

Research on the Mode of Technology Innovation Alliance of the New Material Industry in Hunan Province

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Abstract: One of the main directions of technology development in the 21st century is the development and application of new materials, and the key to the development of the new material industry lies in the industrial technology innovation. The gross scale of the new material industry in Hunan Province ranks the first array in China. Based on the present situation of Hunan's new material industry, three modes of technology innovation alliance are put forward in this paper, namely the government-driven mode, the research-driven and the market-oriented mode. The government-driven mode is applicable to the major technology innovation fields with uncertain market prospect, high risk of innovation and government's direct or indirect intervention; the research-driven mode is applicable to the key technology innovation fields with a high technology content; and the market-oriented mode is applicable to the general innovation fields in which enterprises have demands for technology innovation but such innovation must be achieved via cooperative research and development.

I. Introduction

The Industrial Technology Innovation Alliance is a cooperation organization for the industrial technology innovation adhering to the principles of joint development, complementary advantages, shared benefit and risk, consisting of enterprises, universities, research institutions or other organizations. It takes the development needs of enterprises and the common interests of all parties as the basis, the enhancement of industrial technological innovation capacity as the goal and the legally-binding contract as the guarantee. It is an important way for the construction of national and regional innovation systems, and has played an increasingly important role, especially in the development of strategic emerging industries. In this paper, the technology innovation alliance mode of Hunan's new materials industry is established through the research on the development of Hunan's new material industry.

II. Development Situation of New Material Industry in Hunan Province

The new material industry is always a key area in the development of high-tech industry in Hunan Province. In recent years, a new material industry system with rational layout, advanced technology and strong technological innovation capability has gradually formed in the process of promoting the new industrialization of Hunan.

1. The industry scale is expanding, but the agglomeration situation is obviously insufficient

The gross scale of the new material industry in Hunan Province ranks first array in China and the top of the six provinces in the middle of China. The new material industry system from research and



development to production, combined with production, education and research, involving a full range of categories has formed. In 2015, the full-aperture income of 642 new material enterprises included in the statistics was RMB 451.387 billion, the profit was RMB 5.81 billion and a total new material output value of RMB 313.079 billion was achieved, accounting for 27.9% of strategic emerging industries. Among them, the advanced energy storage materials ranked first in terms of category, scale and market share. The total output of cemented carbide materials ranked first in China and second in the world. However, the new material enterprises in our province are distributed in different regions of the city, and it is difficult to form the agglomeration effect brought about by the cluster development even in the city where the new materials are relatively concentrated. Some of the large-scale new materials industry parks are not professional, and each park contains different types of enterprises, and the layout is not standard, which has resulted in a series of problems like environmental pollution, thus restricting the scaled development of the new materials industry.

2. Key technologies have breakthroughs continuously, but the product level is generally low

Hunan has a number of major universities and research institutions, more than 10 academicians within the industry, two national engineering centers, six state-level enterprise technology centers and over 60 provincial (department) level innovation platforms. The technologies of carbon / carbon composite materials, powder metallurgy materials, high-performance aluminum alloy preparation and refining catalytic materials are at the advanced level in the world. However, of all the new material enterprises in Hunan, many are resource-based and extensive, so the product coverage is narrow. Most of the new material products are at low level, without strong core competitiveness. In the new material field, except for the leading enterprises which have strong independent innovation capacity and relatively adequate R & D investment, most of the enterprises stay at the low end of the industrial value chain, with less research investment, weak in independent research and development, original innovation and package technology development capabilities and engineering ability. The high value-added high-end products and large-scale production capacity is not strong enough while the production capacity of some low-end products are excessive.

3. The product technology is continuously improved, but the industry chains are not linked closely.

A number of key new materials in Hunan hold an important position at home and abroad, and the proportion of high-tech, high value-added new materials is increasingly growing. For example, the new-generation high-strength hull structural steel and ship plate steel self-developed by Xianggang has a market share of 20%; the lithium-ion battery anode materials developed by Shanshan New Materials and the fine zirconia ceramics developed by Lens Hualian play an important role domestically. However, most of the new material enterprises in our province are not associated with each other, and have no effective industrial exchanges and integration channels with advanced equipment manufacturing, rail transportation and other emerging industries. There is lack of social and professional cooperation between up-stream, middle-stream and down-stream enterprises of the new material field, the supporting rate is too low, the industry chain integration is not perfect, the value chain is not extended enough and the supply and demand interaction is not strong.

III. Development Mode of Technology Innovation Alliance of the New Material Industry in Hunan

The industrial technology innovation alliance is technology innovation cooperative organization with the purpose of enhancing the industrial innovation ability, and it is the result of government-industry-education- research-enterprise cooperation. The new material industry has different alliance modes according to the difficulty of technological innovation and the dominant force of the industrial technology innovation alliance. This paper deduces three modes of technological innovation alliance of the new material industry, namely the government-driven mode, the research-driven mode and the market-oriented mode.

1. Government-driven Mode

The government increases the investment in major technological innovation process by guiding new materials enterprises to promote such enterprises hold the dominant position in the process of major technological innovation. On the one hand, the government builds a technological information service platform, to promote the government-industry-education- research-enterprise cooperation; and on the other hand, it also build the university-enterprise- R & D center cooperation platform to achieve the resources optimization for major technological innovation of the new material industry, improving the comprehensive capacity of enterprises, universities and research institutions. This mode (see Figure 1) applies to some major technology innovation fields with uncertain market prospects, and high risk of innovation. The new material enterprises generally do not take the initiative to participate in such major technology innovation. The government should directly or indirectly intervene and guide the formation of industrial technology innovation alliance. In this model, the government is a link between the members of the alliance, and it makes the new material enterprises, universities and research institutions in the alliance linked closely, so that they work together to achieve the goal of technology innovation alliance by making use of their own strengths. Their cooperation can not only bring economic benefits to the members of the alliance, but also produce social benefits.

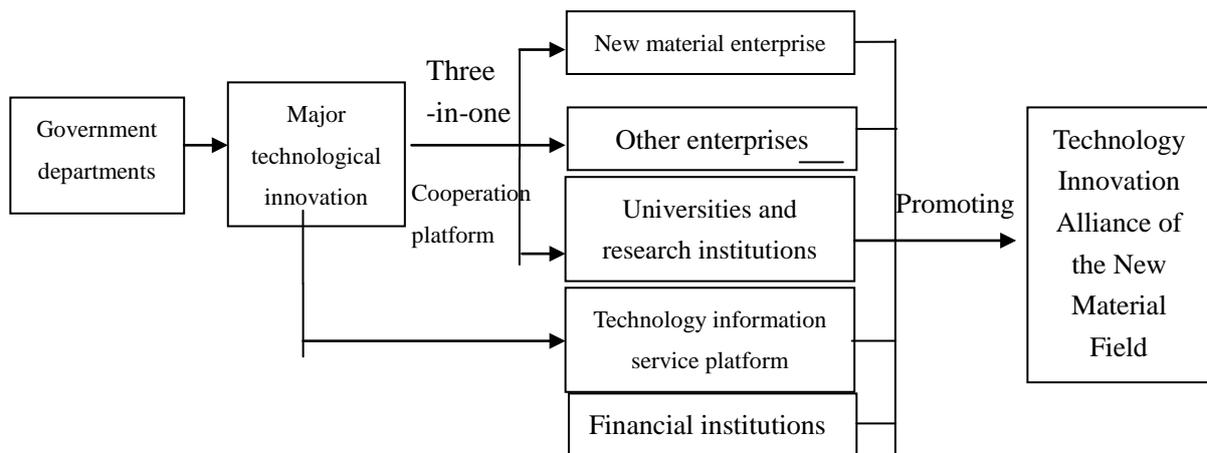


Figure 1 Government-driven Industrial Technology Innovation Alliance Mode

2. Research-Government-driven Mode

New materials enterprises have research demands on the key technologies, but they cannot complete such technology innovation independently, while universities and research institutions can help enterprises complete the major technology innovation by cooperating with other R & D partners, and combining the technology innovation demands, based on their own talent advantages and good experimental conditions. The mode (see Figure 2) applies to the major technology innovation areas with high technology content in the new material industry. In this model, the main cooperative R & D partners sought by universities and research institutions mainly include new material enterprises, government departments and financial institutions. From this mode, universities and research institutions are not only the drive force for the major technology innovation, but also the force to promote the conversion from technology to product, and achieve the technology industrialization. What is particularly important is that universities and research institutions can cultivate more

innovative talents in this mode, to provide higher quality human capital for the technology innovation alliance of the new material industry. Such human capital will bring new knowledge and technology to the alliance so that the alliance can absorb the innovative and open ideas.

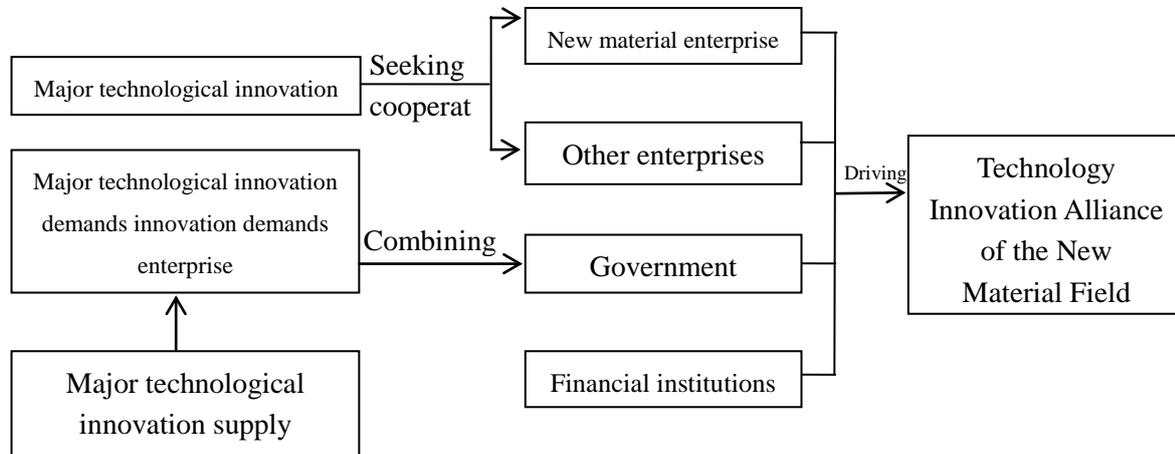


Figure 2 Research-driven Industrial Technology Innovation Appliance Mode

3. Market-oriented Mode

The partners to be sought in this model include universities, research institutions, financial institutions and related enterprises in the same industry. This mode (see Figure 3) applies to the circumstances that the new material enterprises have general technology innovation demands, or have the innovation demands on the technologies with general difficulty, but they hope to achieve the technology innovation jointly with other partners in order to reduce their own technology development costs and research and development time. In this case, the new material enterprises can seek technology research and development partners, and combine with government departments, to achieve the general technology innovation through cooperation with the partners, government departments and other relevant cooperation members. In this mode, the general technology innovation demands meeting the market demands may be achieved by developing technology within a short time. The enterprises in the appliance can provide support mutually in terms of funds, technology and talents. The technology innovation in this appliance is directly market-oriented, which makes the technology innovation has a certain direction, thus the role of the market feedback may be well played. The new material enterprises with general technology innovation demands should select their partners according to the market economy trading rules, based on their own strengths and weaknesses, so that the cooperative effect of resource sharing and complementary advantages are fully exploited.

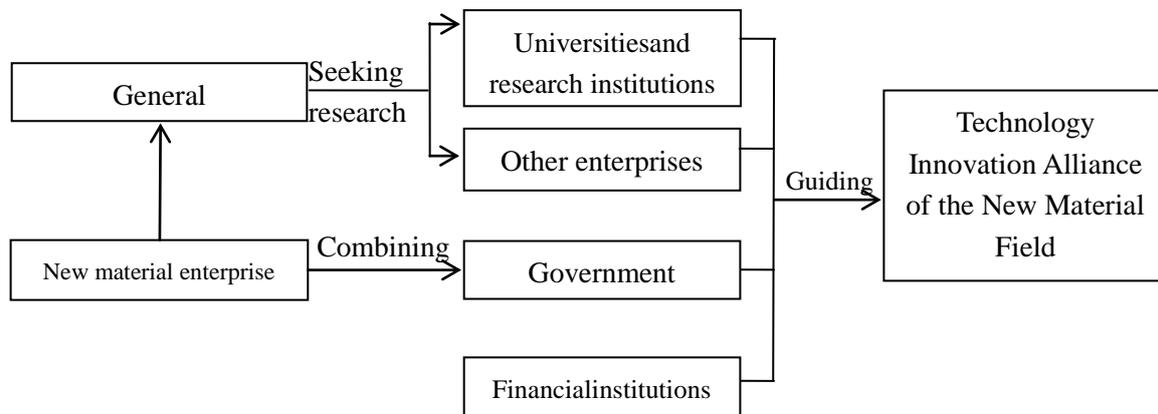


Figure 3 Market-oriented Industrial Technology Innovation Appliance Mode

IV. Conclusion

As Hunan's new material enterprises have not really become the main body of technology innovation, and the government-industry-education-research-enterprise combination is not close enough, the establishment of the technology innovation alliance of the new material industry is an important measure to solve these problems, and is also an important way to develop the new material industry of Hunan. Hunan's new materials industry shall guide more new materials enterprises and research institutions, up-stream, middle-stream and down-stream enterprises or industries to cooperate closely to form the technology innovation alliance of the new material industry, with the technology innovation enterprises as the main body, the upstream and downstream enterprises or industries working closely, technology innovation benefits shared and technology innovation advantages played. During establishment of the technology innovation alliance of the new material industry, the positions of each members, including enterprises, governments, universities, research institutions, financial institutions and users in the alliance should be specified clearly, so that all the members of the alliance can adhere to the principles of joint research and department, complementary advantages, benefits and risk sharing, to promote the efficient operation of technology innovation alliance of the new materials industry.

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