

# Research on the Development Strategy for Regional Innovation Alliances of Strategic Emerging Industries in Pearl River Delta

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**Abstract**—The construction of regional collaborative innovation alliances is an important way to promote industries upgrade from the industrial practice in developed countries. In this paper, in view of the main problems and constraints encountered in the development of technological innovation alliances of strategic emerging industries in Pearl River Delta, by drawing from the development experience of innovation alliances of strategic emerging industries of developed countries, strengthening the government's supervision and management mechanism, increasing the financial support of industrial alliances, improving the technological innovation environment, and paying attention to the construction of scientific research teams, specific countermeasures and suggestions were proposed.

**Index Terms**—Pearl River Delta, Strategic Emerging Industries, Regional Innovation Alliance, Development Strategy

## I. INTRODUCTION

The Pearl River Delta region is one of the most active areas of economic development, scientific and technological strength and human capital in China. Although the strategic emerging industries in the Pearl River Delta region has achieved great success, they are still faced with industrial isomorphism, the risk of strategic allocation of R & D resources in transnational corporations, lack of high-end talents, inadequate core technology, lack of a more scientific and effective linkage mechanism between the source of innovation and market. From the current industrial practice of developed countries, the construction of regional collaborative innovation alliances is an important way to promote industrial upgrading. Hong Kong-Macao-Pearl River Delta region has a large number of large and medium-sized enterprises with considerable research and development level, universities and R&D institutions, gathering the country's R&D strength and intellectual capital while leading the construction of innovative regions. Therefore, the Pearl River Delta region has the advantages of constructing R&D alliances that cover the electronic information, precision instruments, high-end manufacturing and other important strategic emerging

industries, enhancing the innovation capacity and industry competitiveness of strategic emerging industries in Pearl River Delta. Therefore, how to construct more efficient innovation alliances of strategic emerging industries of the Pearl River Delta region is important for future development, it is also of great significance to achieve endogenous growth of the Pearl River Delta region.

The existing research on strategic emerging industries is mainly focused on the definition, characteristics, selection and development policies of strategic emerging industries. The industry common technology innovation project of Yang Wei (2013) is a core task of alliance organizations, and the strategic alliance of industrial technology innovation is a typical project-oriented organization. Based on the perspective of university-industry-institute symbiosis network, Fu Miao (2013) studied the organization model of strategic alliance of industrial technology innovation. After analyzing the innovation alliance development experience of the United States and Japan, Yin Qun et al (2012) believed that China needs to make coordination optimization of the driving forces of legislation promotion, benefit sharing and interpersonal coordination in developing industrial technology innovation alliances. Pan Donghua et al (2013) analyzed the similarities and differences of strategic alliances of industrial technology innovation, university-industry-institute alliances and strategic alliances, and constructed an index system for innovation performance evaluation of strategic alliances of industrial technology by taking science and technology level upgrade, alliance construction and industrial competitiveness as primary indicators, and re-designed the evaluation method of alliance innovation performance. However, the above domestic and international research hardly studied the government policy of innovation alliances. In the Pearl River Delta region, a regional collaborative innovation alliance centered on Guangzhou and Shenzhen is constructed, new system design is required to enhance the capability of independent innovation, which is also the purpose of this paper.

## II. THE STATUS QUO OF TECHNOLOGICAL INNOVATION ALLIANCES OF STRATEGIC EMERGING INDUSTRIES IN PEARL RIVER DELTA AND THE EXISTING ISSUE

### A. Development of innovation alliances of strategic emerging industries in Pearl River Delta

In recent years, strategic emerging industries in Pearl River Delta achieved fast growth. In 2016, the total added value of high-tech manufacturing industry in Guangdong Province tapped 881.768 billion yuan, up by 11.7%, which was 5.0 percentage points higher than the industrial average of the province, accounting for 27.6% in the industrial enterprises above designated size, an increase of 0.3 and 0.6 percentage points compared with the first three quarters and the same period of last year. Since 2012, Guangdong Science and Technology Department has approved the establishment of 69 industrial technology innovation alliances in three batches respectively of 35, 23 and 11. In 2015, Guangdong Province has newly approved 18 alliances covering 8 fields, involving electronic information, advanced manufacturing, new material, biological medicine, new energy, modern agriculture, modern service industry, traditional advantageous industries. Among them, there are 43 industrial technology innovation alliances in the Pearl River Delta, accounting for 49.42% of the total. Among the 43 alliances, there are 25 alliances involving strategic emerging industries, 1 in electronic information field, 6 in the field of energy conservation and environmental protection, 6 in biological medicine field, 6 in new material field, and 2 in new energy field, as shown in Table 1.

TABLE I

BASIC INFORMATION OF TECHNOLOGICAL INNOVATION ALLIANCES OF STRATEGIC EMERGING INDUSTRIES IN PEARL RIVER DELTA

| S/N | Fields                 | Name of alliance  |
|-----|------------------------|---|
| 1   | Electronic information | Digital Family University-Industry-Institute Technological Innovation Alliance                      |
| 2   |                        | Guangdong Smart City Industrial Technology Innovation Alliance                                      |
| 3   |                        | Guangdong Mapping Geographic Information Industrial Technology Innovation Alliance                  |
| 4   |                        | Guangdong Network Space Security Industrial Technology Innovation Alliance                          |
| 5   |                        | Guangdong New Intelligent Terminal Industrial Technology Innovation Alliance                        |
| 6   |                        | University-Industry-Institute Technological Innovation Alliance of Network And Information Security |
| 7   |                        | University-Industry-Institute Technological Innovation Alliance of Software Industrialization       |

|    |  |   |
|----|--|---|
| 8  |  | University-Industry-Institute Technological Innovation Alliance of Internet of Things Information Industry        |
| 9  |  | Guangdong Electronic Printed Circuit Industrial Technology Innovation Alliance                                    |
| 10 |  | Guangdong Typographical Display Technological Innovation Alliance   |
| 11 | New material                                     | University-Industry-Institute Technological Innovation Alliance of Automotive-Advanced Steel Plate                |
| 12 |  | University-Industry-Institute Technological Innovation Alliance of Lead-Free Electronics Manufacturing            |
| 13 |  | Guangdong OLED (Organic Light Display) Industrial Technology Innovation Alliance                                  |
| 14 |  | Guangdong Wear-Resistant Materials Industrial Technology Innovation Alliance                                      |
| 15 |  | Guangdong Green Construction Engineering Materials Industrial Technology Innovation Alliance                      |
| 16 |  | Guangdong Metal-Based Composite Materials Industrial Technology Innovation Alliance                               |
| 17 | Biological medicine                              | Guangdong Stem Cell And Regenerative Medicine Industrial Technology Innovation Alliance                           |
| 18 |  | Guangdong New Drug Industrial Technology Innovation Alliance  |
| 19 |  | Guangdong Traditional Chinese Medicine (TCM) Industrial Technology Innovation Alliance                            |
| 20 |  | Guangdong Molecular Diagnostics Industrial Technology Innovation Alliance   |
| 21 |  | Guangdong Human Tissue Reconstitution Industrial Technology Innovation Alliance                                   |
| 22 |  | Guangdong Pharmaceutical Preparations Industrial Technology Innovation Alliance                                   |
| 23 | New energy                                       | Electric Vehicles University-Industry -Institute Technological Innovation Alliance                                |
| 24 |  | Guangdong Bio-Energy And Bio-Based Products Industrial Technology Innovation Alliance                             |
| 25 | Energy conservation and environmental protection | University-Industry-Institute Technological Innovation Alliance of Comprehensive Utilization of Mineral Resources |

It can be seen from the table, the Pearl River Delta has certain advantages in electronic information, new material, biological medicine, new energy and other strategic emerging industries, and the structure layout of the industrial technology innovation alliance has been basically completed, a strong push of the development of strategic emerging industries in Pearl River Delta.

### B. Issues in the technological innovation alliances of strategic emerging industries in Pearl River Delta

1. Lack of long-term strategic cooperation and planning of industrial technology

Firstly, the lack of long term planning at the industrial level. The strategic emerging industries in different cities in the Pearl River Delta have homogeneous competition, there is also room for complementary cooperation. The government did not make scientific and rational planning and layout of the innovation alliances of strategic emerging industries from the Guangdong Province or the Pearl River Delta, making the development of industrial technology innovation alliances separated. The collaborative innovation of regional strategic emerging industries is not well embodied, seriously hindering the promotion of innovation capacity and international competitiveness of strategic emerging industries in Pearl River Delta; Secondly, the lack of long-term strategic cooperation in industrial technology. The lack of long-term planning of industrial innovation alliances has led to the in-synergy between long-term goals of cities in the construction of innovation alliances of strategic emerging industries, resulting imbalance between short-term goals and long-term goals, imparities between enterprise's single and short-term technological innovation needs and long-term strategic cooperation and positioning of industrial technology innovation alliance. In addition, the key common technologies involved in strategic emerging industries and inter-city cooperation also need to be strengthened, interdisciplinary, cross-sectoral and cross-industrial cooperation needs to be enhanced.

2. Imperfect benefit safeguard mechanism of innovation alliances

The innovation alliances involve the government, enterprises, universities, research institutes and different other subjects, alliance members need to jointly establish an effective technology innovation cost sharing mechanism to achieve benefit sharing and risk sharing. Today, the benefit safeguard mechanism of technological innovation alliances of strategic emerging industries in Pearl River Delta is yet to be improved. First, the alliance members have different interest appeal in the process of cooperation, the lack of effective laws and regulations will result in unclear responsibilities, rights and obligations of innovation alliance members, further dispute over trifles, affecting the cooperation efficiency; second, generally there is a predominant coalition among the innovation alliances, and the lack of an effective external oversight mechanism will leave the legitimate interests of the alliance members unprotected; third, the mechanism of joint investment, results sharing and risk sharing in innovation alliance is not perfect. Capital investment is the key to the normal operation of innovation alliances. Some of the loyal alliance members may suspend capital investment due to the lack of appropriate penalties, affecting the follow-up cooperation. In addition, the intellectual property protection mechanism of the cooperation achievements is not perfect, the intellectual property and the benefits of achievement transformation are lack of clear and operational agreement.

3. Lack of sound venture capital functions and mechanism

Strategic emerging industries feature high growth and innovation, and can be strategic and advanced, risks also come along due to the complexity of the technology in the development process, thereby large capital investment is required. By merely relying on the capital investment from coalition enterprises, the needs of industrial development cannot be met. On the one hand, from the government perspective, although the relevant government departments set up special industrial development funds, it is difficult to bolster the development and application technology of innovation alliances due to limited funds, affecting the enthusiasm of R&D investment and achievement transformation; on the other hand, from the perspective of social venture capital firms, although there is a large number of venture capital institutions in Guangzhou and Shenzhen, there is still a big gap compared with the developed countries. The cooperation risk of many projects far exceeds the degree where both sides can assume. The project will be difficult without intervention of the risk fund.

### III. POLICY SUGGESTIONS ON THE DEVELOPMENT OF REGIONAL COLLABORATIVE INNOVATION ALLIANCES OF STRATEGIC EMERGING INDUSTRIES IN PEARL RIVER DELTA

#### A. *Actively do a long-term plan of the development of innovation alliances*

Since 2012, Guangdong Province has approved and set up a batch of innovation alliances covering electronic information, new material, new energy, biological medicine, energy conservation and environmental protection, but the geographical distribution, industrial choice, development model and other aspects lack of long-term planning, hindering the sustainable development of innovation alliances. The government must do a good job of overall planning of the innovation alliances of strategic emerging industries in Pearl River Delta, by analyzing the future development trend of technology and emerging industries, and the present situation of social and economic development in Guangdong Province. The relevant contents include: First, drawing on the international experience. The relevant government departments should view the new industrial revolution, the German industry 4.0, high-end manufacturing reflow in developed countries, the global value chain reconstruction and other large industrial development background, make a system analysis of the future development trend of technology, the general experience, characteristics, models, applicable conditions and historical evolution laws of the strategic emerging industries and innovation alliances in developed countries, summing up the main rules at different stages and providing reference for industrial policy-making suitable for different governmental systems. Second, the status quo analysis and demand analysis. It is recommended to take the high-end electronic information, LED, biology, new material, energy conservation and environmental protection and other industries in the Pearl River Delta region as the survey objects. Make a system analysis of the development scale, the status in the global market, the

innovation model and colony innovation network of related industries, the implementation and the effect of relevant industry innovation strategies, similarities and differences of different industrial innovation models and paths, the related industrial products and innovation capacity in the global industrial chain and other issues. Through analysis, the status quo of technological innovation and innovation alliances of strategic emerging industries, as well as the internal need for the development of regional collaborative innovation alliances of strategic emerging industries in Guangdong Province is made clear, providing detailed data support for the planning of innovation alliances. Third, the specific countermeasures. Based on the international experience, the status analysis and demand analysis, the development direction, development strategy, industry orientation, spatial distribution, innovation chain, proposed project and the implementation plan of innovation alliances of strategic emerging industries are made clear, providing guidance for the development of innovation alliances of strategic emerging industries.

#### *B. Develop a tailored innovation policy system*

Strategic innovation industry is the direction of future industrial development. Under the constraints of technology blockade and market control in developed countries, the government's innovation policy plays an important role in driving cognitive development and guiding cognition to break through technical blockade and control market. However, in the different stages of strategic development industries, there are significant differences in the demand for innovative policies. The policy concerns of different periods of industrial development will be different. For instance, in the industrial incubation stage, the key point in innovation policy design is to support and encourage local product development platform and its support system, and to encourage enterprises' dynamic design. In the stage of industrial growth, innovation policy should focus on supporting the design of leading products, gradually establishing rules, regulating the market order and improving the technical standard system, gradually establishing a patent system that supports new technologies. In the stage of industrial maturity, the innovation policy must encourage and guide enterprises to actively participate in the formulation and revision of international pricing mechanism and standard system, reconstruct the knowledge system based on local products, promote strategic emerging industries to integrate into the global innovation chain, and finally enhance our strategic emerging position in the global value chain. In addition to consider the stage of industrial development, policy design must also take into account the differences in industrial development in different regions and the technical characteristics of different industries. As a result, the Government should, on the basis of the strategic innovation industries in Pearl River Delta and the innovation needs, build a three-dimensional dynamic innovation policy system to promote the development of innovation alliances of strategic emerging industries in Pearl River Delta and industry

upgrade from the three dimensions of time (to provide different support measures for innovation alliances at different stages of growth), space (to promote innovation alliances of strategic emerging industries to choose an effective spatial distribution) and industry (to adopt tailored innovative policies according to the specific characteristics of different industries). An innovation alliance policy system including "time+space" (to develop space countermeasures by sub-growth stages), "time+industry" (to develop innovative countermeasures taking into account the different stages of industry growth and the different industries), "space+industry" (to take different strategies for different industries). The development of innovation alliances of strategic emerging industries in Pearl River Delta is driven by the government and market forces, further promoting strategic emerging industries.

#### *C. Build a diversified capital investment mechanism and improve the innovative financing environment*

The high risk and high input of strategic emerging industries demand a large amount of capital, and a good financing environment is the key to the development of strategic emerging industries. At the moment, the capital input of innovation alliances of strategic emerging industries in Pearl River Delta is still relatively simple, with government agencies accounting for the main part. It is urgent for innovation alliances to expand financing channels, making efforts to create a diversified capital investment mechanism. First, increase the support of financial funds and establish a year-on-year growing investment mechanism. The government should, on the basis of the existing development funds for strategic emerging industries, continue to improve and expand the financial support strength and forms of the technological innovation alliances of strategic emerging industries. Encourage the establishment of key industrial technology innovation alliances through fiscal policy, financial subsidies or incentives, give full play to the role of relevant government agencies in the strategic alliances of industrial technology innovation. Meanwhile, the government can establish special research projects of strategic emerging industries based on the actual needs and future trend, or develop specific targets or project scope. Applicants can apply for the project in the name of alliance or by cooperation of alliance members. The special projects are mainly used for priority support of innovation alliances to carry out R&D of key common technologies and technology achievement transformation, leading technology innovation of the alliances. Second, increase the support of credit funds, improve credit service for technological innovation alliances of strategic emerging industries. The development of strategic emerging industries requires a great deal of financial support, and the government's investment is very limited. Therefore, alliance development must depend on the large amount of credit fund support from the banks. The government should encourage and support the state-owned commercial banks. According to the features of innovation alliances of strategic emerging industries, the government should establish the corresponding credit

system, perfect the way of fund management, increase credit varieties, expand the ways of guaranty, expand science and technology credit investment, continue to reduce the cost of alliance enterprises in using credit funds. Third, the government should set up a venture investment guidance fund against the development risks of innovation alliances of strategic emerging industries, improve the operation mechanism of risk investment, and attract more social capital to promote the diversification of innovation alliance funds.

#### IV. CONCLUSION

The Pearl River Delta is an important central city of the country. The Pearl River Delta region is one of the most active areas of economic development, scientific and technological strength and human capital in China. The question is how the enterprises in the Pearl River Delta and the Pearl River Delta should foster their capability of independent innovation and upgrade their industries in the competition with transnational corporations, so as not to fall into the trap of low-level and extensive growth. Strategic emerging industries, as a pillar industry in the future Pearl River Delta development, will directly affect the direction of the transformation and upgrading of the manufacturing industry in the Pearl River Delta. At present, the Pearl River Delta strategic emerging industries are lack of innovation capacity, uneven in distribution of innovation resources, lack of coordination between regional innovation systems and other prominent issues. Therefore, it is of important theoretical and practical significance to study the construction and operation mechanism of technological innovation alliance of strategic emerging industries in Pearl River Delta. After the present situation of strategic emerging industries in Pearl River Delta and the status quo of industrial isomorphism with other cities in the Pearl River Delta were investigated and analyzed, the problems existing in Pearl River Delta strategic emerging industry innovation and industry technology innovation alliance operation were diagnosed, the policy orientation for improving the government's service platform for the development of new industries and optimizing the government are proposed, and a series of policies and measures have been formulated and perfected to support the development of strategic emerging industries, so as to promote strategic emerging industries to enhance innovation capability through regional collaborative innovation alliance and to participate in international competition.

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