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Integration of industrial chain and innovation chain of equipment manufacturing industry cluster

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Abstract: *The integration of industrial chain and innovation chain of equipment manufacturing industry cluster is a benign coordination mechanism to realize complementary advantages and mutual benefit among the main bodies of equipment manufacturing industry cluster. Based on the four elements of production input, market supply, subject cooperation and achievement transformation, the integration path of the industrial chain and the innovation chain of the equipment manufacturing industrial cluster is analyzed, which provides reference for the sustainable development and innovation and upgrading of the equipment manufacturing industrial cluster.*

Keywords: *industrial chain; innovation chain; Equipment manufacturing industrial cluster*

1. Introduction

The report of the 20th National Congress of the Communist Party of China proposed to strengthen the deep integration of industry, education and research led by enterprises, strengthen goal orientation, and improve the level of transformation and industrialization of scientific and technological achievements. Strengthen the main position of enterprise scientific and technological innovation, give play to the leading and supporting role of science and technology backbone enterprises, create a good environment conducive to the growth of science and technology small and medium-sized enterprises, and promote the deep integration of innovation chain, industrial chain, capital chain and talent chain and other strategic deployments. Equipment manufacturing industry is a general term for industries that provide various types of production technology and equipment to meet the needs of national economic development and national security, and is the core of national industry and an important part of comprehensive national strength. In the completely competitive market, the equipment manufacturing industry has formed a centralized industrial cluster structure, with high economic scale requirements, long industrial chain, high technical content and large industrial relevance. China's equipment manufacturing industrial cluster has developed rapidly, with a considerable scale and a certain level of industrial system, but there are still problems such as weak independent innovation ability, unreasonable industrial structure, and weak competitiveness. Deploying an innovation chain around the industrial chain to lay a solid foundation for the development of industrial clusters is the fundamental driving force for solving the current situation of industrial clusters. A good innovation environment and innovation mechanism can create a good innovation ecology for knowledge innovation and technological innovation in the equipment manufacturing industry, give full play to the integration role of the industrial chain and innovation chain, and improve the competitive advantage of China's equipment manufacturing industrial cluster and promote the coordinated development of the industrial economy. Therefore, in the process of studying equipment manufacturing industrial clusters, it is necessary to strengthen the integration of industrial chain and innovation chain.

2. Equipment manufacturing industrial cluster

Equipment manufacturing industry cluster refers to the spatial agglomeration of equipment manufacturing enterprises and related supporting institutions such as universities and research institutes with close industrial relations in a certain region. The equipment manufacturing industry manufactures various technical equipment to meet the development of the national economy and national defense construction, which is an important force for promoting the industrialization and economic modernization of the country. Compared with general industrial clusters, the characteristics of

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equipment manufacturing industrial clusters are affected and constrained by industrial economic characteristics and technical characteristics, as follows:

(1) The industrial chain in the equipment manufacturing industrial cluster is long, involving raw materials, research and development, production, sales, application and service.

(2) The equipment manufacturing industry has a long production cycle, a variety of production processes, a complex structure, and high technical content, so the analysis of the equipment manufacturing industry cluster should pay attention to the study of industrial relevance.

(3) The equipment manufacturing industry covers a wide range, involving high-end intelligent equipment manufacturing, large-scale mechanical component manufacturing, intelligent robot manufacturing, large-scale general equipment manufacturing, special equipment manufacturing, etc.

(4) The equipment manufacturing industry cluster has high requirements for informatization. The combination of information technology and modern equipment manufacturing industry is a necessary trend in the development of today's equipment manufacturing industry cluster, it is necessary to improve the industrial system, strengthen the construction of information base in network, production and other aspects, apply information technology in product production, research and development, management and other links, stabilize the development of equipment manufacturing industrial cluster, and improve cluster work efficiency and economic benefits.

(5) The core enterprises in the equipment manufacturing industry cluster have a strong driving role, and can gather many small and medium-sized enterprises for collaborative cooperation and supporting production, which is an indispensable part of the cluster.

(6) The equipment manufacturing industry cluster attaches importance to the cooperation between enterprises, especially the cooperation between equipment manufacturing enterprises and universities and research institutes, which can improve the research and development level and innovation ability of enterprises.

3. Integration of industrial chain and innovation chain

The concept of industrial chain originated from Adam Smith's study of the division of labor among firms, and Marshall later extended it to the division of labor between enterprises, emphasizing the importance of mutual cooperation. The industrial chain recognized by academia today is composed of four dimensions: space chain, value chain, enterprise chain and supply and demand chain, which is essentially a relationship chain of production, technology and market formed by enterprises by integrating industrial upstream, middle and downstream resources.

The idea of innovation chain comes from the study of industrial chain, and in 1977 Visvanathan germinated the idea of innovation chain[1]. With the deepening of the theoretical research of innovation chain, scholars have made different interpretations of the connotation and functional structure of innovation chain. These include the three-stage theory of "research and development, establishment of demonstration projects, and technology diffusion"; The four-stage theory of "basic research, technology research and development, practical application, industrialization and marketization"; "Basic research, applied research, experimental research, achievement transformation, industrial promotion" five-stage theory and multi-stage theory. The innovation chain is a chain process of large-scale market-oriented development from basic research, applied research, technology research and development to productization through the participation of relevant innovation subjects.

The discussion on the integration and development of industrial chains and innovation chains began in 2014 with the proposal of "laying out innovation chains around industrial chains, laying out industrial chains around innovation chains." The industrial chain is a dynamic structure formed by the division of labor and cooperation between different enterprises or organizations, and each link on it can form an innovation chain to promote the transformation and upgrading of the industry and high-quality development. If the innovation chain is separated from the market and industrial demand, it will lose the basis of industrialization and become an isolated innovation. The deep integration of industrial chain and innovation chain is an important support for promoting high-quality economic development. Each link in the industrial chain can form an innovation chain to promote the transformation and upgrading of the industry. If the innovation chain is separated from the market and industrial demand, it will lose the basis of industrialization and become an isolated innovation. In summary, this paper argues that the integration of industrial chain and innovation chain is to further improve the integration

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ability of inter-chain factors by integrating production factors and innovation factors on the chain, promote each other and develop together, accelerate the pace of scientific research and innovation development, and improve the modernization level of the industrial chain.

4. Integration of equipment manufacturing industry cluster, industrial chain and innovation chain

4.1 Strengthen cluster production input

Strengthen the investment in funds, infrastructure, equipment, talents and other factors of equipment manufacturing industry clusters, so that equipment manufacturing enterprises can carry out digital transformation and intelligent upgrading of production capacity to achieve intelligent production. This accelerates the process of industrial innovation and promotes the integrated development of industrial chain and innovation chain.

Reasonable investment of funds around the innovation links at different stages of the industrial chain is an indispensable element in the production activities of equipment manufacturing products. By providing some preferential policies such as land, taxation, and innovation subsidies, the government encourages banks to give a certain proportion of credit support to industrial cluster development projects in the form of "investment and loan linkage", and at the same time guides all sectors of society to increase investment in scientific and technological innovation funds for equipment manufacturing industrial clusters.

Different enterprises or organizations in the equipment manufacturing industry cluster need to cooperate with various talents in different industrial chains. The talents here include: management talents, technical talents, operation talents, knowledge talents and other types of talents. In the process of industrial cluster development, talents of different positions and levels form a chain structure and network structure, and the talents of each position are closely connected to form an innovative talent system. Talents cultivated by universities, enterprises, research institutes and social organizations can participate in the innovation activities of equipment manufacturing industrial clusters through project cooperation, talent introduction and other forms, so that efficient and lasting communication and cooperation can be maintained within the industrial cluster, and talent support can be provided for the innovation and development of the industrial chain of the industrial cluster.

In addition, build an incubation platform that can provide infrastructure and R&D equipment, innovative services, technology and financial support for equipment manufacturing enterprises in industrial clusters, reduce innovation costs, and improve the efficiency of new technological innovation.

4.2 Strengthen the efficient supply of clusters

Strengthen the market concentration of equipment manufacturing industry clusters, increase product market share, and form a certain scale advantage, so that enterprises in the cluster can more conveniently and quickly obtain market information such as customer needs and more opportunities to communicate with customers. Effectively collect customer data, carry out professional data analysis, fine extraction, combine the obtained information with the innovative ideas of products or technologies, and play a greater role in promoting the research and development and innovation of future equipment manufacturing products, so that the equipment manufacturing industry cluster can be orderly and healthy development.

Equipment manufacturing products have a high technical level, a more complex structure, many aspects that are prone to failure, and the application range of products is also relatively wide, which shows that the market demand not only requires equipment manufacturing related enterprises to provide high-quality hardware products but also to provide customers with product-related services. The equipment manufacturing industry cluster provides a series of related solutions such as operation and maintenance while providing products to help users grasp the performance of products as soon as possible, and the cluster can also get timely problems and information feedback to strengthen the renewal and development of innovation chain and industrial chain. The life cycle of equipment manufacturing products is long, so the service chain will grow accordingly, so the equipment manufacturing industry cluster should strengthen the integration of service and innovation in the industrial chain and innovation chain.

Provide personalized rental services according to the actual situation of customers. The equipment

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manufacturing industry cluster has established an open personalized customization platform, used the power of the network to obtain information in all aspects, and strengthened the demand management of users. Optimize the production capacity of some links in the industrial chain, increase the supply of new high-quality products, and meet the diversified needs of different groups[2].

4.3 Strengthen cluster principal collaboration

With the implementation of the "chain length system", cultivating leading enterprises has become a powerful measure for the innovation and development of equipment manufacturing industrial clusters. Through the leading role of "chain master" enterprises, attract capital, resources and high-end talents, integrate more innovation elements, and establish a collaborative innovation mechanism of industrial chain benefit sharing and responsibility sharing. With the leading enterprises in the industrial chain as the core, other enterprises in the cluster are involved to form an innovation cooperation alliance based on stage products, and the members of the alliance exchange relevant knowledge about the market and technology, solve various problems arising in the project, and develop and adjust research, production, distribution and after-sales strategies. Leading enterprises in the industrial chain rely on their own resources and advantages to play a leading role, radiate, guide and gather supporting enterprises, achieve complementary advantages, improve the production efficiency of the corresponding links of the industrial chain and innovation chain, and guide industrial upgrading.

The interaction between the various subjects and their elements in the equipment manufacturing industry cluster constitutes a network relationship structure through the interaction of information chain, capital chain, technology chain and talent chain. Universities, scientific research institutions, etc. provide intellectual support and give full play to the innovation and application of industrial cluster knowledge and technology. The government has established a series of management systems such as special planning to create a harmonious and orderly innovation environment for industrial clusters. Intermediary service institutions provide specialized services such as innovative resource allocation and management consulting for equipment manufacturing industrial clusters. Strengthening the synergy and cooperation of all entities of the equipment manufacturing industry cluster can form a clear cluster innovation network effect.

With the acceleration of the process of industrial transformation and upgrading, relevant auxiliary industries have cut into the equipment manufacturing industry chain, and enterprises in the industrial cluster can expand the marketing scope of equipment manufacturing products by increasing the purchase rate of third-party services. Productive service industries with technical management and business dealings with the equipment manufacturing industry, such as some transportation industries, warehousing industries, equipment leasing industries, computer industries, etc., continue to cut into the industrial chain, which can promote the continuous growth of the integration pattern of the two chains of industrial clusters.

4.4 Promote the transformation of scientific and technological achievements

As an important link in the innovation chain, the transformation of scientific and technological achievements is the result of effective digestion, absorption and utilization of knowledge and technology, and it is also an important link in the integration of science and technology with the economy.

Strengthen the construction of a public technology platform with multi-subject participation, provide R&D services and technical resources to enterprises in the cluster, and help them break through the key and common technical difficulties in the R&D process, so we should focus on improving the breakthrough and innovation in key links of the industrial chain and realize the transformation and development from technology introduction to independent innovation[3]. For most equipment manufacturing industrial clusters, the key link of the integrated development of the two chains is the manufacture of parts and complete machines, such as sensors, controllers and other key components, and strengthening the technological innovation of the key links of the two chains can optimize the allocation efficiency of industrial cluster resources and form an innovative pattern with complementary advantages and synergy and efficiency.

Layout around key links in the industrial chain, promote the application of key core technologies, and promote the application and industrialization of special achievements[4]. Focusing on the future development needs of the equipment manufacturing industry, core enterprises cooperate with universities and scientific research institutions to build cutting-edge technological innovation platforms

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in areas with intensive innovation resources, attract the agglomeration of innovation resources, and give birth to many cutting-edge technology industry chains[5].

Stimulate the innovation enthusiasm of scientific researchers through economic incentives and other means, meet the application conditions of new technologies, continue to promote the construction of innovation demonstration bases or incubator bases, and improve the efficiency of the transformation of scientific and technological achievements. Improve the mechanism for the transformation of scientific and technological achievements in equipment manufacturing industrial clusters, and improve the speed and quality of the transformation of scientific and technological achievements of equipment manufacturing products. The state can actively build a system for the transformation of scientific and technological achievements through measures such as building a regional technology trading market, improve the service capacity for the transformation of scientific and technological achievements, lead the equipment manufacturing industrial cluster to open up new fields, and cultivate new economic growth points.

5. Conclusion

The integration of industrial chain and innovation chain is an effective way to upgrade and develop equipment manufacturing industrial clusters. The deep integration of the equipment manufacturing industry chain and the innovation chain reflects the collaborative innovation of the production and innovation subjects of the equipment manufacturing industry, the coordination between the development of the equipment manufacturing industry and the scientific and technological innovation, and the integration of the original innovation and industrialization of the equipment manufacturing industry. In the critical period of the development of core technologies in the new round of industrial revolution, China's equipment manufacturing industry should seize this historical opportunity to achieve leapfrog development and change lanes and overtake.

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