the Degree of Silicon-based New Materials Industry Clusters in Bengbu

In order to analyze the degree of silicon based new materials industry cluster in Bengbu and the influencing factors of the cluster effect, this topic first uses the entropy value method to calculate the aggregation level of silicon based new materials industry cluster in Bengbu. The entropy method is the location quotient method, which measures the degree of specialization of a cluster in its region. Therefore, the location quotient index is also known as the specialization rate. The location quotient is actually an indirect measure of the degree of agglomeration of a cluster in its region by measuring the degree of specialization, and to some extent it also reflects the structure of economic activity linkages between clusters. The location quotient method is a quantitative analysis method used to measure the efficiency of an industry, usually in terms of output value, production, employment, etc. Its formula is

$$LQ_i = \frac{e_i / \sum_{i=1}^n e_i}{E_i / \sum_{i=1}^n E_i}$$

LQ is the location entropy value, which indicates the output value (or production, employment, etc.) of the whole region, the selected region E_i is the output value of sector i ; the selected region $\sum_{i=1}^n E_i$ is the output value of all sectors; the background region e_i is a sector industry; the background region $\sum_{i=1}^n e_i$ is the output value of all sectors. It is used to judge the development intensity of strategic new industries in a region, i.e., the larger the value, the greater the development intensity of strategic new industries in the region. When $LQ > 1$, it indicates that the industry has high geographical concentration and high development intensity, and has strong competitiveness and comparative advantage; when $LQ < 1$, it indicates that the industry has low geographical concentration and weak development intensity, and has comparative

disadvantage compared with other industries; when $LQ = 1$, it indicates that the industry is in medium status and has insignificant development intensity.

3.1.2. Calculation of the Degree of Silicon-based New Materials Industry Cluster in Bengbu and Analysis of the Results

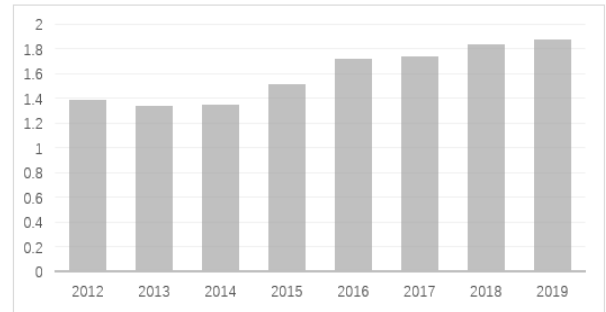


Figure 1. Bengbu City 2012-2019 strategic emerging industry gathering analysis

As can be seen from the figure, the location quotient of Bengbu's silicon-based new materials industry has been greater than 1 from 2012 to 2019, and even gradually stabilized at around 2 in the later years, which indicates that the silicon-based new materials industry belongs to the industry with significant comparative advantages in Bengbu, regional scale production and the development towards specialized industrial clusters, which is reflected in the reality level that Bengbu's silicon-based new materials industry cluster has formed a certain scale. From 2012 to 2014, the location of Bengbu's silicon-based new materials business was in a slow decline, and then started to rise again in 2015, but the degree of change in recent years has not been significant. 2012-2019 Bengbu's silicon-based new materials industry is generally in an upward trend, indicating that Bengbu's silicon-based new materials industry and the development of strategic emerging industries in Anhui Province are gradually gaining a firm foothold in the global value chain. Most of the enterprises in China lack core technology in silicon-based new materials and are only located in the middle and low end of the GVC, and as a city in a province of China - Bengbu City, Anhui Province, is no exception, the current Bengbu silicon-based new materials industry cluster is in the middle and low end of the GVC.

3.2. Analysis of Factors Influencing the Silicon-based New Materials Industry in Bengbu

3.2.1. Selection of Indicator Variables and Data

The GEM model commonly used in academic research on industrial clusters has six factors that have the greatest influence on the competitiveness of industrial clusters, mainly "resources", "facilities", "suppliers and related auxiliary industries", "structure, strategy and competition of enterprises", "local market" and "external market". On this basis, this paper selects some relevant indicators to study the degree of their influence on the silicon-based new materials industry cluster in Bengbu.

Indicator 1: Infrastructure conditions, the proportion of the number of employees in the electrical, gas and water production and supply industry and the number of employees in the transportation, storage and postal industry in Bengbu to the total number of employees in Bengbu in that year is chosen to measure the infrastructure conditions, which is called infra.

The selected indicator 2: support, due to the absence of some micro data, the subject chose similar data indicators, namely, the amount of fixed government investment in urban construction to measure the strength of social support, recorded as sup.

Select indicator 3: technology level (billion yuan), this paper selects Bengbu city science and technology business expenditure to measure the technology level of industry, recorded as tech.

Select indicator 4: specialized human resource level (million people), the number of employees in technical and scientific units in Bengbu city is chosen to measure the level

of specialized human resources, which is recorded as PHRL.

Select indicator 5: international market demand (million units), this paper selects the export sales revenue of new products in high-tech industry of silicon-based new materials industry to measure the international market demand by indicating the international market demand, recorded as fm.

Select indicator 6: domestic market demand (billion yuan), Porter's competition theory shows that there is a positive correlation between the gross product and market capacity, so this paper selects the gross domestic product to measure the international market demand, recorded as dm.

Table 1. Time series of independent and dependent variables

year	LQ	infra	sup	tech	phrl	fm	dm
2019	1.87	5.37%	324825.51	16.62	0.4	29987751	986515.2
2018	1.83	6.52%	344420.2	10.64	0.53	31035707	919281.13
2017	1.74	6.80%	257664	12.68	0.55	24580831.7	832035.95
2016	1.72	6.73%	277859	13.38	0.59	24546514.7	746395.06
2015	1.51	6.68%	356451	11.22	0.6	18325892.3	688858.22
2014	1.35	7.04%	673339	7.62	0.7	16675566.4	643563.1
2013	1.34	7.81%	574061	7.24	0.69	12985822.4	592963.23
2012	1.39	7.52%	752062	5.68	0.5	14646226	538579.95

3.2.2. Establishing an Econometric Model

This paper uses SPSS measurement software to analyze the data, and uses multiple linear regression analysis to find out the influencing factors affecting the agglomeration level of silicon-based new materials industry cluster in Bengbu City, and constructs an econometric model as follows:

$$LQ = \beta_0 + \beta_1 \text{infra}_{it} + \beta_2 \text{sup}_{it} + \beta_3 \text{tech}_{it} + \beta_4 \text{phrl}_{it} + \beta_5 \text{fm}_{it} + \beta_6 \text{dm}_{it} + \Delta \varepsilon$$

The following preliminary linear regression empirical analysis is carried out by substituting the actual data, and the results are shown in the following table.

Table 2. Results of multiple linear regression analysis

Linear regression analysis results (n=8).							
	Non-normalized coefficients		Normalization factor	t	p	Collinear diagnostics	
	β	Standard error	Beta			VIF	Tolerance
constant	0.554	0.071	-	7.810	0.081	-	-
infra	9.295	0.588	0.307	15.812	0.040*	15.673	0.064
sup	-0.000	0.000	-0.116	-6.796	0.093	12.058	0.083
tech	0.018	0.001	0.298	12.597	0.050	23.295	0.043
phrl	-0.461	0.017	-0.206	-27.019	0.024*	2.423	0.413
fm	0.000	0.000	0.757	37.031	0.017*	17.356	0.058
dm	0.000	0.000	0.014	0.611	0.651	20.548	0.049
R ²	1.000						
Adjust R ²	1.000						
F	F (6,1) =6917.228, p=0.009						
D-W	2.938						
Dependent variable: LQ * p<0.05 ** p<0.01							

From the table above, the model equation is $LQ=0.554 + 9.295*\text{infra}-0.000*\text{sup}+ 0.018*\text{tech}-0.461*\text{phrl}+ 0.000*\text{fm} + 0.000*\text{dm}$. When the F-test was conducted, it was found that the model passed the F-test ($F=6917.228, p=0.009<0.05$) which also means that the model construction is meaningful.

3.2.3. Analysis of Empirical Results

Based on the results of the regression analysis above, it can be concluded that infrastructure, international market demand will have a significant positive influence relationship on LQ. The level of specialized human resources has a significant negative effect on LQ. However, the level of support, technology, and domestic market demand do not have any effect on LQ.

(1) Level of infrastructure

The results show that the level of infrastructure construction, measured by the number of jobs, has a positive relationship with the Bengbu silicon-based new materials industry cluster. Infrastructure is a public good and is closely related to both the development of various industries and people's lives. The better the infrastructure construction, the more convenient the circulation of various resources, so the level of infrastructure is particularly important in all stages of the cluster. Therefore, we can predict that in the long run, the level of infrastructure and the cluster effect will gradually develop towards a significant positive correlation.

(2) International market demand

Over the past decades, with the increasing globalization of production and trade, global production factors and resources have been increasingly concentrated in those industrial clusters that are rich in characteristics. In other words, under the development of globalization, international market demand expands, and industrial multinational investors, in order to meet daily demand and maximize production efficiency, invest various production factors in areas with higher production efficiency and more value, thus forming industrial agglomerations. It is the geographical agglomeration of each value link that makes many local industry clusters become a subordinate part of the global industrial value chain. Many industrial clusters in China, for example, are a part of the global value chain. The outsourcing system after the vertical separation of the global value chain occurs with such a high frequency of industrial clustering among the overseas tolerances. The reason is that clusters are easy to manage and reduce costs, and can generate huge agglomeration economy, which will greatly enhance the competitive advantage of enterprises, as well as strengthen the competitiveness of local industries and promote the development of regional economy. Therefore, international market demand is a major driving factor for the development of China's emerging strategic industrial clusters

(3) Specialized human resource level

The level of specialized human resources is a reflection of the professional level and innovation ability of an industrial cluster. For a purchaser type industry, the ability of R&D and innovation is fundamental to its development and progress and to improve its international competitiveness, so highly educated and qualified professionals are extremely important in all aspects of the industrial cluster. The results of the regression show a small negative correlation between the level of specialized human resources and the effect of clusters. The reason for this is that although the specialized human resources in Bengbu's silicon-based new materials industry are increasing, the human resources in the cluster are not highly internationalized and lack core technology and innovation capability. The phenomenon of "first-class equipment, second-rate management, third-rate technology", which leads to the cluster in the domestic competition does not reflect the advantages, international disadvantages.

4. Grading Path and Policy Suggestions for Anhui Strategic Emerging Industry Clusters under GVC

4.1. Upgrading Paths

There are different upgrading paths for the optimal development of strategic emerging industry clusters under GVC, and the development of strategic emerging industry clusters in Anhui should choose the most suitable path for itself in the light of the actual situation. Based on the influencing factors that promote the optimal development of strategic emerging industry clusters and the contradictory problems that exist in them at present, according to the research obtained, we provide scientific and reasonable upgrading methods and paths for the clusters to better embed in GVC, make full use of the reverse optimal development of GVC, and upgrade the status of Anhui strategic industry clusters in GVC.

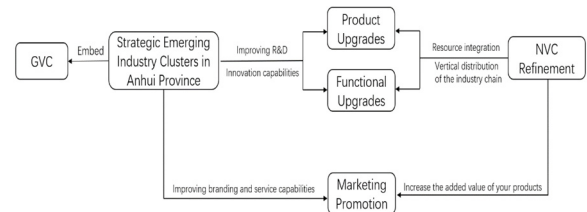


Figure 2. Anhui strategic emerging industries cluster upgrade path

For the strategic emerging industry clusters in Bengbu, we can fully refer to the upgrading path of the industrial clusters in the global value chain in Taiwan's Hsinchu Industrial Park. The first and the most crucial step is to focus on developing its own independent innovation capability, taking the initiative to obtain technology and management mode from the upstream enterprises in the global value chain, and on this basis, continuously improve its independent R&D capability, gradually climb up from the low-end link of OEM production and processing manufacturing to the R&D and design link, so as to realize the product upgrade and function upgrade of the strategic emerging industry cluster. On the one hand, the development of NVC can save a lot of costs, and the exchange of resources, products and talents in the country is much smoother than in the international arena. After the upgrading of products and functions, Shanghai's strategic emerging industry clusters should increase the investment in marketing and promotion to produce the brand effect of clusters and enterprises, not only to satisfy the development of the domestic market, but also to develop the domestic market. They should not only be satisfied with the development of the domestic market, but also look at the international market, compete with international big brand enterprises, and improve their global competitiveness.

4.2. Policy Suggestions

4.2.1. The State Should Reasonably Plan the Strategic Policy of Shanghai Strategic Emerging Industry Clusters Embedded in GVC

Strategic emerging industries play a pivotal role in China's industrial transformation and upgrading strategy, and their cluster development is an important means to speed up the current economic and social development. To promote the optimal development of local strategic emerging industry

clusters must be tailored to local conditions. For Shanghai, the strategic emerging industry clusters embedded in GVC development strategy must consider the development characteristics of each cluster, development situation, industrial layout characteristics and comparative advantages of Bengbu City, and other factors, and on this basis, a more reasonable strategic plan for international development should be formulated. In addition, for different enterprises in different fields of different strategic emerging industry clusters, they should coordinate the cooperative relationship between them with the same standard to jointly promote the international development of the clusters. At the same time, in order to cope with the pressure of international competition, large enterprises in the cluster should be actively promoted to establish relevant R&D institutions at home and abroad, so as to integrate the cluster into the GVC and create a favorable R&D environment.

4.2.2. Clear Positioning of Regional Government

The regional government should play the role of a good planner and service provider. Create an innovative and entrepreneurial environment with a net inflow of high-quality enterprises and high-quality production factors, and play more of a planner and servicer role rather than a dominant role under the premise of market allocation of resources. Create an environment that is conducive to the competition of innovation sparks, the continuous flow of innovative ideas, and the effective transformation of innovative achievements, so that science and technology workers can discuss more freely, study more intently, and explore more independently. The role of government in innovation in industrial clusters can be expressed as a facilitator of networks, a catalyst of dynamic comparative advantages and a builder of public institutions, establishing effective incentive mechanisms to eliminate ineffectiveness of innovation systems. Increase the concentration of quality production factors (capital, talents, entrepreneurs and quality enterprises).

For the Bengbu government, it needs to determine the core development areas of different strategic emerging industry clusters and their development modes and governance modes based on the industrial policies formulated by the state and the internal demands of strategic emerging industry clusters, and then combine the industrial base and comparative advantages of Bengbu city to formulate corresponding preferential and subsidy policies, improve the service platforms supporting cluster development, and make a strategic layout for each cluster. On the basis of these policies, we will formulate corresponding preferential and subsidized policies, improve the service platform to support cluster development, make strategic layout for each cluster development, and put forward corresponding development goals in different development stages.

4.2.3. Industry Standardization and Maintenance of Healthy and Orderly Development

Under the guidance of the government, the industry associations of Shanghai's strategic emerging industries should maintain coordination among enterprises in Shanghai's strategic emerging industry clusters, maintain healthy competition and orderly development in the industry, and strictly set standards and norms in the industry, supervise the behavior of enterprises in the clusters in real time, and regularly collect and report industrial information to the people and the government, so as to provide a well-ordered and fair development for Shanghai's strategic emerging industry clusters. To provide an orderly, fair and open

environment for the development of strategic emerging industry clusters in Shanghai. In addition to these basic functions, the industry association should also strictly control each link of production to ensure the safety of production and the quality of products, promote cooperation and information technology exchange among enterprises, accelerate the knowledge spillover from the cluster, select and send outstanding talents in the industry to participate in international industry fairs, visit and study in foreign strategic emerging industry clusters and enterprises, strengthen the close exchange and cooperation with advanced clusters and enterprises under GVC, and actively promote the knowledge spillover from the cluster. We will strengthen the close communication and cooperation with advanced clusters and enterprises under GVC, actively promote and publicize the cluster's own brands, help brand enterprises broaden their marketing channels, and realize the increase of added value of products under GVC.

4.2.4. Enterprises Achieve Technology and Management Capacity Improvement.

Therefore, for technology-intensive strategic emerging industries clusters, R&D capability and technical capability are the most important parts, and professional and technical talents are the basis for supporting the whole research system, and only when a cluster pays attention to the cultivation and discovery of professional talents can provide a continuous power for the long-term development of the cluster. The only way for the long-term development of a cluster is to pay attention to the training and discovery of professional talents. Enterprises in the cluster should strengthen the cultivation of professional talents from several aspects: first, enterprises can fully take advantage of the excellent economic environment and scientific and creative atmosphere in Bengbu to attract excellent technical talents from all over the country and even the world to join. Secondly, a perfect assessment system and incentive system should be established to promote the talents in the enterprises to keep learning and breakthrough and improve their innovative technology. Finally, each enterprise strives to create a corporate cultural environment with technical and academic atmosphere for its employees, so as to make a good pavement for enterprises to cultivate talents.

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References

- [1] Arkadiusz Michal Kowalski. Towards an Asian Model of Clusters and Cluster Policy: The Super Cluster Strategy [J]. *Journal of Competitiveness*, 2020(4):74-90.
- [2] Marta Gotz. Cluster role in industry 4.0—pilot study from Germany [J]. *Competitiveness Review: An International Business Journal*, 2021(1):54-82.
- [3] Shi M.H., Liu Y. A study on the dynamic mechanism and key inducing factors of cluster-based innovation in strategic emerging industries [J]. *Science and Technology Management Research*, 2013, 33(24):203-206.
- [4] Yu Dengke, Zhou R. Research on all-factor network model and factor sharing mechanism of strategic emerging industry cluster [J]. *Science and Technology Progress and Countermeasures*, 2016, 33(03):50-56.

- [5] Lu Lina, Hu Feng,Liu Yuan. Gradient differences and synergistic development of strategic emerging industry clusters--analysis of data based on Jiangsu [J]. Science and Technology Management Research,2019,39(20):59-63.
- [6] Wang Dandan,Kan Lirong,Fu Shuaishuai. Research on the collaborative operation of strategic emerging industry cluster ecological chain [J]. Complex Systems and Complexity Science, 2022, 19(01):60-66.
- [7] Tu Wenming. The development path and practice mode of regional agglomeration of strategic emerging industries in China [J]. Modern Economic Discussion, 2012(9).
- [8] Ou Tiangqiang, et al. Study on Innovation Network of Strategic Emerging Industry Clusters Led by Core Enterprises [J]. Business Times, 2013, (25).
- [9] Mou Shaobo . Research on cluster-based innovation network of strategic emerging industries and its governance mechanism [J] . Science and Technology Progress and Countermeasures. 2014, 31(01).
- [10] Liu Zhiyang . Research on the formation mechanism and competition strategy of the dominant design of strategic emerging industries [J]. Economic and Social System Comparison. 2010(05).
- [11] Zhang Jinyan . Research on State Intervention in Technological Innovation in China under the Perspective of Economic Law [J] . Economic Law, 2020(02).