

Thoughts and Countermeasures of Innovation Driven Development in Guangzhou — Enlightenment Based on Singapore's Experience

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Abstract—As the thirteenth national city of independent innovation demonstration zone, Guangzhou has always hoped to draw lessons from the international advanced scientific and technological management experience to innovate the science and technology management system. By utilizing the global scientific and technological innovation resources, and fully mobilizing the power of the whole society to innovate, the construction of Guangzhou National Independent Innovation Demonstration Zone has been sped up. This paper mainly introduces Singapore's successful model of innovation-driven economic development, which draws on a series of innovative strategic planning and policy measures in the fields of technology, talent, capital and culture. Combining the regional facts of Guangzhou, the paper put forward the path and countermeasure of Guangzhou science and technology innovation drive development.

Keywords—Singapore; Guangzhou; innovation-driven development; policy experience; development path

I. INTRODUCTION

In 2009, Guangzhou and Singapore worked together to build a new knowledge city in Guangzhou, and Singapore provided Guangzhou with valuable development experience. In the past 20 years, Singapore has vigorously implemented the strategy of scientific and technological innovation, introduced a series of measures to support the innovative development of the manufacturing and service industries, and trained and introduced world-class innovative and entrepreneurial talents to build a smart country. Singapore has successfully transformed itself into an innovative country based on knowledge economy, promoted its successful transformation into a regional innovation center driven by innovation, and became an important scientific and technological innovation center in Asia and even in the world. It also provides a reference for Guangzhou to build a national independent innovation demonstration zone.

On March 24, 2015, the CPC Politburo considered and passed the reform and opening up plan of Guangzhou free

trade zone, including Guangzhou Nansha District. On November 3, 2015, eight national high-tech zones, including Guangzhou, Zhuhai, Foshan, Huizhou Zhongkai, Dongguan Songshan lake, Zhongshan torch, Jiangmen and Zhaoqing, were approved to build national independent innovation demonstration zones, which are collectively referred to as the Pearl River Delta national independent innovation demonstration zones. Nansha pilot free trade zone covers an area of 60 square kilometers, and the national independent innovation demonstration zone in Guangzhou covers an area of 37.34 square kilometers. The two national strategic zones have an overlapping area of 2.5 square kilometers, which is Nansha Information Technology Park. If Guangzhou is to build a national independent innovation demonstration zone through innovation drive, this is a subject that the government and scientific research institutions must think deeply about. Based on this, this paper analyzes the experience of Singapore at the same time, combined with the current situation of Guangzhou, puts forward the ideas and countermeasures of innovation-driven development in Guangzhou.

II. SINGAPORE'S INNOVATIVE ACHIEVEMENTS AND POSITION

Singapore is a country with a territorial area of 716 square kilometers and extremely scarce resources. However, through sustained investment in science and technology, the introduction and cultivation of innovative and entrepreneurial talents, the full utilization of international innovative resources and the optimization of innovative environment, Singapore has established a relatively perfect system of scientific and technological innovation. Singapore has transformed from a capital-driven economy to an innovation-driven economy, and has become one of the most developed countries in the world in terms of economy and technology. Singapore ranks among the top 10 in the world in all kinds of innovation indices worldwide. 2015, Singapore's gross domestic product (GDP) was 4 024.58 S\$ Billion, ranked 37th in the world, with GDP per capita as high as S\$73,000 (Total about 5.1 million dollars), ranking 7 in the World.

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On August 15, 2016, the Swiss International Business School, the World Intellectual Property Organization under the United Nations and the University of Cornell in the United States jointly released The Global Innovation Index 2016. The report evaluated the innovation capacity performance of 128 economies with a total global GDP of nearly 98% from seven aspects, including institutions, human capital and research, infrastructure, market maturity, business maturity, knowledge and technology output and

creative output. And the results show that Singapore's Global Innovation Index rankings have risen year in recent years. In 2016, it ranked 6th in the world, one place higher than 2015, leading the Asian region. Singapore ranked first in the world in terms of innovation input indicators, ranking among the top 5 in the world in all two levels of indicators, with the highest level of infrastructure and business maturity indicators, shown in "Table I".

TABLE I. SINGAPORE INDICATORS SCORES AND RANKINGS IN THE GLOBAL INNOVATION INDEX 2017

Level I indicator	score/Sub	Ranking/bit	Level II indicator	score/sub	ranking/bit
			System	94.85	1
			Human capital and research	67.08	2
<i>Innovation revenue</i>	72.94	1	Infrastructure	69.11	1
			Market Maturity	71.52	5
			Business Maturity	62.14	1
			Knowledge and technology outputs	49.63	10
<i>Innovative output</i>	45.38	20	Creative output	41.14	33

III. KEY INITIATIVES TO IMPLEMENT INNOVATION-DRIVEN STRATEGIES IN SINGAPORE

A. *Focus on Leveraging Multinationals to Expand Research and Development (R&D) Capabilities*

Singapore is a successful example of leveraging transnational company (TNC) R&D activities to enhance its innovation capabilities, and its transnational company R&D spending accounts for more than 60%. More than 7000 multinational companies around the world have established institutions in Singapore, with 60% companies setting up regional or international headquarters. By strengthening the cooperation between national scientific research institutions and transnational corporations in tackling technological challenges, Singapore has mastered the core and key technologies of research and development with the help of transnational corporations, and realized independent innovation and integrated innovation through introduction, digestion, absorption and re-innovation. Many of the cutting-edge innovative technologies of Singaporean companies are traced to multinationals such as Microsoft, Apple, Motorola, Emerson and Hewlett-Packard Labs. By setting up R&D funds to encourage multinational companies to carry out research and development activities, Singapore has formulated R&D assistance plans and corporate research incentive plans to provide funds for the R&D activities of multinational companies and encourage multinational companies to set up R&D headquarters and carry out research and development activities in Singapore. The Singapore government has selected a group of outstanding technical backbone and management personnel among its domestic enterprises for professional training, and then sent this group of personnel to work in multinational enterprises, and paid a certain amount of remuneration for these talents. By studying and practicing in multinational enterprises, this group of talents can find the gap between their company and multinational companies in the level of technology and management, and helps their enterprises to come up with operational solutions, which in turn better serve the enterprise.

B. *Focus on Establishing an Open and Innovative Talent Cultivation and Introduction Mechanism*

Talent is a key element of knowledge creation and technological innovation in Singapore; Singapore attaches great importance to the cultivation of local talents and the introduction of overseas talents, and constructs an open and innovative talent introduction and training mechanism. Through talent introduction and education, Singapore in biomedical, information technology and other key areas has accumulated a large number of high-quality personnel, Singapore government has established the "Contact Singapore" network and set up offices for specialized service talent recruitment in major cities around the world; through the establishment of specialized research programs to attract talents, such as the globally competitive NRF research fund project, Singapore has successfully attracted a large number of young scientists and researchers from all over the world to conduct free research in Singapore. To implement the loose residence policy and the talent return program, the government of Singapore has introduced professionals from all over the world by offering tax incentives, long-term work visas and making them permanent residents to foreign workers. Also, through international cooperation, it has cultivated local talents and established cooperative relations with world-class universities, such as national university of Singapore, Johns Hopkins University and Stanford University

C. *Focus on Scientific and Technological Innovation Activities to Support Small, Medium and Micro Enterprises*

Singapore has issued a series of science and technology innovation plans for small, medium and micro-sized enterprises, and formulated a package of policies or plans on reducing service fees, providing technical support, encouraging scientific and technological innovation, cultivating entrepreneurial talents, strengthening service guidance and alleviating capital constraints, with a view to continuously improving the innovation level of MSMEs. In 2009, the Singapore Standards, Productivity and Innovation Agency launched the Innovation Voucher program, which

was extended to the areas of productivity, human resources and financial management 2012 later and renamed as the Innovation and competency voucher policy (see “Table II”) to provide all-round support for the innovation and development of MSMEs. In order to overcome the problems of small land area and limited local market, the Singapore government has been vigorously supporting MSMEs to “go

out” and make full use of international innovative resources and international market demand. For example, the Singapore Enterprise Development Board has allocated 10 million Singapore dollars annually from 2010 to 100 MSMEs to cover some of the expenses they need to expand their overseas markets.

TABLE II. SINGAPORE: COMPARISON OF “INNOVATION VOUCHER POLICY”, “INNOVATION AND COMPETENCY VOUCHER POLICY”

Project	Innovation Voucher Scheme (IVS)	Innovation and Competency voucher policy (ICV)
<i>Implementation Time</i>	March 2009	June 2012
<i>Covers content</i>	Innovation	innovation, productivity, human resources and financial management
<i>Main purpose</i>	Connecting knowledge institutions, encourage enterprises to carry out scientific and technological innovation	Encourage enterprises to upgrade and improve their competitiveness in the four areas
<i>Application Method</i>	Mail the application to the address specified	Online submission +entrance Management
<i>Application time and Steps</i>	March, June and October every year (8 steps)	Submit at any time (steps)
<i>G5mm processing Time</i>	4 - 6 weeks	2 workdays
<i>Time per year and face value</i>	3 times (5000 Singapore dollars)	2 times (5000 Singapore dollars) Each area can be
<i>Application Form (duration)</i>	1 sheet (1 year)	2 sheets (6 months)
<i>Service Provider</i>	19	22

D. Focus on the Integrated Development of Scientific and Technological Innovation and Commercialization

Singapore attaches particular importance to the integration of science and technology and industry, and through a series of open innovation policies, encourages enterprises and R&D institutions to maximize their expertise in R&D and innovation, and promotes the upgrading and transformation of Singapore to a knowledge-based economy. The technology ambassador system has been established according to the needs of enterprises, which will specifically select scientific research and engineering and technical personnel from public research institutes to work in enterprises for one or two years. Businesses pay only 30% of the salary of sci-tech ambassadors, and the rest is paid by the Bureau of Technology and Research. At the same time, the government has implemented the "proof-of-concept funding scheme" to select a number of projects for the transformation of scientific and technological achievements, to provide funds for researchers in public research institutions and universities, to encourage further research, and to realize the commercialization of scientific and technological achievements

E. Focus on Multi-channel and Increase Investment in Science and Technology Innovation

The Singapore Government has continued to increase investment in science, technology and innovation through the government's direct financial support, indirect incentives for tax incentives and various policies such as venture capital funds and sci-tech financial mechanisms. In 2014, the

government's R&D investment in Singapore reached S\$4.39 billion, an increase of 7.9 percent over the previous year and accounting for 38.8% of the total R&D investment in the whole society. The government maintains a high R&D input, which is particularly important for basic and applied research, especially for basic research. In 2013, Singapore Government's basic research investment accounted for 67% of the total investment of basic research in the whole society, and was the main source of funding for basic research investment (e.g. “Table III”). The Singapore government has introduced a series of tax incentives to encourage enterprises, especially small and medium enterprises, to increase their R&D investment. For example, in the implementation of the "productivity and innovation incentive scheme", the government stipulates that enterprises can enjoy a tax rebate of 250% for the part of R&D expenditure lower than (including) S\$300,000, and 150% for the part of more than S\$300,000. This will create a full range of sci-tech financial Network, to provide full life cycle financing services. Singapore has launched "a package" of financing assistance schemes and supporting financing products based on the potential financing needs of enterprises from start-up to growth to different stages of internationalization, with the aim of filling the funding gap that technology-based enterprises may face at different stages from their initial development to global companies, providing them with a full range of life-cycle financing services.

TABLE III. 2013 GOVERNMENT'S INVESTMENT IN THE TOTAL R&D INVESTMENT OF SINGAPORE

Research area	Government input billion SGD	Government input Growth ratio%	Total input billion SGD	Total input growth ratio%	Government input percentage ratio%
<i>Basic Research</i>	10.4	4.8	15.5	9.1	67.1
<i>Application Research</i>	10.6	7.8	25.6	7.8	41.4
<i>Experimental Development</i>	9.8	13.5	34.8	13.4	28.2

F. Focus on the Construction of Innovative Basic Environment

Innovation Environment is the premise of scientific and technological innovation, science and technology innovation platform is the infrastructure of innovation environment. Singapore has built a world-class innovation infrastructure, constructing a perfect network of sci-tech innovation platform. It not only pays attention to the protection of intellectual property rights and the creation of cultural atmosphere, but also constantly optimizes the innovation environment [6]. Singapore has promoted the application of the public-private partnership (PPP) model to technological innovation. From infrastructure development to technological innovation in small and medium-sized enterprises, PPP mode has adopted to solve problems that need technological innovation but cannot be solved by the government's own ability; the authority has also established specialized technology procurement PPP platform, specializing in the development and marketization of advanced technologies such as municipal construction for small and medium-sized enterprises [7]. Outstanding projects selected by the government will be financially supported in the early stage of research and development, and will be purchased in batches after the prototype production and passing the test, which greatly improves the technological innovation ability of small and medium-sized enterprises; these innovative technologies and solutions, after commercialization and marketization, have been exported to PPP project development, financing and construction for overseas infrastructure and municipal construction, which enhanced Singapore's competitiveness as a comprehensive solution provider for infrastructure construction in Asia.

IV. CONCLUSION

In terms of economic scale, the gross domestic product (GDP) of Guangdong is four times that of Singapore: in 2015, the GDP of Guangzhou was about 1.169 trillion us dollars, while that of Singapore was about 2.925 billion us dollars, which was the same as that of Guangzhou (290.6 billion us dollars) and Shenzhen (273.8 billion us dollars). In terms of R&D expenditure of the whole society, Guangzhou is nearly five times as much as Singapore: in 2015, Guangzhou spent about 30 billion us dollars on R&D expenditure, while Singapore spent about 6 billion us dollars on R&D expenditure (2014). In terms of R&D input intensity, Guangzhou is slightly higher than Singapore, both exceeding 2.0 percent (Singapore exceeded 2.0 percent in 2001 and Guangzhou exceeded 2.0 percent in 2012), and both are in the stage of innovation-driven development: in 2015, R&D input intensity in Guangzhou was 2.47 percent and that in Singapore was 2.2 percent (2014). In terms of per

capita GDP, Singapore was five times that of Guangzhou: in 2015, the per capita GDP of Guangzhou was about 10,300 us dollars, while that of Singapore was about 51,100 us dollars (ranking 7th in the world). Thus, although the current Guangzhou and Singapore are the same as in the innovation driven development stage, but in science and technology innovation strength and the level of economic development, we still have some gap. We need to learn from Singapore, accelerate the innovation development strategy, and promote scientific and technological innovation to be translated into real productivity to the greatest extent, so as to promote rapid economic and social development and the improvement of people's living standards

In addition, the Singapore as with Chinese as the main body of the city and coastal city, the land area is narrow and the resources are relatively scarce. However, through the joint efforts of the "hand of the government" and the "hand of the market", Singapore complements each other's strengths and enables the "visible hand" of the government to better leverage and unleash the "invisible hand" of the market, to build a world-class innovative entrepreneurial environment and an open regional innovation system. By making full use of global innovation resources, Singapore has gradually developed into an innovation-oriented country and a global sci-tech innovation center, ranking among the top 10 countries in the world in terms of innovation capacity. As the frontier of China's coastal cities and reform and opening up, Guangzhou should fully learn from Singapore's experience, give better play to the role of government and the decisive role of the market. We should not only constantly improve the governance system of scientific and technological innovation and open regional innovation system, further utilize global sci-tech innovation resources, but also fully mobilize the innovation forces of the whole society and accelerate the construction of an innovation-driven national innovation demonstration zone.

A. Accelerating the Top-level Design and Urban Layout of the National Innovation Center for Science and Technology Industry

In recent years, especially since the financial crisis, Singapore has gradually established an innovation-driven economic development model, introduced a series of strategic planning and policy measures such as research, innovation and entrepreneurship, and built a science and technology innovation center with global influence. The outline of China's 13th five-year plan proposed to support the pearl river delta region in building new heights of openness, innovation, transformation and upgrading, and speed up the construction of an innovation center for the sci-tech industry in Shenzhen. Building a national innovation center for sci-tech industry is the new positioning and requirements of the

CPC central committee and the State Council for Guangzhou, which brings rare opportunities for accelerating the innovation and development of Guangzhou.

Firstly, the construction of the National science and technology Industry Innovation Center top-level design should be accelerated. At present, Shanghai, Beijing and Jiangsu have issued a series of planning policies for the construction of sci-tech innovation centers with global influence, implementation plans for national sci-tech innovation centers and implementation opinions for industrial sci-tech innovation centers with global influence. Guangzhou should accelerate the introduction of policies and measures to build a national sci-tech innovation center, in key areas, support measures, reform measures, regional urban layout and other aspects of the overall deployment and reform experiment, and give full play to the government in planning guidance, policy support and other aspects of the active role.

Secondly, Shenzhen should be supported to speed up the construction of international sci-tech industry innovation center. The government should accelerate the development of the innovation center of the Shenzhen international technology industry, take full advantage of marketization and enterprise innovation, and accelerate the technological innovation and expand its intellectual innovation; relying on the policy advantages of Shenzhen national independent innovation demonstration zone and its geographical advantages adjacent to Hong Kong and Macao, we should actively participate in international scientific and technological Innovation competition, strive to lead or lead the development direction of global industrial technological innovation, so as to improve Shenzhen's position in the global Innovation Network, and create a technology industry innovation center with global influence.

Thirdly, Guangzhou should be supported to speed up the construction of international science and technology innovation hub. The advantages of Guangzhou universities, scientific research institutes and scientific research talents should be given full play to further strengthen the construction of high-level universities and high-level universities of science and engineering, to strengthen the advantages of scientific research and basic research, and to actively promote the integration of knowledge innovation and technological innovation; relying on the policy advantages of the national independent innovation demonstration area of the Pearl River Delta, to build a national innovation center city with global influence and an international science and technology innovation hub, it is necessary to improve the market-oriented mechanism of technology innovation.

Fourthly, Zhuhai, Dongguan, Shantou, Zhanjiang and other coastal cities should be supported to build regional science and technology innovation center. The government should support Dongguan to give full play to the advantages of manufacturing Foundation, so as to build a global influence of advanced manufacturing base ; support Zhuhai to give full play to the advantages and ecological advantages of the special zone and build the Pearl River West Bank

Regional Innovation Center ; support Foshan to give full play to the advantages of Guangfo city, and build the South China Sci-Tech Financial industry Fusion Innovation Center ; support Shantou to give full play to the advantages of the SAR and the rich advantages of overseas Chinese resources, and build the regional innovation center ; support Zhanjiang to give full play to the advantages of western Guangdong Province Science and Technology Education Center, the construction of western Guangdong Province Regional Innovation Center.

B. Establishing a Scientific and Technological Innovation Governance System that Improves the Common Power Between Government and Market

Singapore has established a government-led national innovation governance system, and set up a research, innovation and entrepreneurship council chaired by the prime minister of the cabinet. It has a well-functioning, unified and coordinated government science and technology innovation management agency, which has strengthened the government's function of guiding macro-strategic planning and providing innovative services. In promoting technological innovation, the Singapore government has also played a strong government and market leadership role. Its strength lies not in setting the direction for each enterprise, but in formulating various strict laws and perfect service packages, introduces policy measures to promote technology research and development and collaborative innovation, builds major innovation platforms such as national laboratories, major scientific research institutions or innovation park carriers, so that enterprises, universities and scientific research institutions spontaneously converge to the development direction of policy formulation, which better deal with the balance between the "tangible hand" of the government and the "invisible hand" of the market. This leads to the Enlightenment to Guangzhou:

Firstly, the unified and coordinated scientific and technological innovation of the government organization management system should be improved. The member units of the municipal leading group of science and technology education should be increased in time to further play the role of the leading group of sci-tech education in Guangzhou. The leading group shall hold a plenary meeting at least once a year to strengthen the top-level design, guidance and supervision of the city's science and technology innovation strategy, coordinate the joint decision-making of all relevant departments, coordinate the layout of the city's sci-tech innovation resources, review and approve major issues in the management and reform of sci-tech innovation, and strengthen the overall planning and coordination of major sci-tech decisions. A system of joint meetings involving departments of finance, development and reform, economy and information technology and education shall be established and rules of procedure formulated. It is mainly responsible for coordinating and negotiating the strategic plan for the development of scientific and technological innovation, the layout and setting of scientific and technological projects (special projects, funds, etc.), the comprehensive major tasks or problems of scientific and technological innovation, and strengthening the effective

connection between sci-tech innovation policies and policies and measures in talent, education, economy, industry, taxation, finance and society.

Secondly, effective mechanisms to better play the role of market-led and government should be explored. The key to constructing a perfect innovation multi-governance system for government, market and social pluralism is to deal with the relationship between government and market. Guangzhou should speed up the transformation of government functions, rationally locate government and market functions, promote decentralization, integration of management, optimization of service reform, strengthen government strategic planning, policy formulation, environmental construction, public services, supervision and evaluation, and the implementation of major tasks, and reduce the direct distribution of innovative resources. Public scientific and technological activities such as basic frontier, social public welfare and major common key technological research that cannot effectively allocate resources in the market should be supported with emphasis, and innovative service platform institutions with specialization, socialization and marketization should be vigorously supported and nurtured to actively create a good environment conducive to innovation and entrepreneurship. Also, the authority must maximize the decisive role of market allocation of innovative resources, the market and enterprises determine the competitive development of new technologies, new products and new formats.

Thirdly, the government sci-tech innovation decision-making consulting system should be improved. Strengthening the functions of the Scientific and Technological Advisory Committee of the municipal government and improving the working mechanism of the Scientific and Technological Advisory Committee, are the key to attract well-known entrepreneurs, entrepreneurs from emerging fields, heads of private think tanks, heads of scientific research institutions, renowned scholars and so on as high-level experts. So that the experts can regularly report to the municipal government on the trend of sci-tech innovation at home and abroad, and advise on major scientific and technological innovation issues such as strategic planning and policy making of science and technology innovation Promoting the construction of sci-tech decision-making consulting think tank and strengthening the international science, technology and innovation strategy and policy tracking and monitoring, are intended to provide reference for the government to formulate strategic planning and policy measures for sci-tech and innovation.

C. Implementing the Internationalization Strategy of Science and Technology Innovation, Making Full Use of the Global

Singapore takes advantage of its high degree of openness, strategic location and high concentration of multinationals to enhance regional R&D capabilities, promote innovative international cooperation, enhance technological innovation efficiency and increase the diversity of innovative sources through the establishment of an international open innovation network and the use of multinational enterprise

R&D platforms. As China's open innovation leading area, Guangzhou can draw on Singapore's open innovation business model, plan and promote innovation with a global perspective, actively integrate and proactively lay out the global innovation Network, promote the two-way opening and flow of innovative resources, and enhance the internationalization level of scientific and technological innovation in all directions.

Firstly, the establishment of high-level R&D centers and technology transfer centers in Guangdong by multinational corporations and well-known scientific research institutions should be encouraged. Drawing on Singapore's experience, the government can encourage multinationals to set up or jointly set up specialized R&D centers or innovation bases in Guangdong through the establishment of R&D funds and post-financial subsidies, upgrade the energy level of the original R&D department, and encourage it to upgrade from a technical sector that provides only technical support to a large regional R&D center involved in the development of core technologies for parent companies, thus it will become an important part of the global R&D Network. Multinational corporations and well-known scientific research institutions should be encouraged to jointly set up technology transfer centers in Guangdong to attract important scientific and technological achievements from abroad to implement transformation and industrialization in Guangdong.

Secondly, high-level international tech cooperation should be supported. Guangzhou should deepen sci-tech cooperation with national institutions such as Israel, the Netherlands and Japan, strengthen scientific and technological exchanges and R&D cooperation with multinational corporations and internationally renowned scientific research institutions, and promote cross-border R&D cooperation, joint laboratories, personnel training bases, cooperative running schools and other activities. In order to accumulate human capital and knowledge capital through international cooperation, powerful universities, scientific research institutions and innovative enterprises should be encouraged to actively participate in international scientific and technological cooperation, major international scientific projects and related foreign aid program in basic research and major global sci-tech fields.

Thirdly, innovative enterprises should be supported to "go out". Enterprises should be encouraged to acquire or merge high-tech enterprises or start-ups abroad, and establish or jointly establish overseas R&D bases or incubation bases; the government must actively participate in the formulation of international standards, promote equipment, technology, standards, services to go out, and promote local innovative enterprises in the world to a higher level, stronger density of the allocation of sci-tech innovation resources.

Fourthly, an international innovation and entrepreneurial environment should be created. Guangzhou should implement a strict intellectual property protection system, strengthen the construction of scientific research integrity, improve innovation policies and regulations, improve the construction of sci-tech infrastructure such as transportation and network, and create a good market environment for fair

competition, and gradually form an innovative culture that dares to be the first, brave and sharp, and tolerant of failure.

D. Carrying out the Policy of Tilt Support for Micro, small and medium enterprises Such as Innovation Capability Voucher

Singapore attaches great importance to the scientific and technological innovation activities of micro, small and medium enterprises, and has introduced a series of sci-tech innovation plans for MSMEs, which provide MSMEs with innovative vouchers and other financial support policies; At the same time, in order to encourage MSMEs to increase R&D investment, the preferential tax policy of R&D expenditure for MSMEs has been implemented. Drawing on Singapore's experience, it is recommended that Guangzhou take the following initiatives:

Firstly, the policy of innovation and competency voucher should be implemented. The scope of Guangzhou science and Technology innovation voucher subsidy support should be broadened. Its scope should be expanded from the original support for MSMEs to buy scientific and technological achievements, R&D equipment or R&D design, consulting, inspection and testing, information and other sci-tech services to the field of international standard certification such as quality and environmental safety, introduction of human resources training, financial management, etc. And the application and reimbursement period for innovation vouchers should be shortened also.

Secondly, the related preferential policy of differentiated R&D costs should be implemented. The authority should continue to use the financial subsidy mechanism to encourage enterprises to establish a system of R&D reserve, improve the proportion of small and medium-sized Enterprises R&D investment financial subsidies, and increase financial support for MSMEs; strive to carry out the optimization of R&D cost plus deduction policy pilot, change the current R&D cost plus deduction policy for all enterprises "one-size-fits-all" approach. The percentage of additional deductions for R&D expenses of small, medium and micro enterprises shall be increased by 50 percentage points on the basis of the percentage determined by the state.

Thirdly, a special plan should be released to encourage innovation among small, medium and micro businesses. Aiming at the characteristics of scientific and technological innovation of MSMEs, special technological innovation plans should be issued to promote the innovative development of MSMEs. It is suggested that the Singapore experience be drawn upon to focus on the formulation of a "package" of policies or plans in the areas of reducing service costs, providing technical support, encouraging scientific and technological innovation, nurturing entrepreneurial talent, strengthening service guidance and easing capital constraints.

Fourthly, an innovation alliance should be formed to promote collaborative innovation among large and medium-sized enterprises. MSMEs should be encouraged to carry out various forms of cooperation with large enterprises to establish a technology innovation alliance, carry out

collaborative innovation between large and medium-sized enterprises, and government should guide large and medium-sized enterprises establish a stable cooperative relationship in the supply of raw materials, R&D and production, marketing and other links to; also, it is necessary to support small micro-enterprise and large-scale backbone enterprise to meet that needs of small micro-enterprises and boost the collaboration level of SMEs.

E. Exploring the Implementation of New Policy Tools Such as Concept Validation Funding

Based on policy measures such as the Singapore Concept Verification subsidy scheme and the application of PPP model in the field of technological innovation, Guangzhou should explore and implement new innovative policy support tools to improve the efficiency of the use of financial funds.

Firstly, the "Guangzhou Concept verification funding program" should be explored and launched. The establishment of the concept verification funding scheme can provide continuous support for basic research or cutting-edge technical research results, evaluate selection application projects from technological innovation, technological stability, market potential, manufacturing, etc. The plan can also provide financial support for project-proven projects, encourage further research, fill the gap between the value chain of basic research and application development projects, and promote the industrial application of scientific and technological achievements.

Secondly, the PPP model should be extended to the field of enterprise technological innovation. In view of the use of PPP model in technological innovation of small and medium-sized enterprises, it is suggested to establish a special technology procurement PPP platform, select advantage projects, and provide financial support in the early stage of R&D. After the prototype of the product is produced and tested, it will be mass-purchased to promote the commercialization of innovative technologies for SMEs. What's more, supporting SMEs engaged in PPP cooperation with the Government to use the expected benefits awarded by the government to obtain loans at financial institutions is one of the ways to open up new channels for SME financing

F. Constructing the Whole Life Cycle of Science and Technology Financial Service Chain

Enterprise is the main body of technological innovation, the focus of enhancing the innovation and vitality of enterprises is to expand the financing mode for enterprises, to create a flexible, efficient and diversified scientific and technological financial environment. Drawing on Singapore's experience, according to the potential financing needs of enterprises from start-up to growth to different stages of internationalization, the introduction of a financing assistance program and supporting financing products can provide enterprises with a full range of life-cycle financing services.

Firstly, the whole life cycle sci-tech financial service system should be constructed. It is suggested that the framework of the whole life cycle science and technology financial services system should be set up to strengthen the

business development of angel investment, venture capital, equity investment, banks, securities companies, insurance companies, trading markets, financing guarantee companies, micro-lenders and intellectual property assessment and credit rating agencies, which can provide comprehensive, life-cycle financing services for technology-based enterprises at different stages of growth, such as seed, start-up, growth, and maturity.

Secondly, venture capital investment should be vigorously developed. The Guangzhou authority should formulate policies and measures promoting the development of venture capital industry, and guide the development and growth of venture capital enterprises through such policies as tax support, special fund guidance, risk compensation, etc. Also, it should implement the pilot projects of investment and loan linkage, set up buyout fund for the pledge of tech-shares, and support banks' loan services in the pledge of tech-shares. Guangzhou should play the role of policy funds such as industrialization funds for major scientific and technological achievements, guide leading venture capital institutions at home and abroad to set up venture capital funds in Guangdong, and encourage and standardize the development of market-oriented operation, professional management of venture capital parent funds. Guangdong Finance Group venture capital sector should be supported to strengthen and specialize in the venture capital sector, and build seed, angel, venture capital (VC), private equity investment (PE), industry investment and parent fund whole-industry chain venture capital group.

Thirdly, technology credit and insurance should be further developed. The government should strongly support the construction of science and technology financial institutions such as sci-tech branches, sci-tech microfinance companies, sci-tech venture banks, encourage investment and loan linkage, and guide banking financial institutions to actively carry out science and technology equity pledge loan business; explore the development of enterprise credit insurance system, establish a science and technology insurance reward mechanism and a technology reinsurance system; innovate science and technology insurance varieties, continue to promote the pilot work of patent insurance, and improve the city's first (set) major technical equipment insurance premium subsidy policy; set up a pool of risk reserve for sci-tech enterprises to provide government credit enhancement and risk compensation for SMEs financing in seed period and start-up period.

Fourthly, government should increase the capital market to the small and medium-sized micro-enterprises innovation support. Drawing on Singapore's "asset securitization" experience, Guangzhou should set up a specialized agency, or commissioning a professional financial asset management company to work with banks to centralize loans from SME with low credit ratings into the capital market and finance them through bond issuance or holding, thus achieve a seamless interface between MSMEs, banks and capital markets. At last, the equity investment, debt financing, mezzanine financing, acquisition financing; bridge loans, structured financing, equity pledge loans and listing listed tools should be used to support the development and growth

of science and technology enterprises in different stages of growth.

G. Building an Open International Higher Education System

The Singapore Government has always attached great importance to higher education, implemented the strategy of national education, and attracted leading international universities such as Yale University and the University of Chicago to set up branch schools or training centers in Singapore, trained local talents and introduced international talents, formed internal and external efforts, and gradually built into a world-class international education center. Global Higher Education Analytics Agency QS Global Education Group's QS Asia University Rankings, released in June 2016, show that the National University of Singapore and Nanyang University of Technology are ranked first and third respectively. Therefore, drawing on Singapore's advanced experience, it is suggested that Guangzhou take the following measures:

Firstly, Guangzhou should deepen the building of high-level universities. We should expand and implement the autonomy of colleges and universities, encourage professors to participate in school management, improve the internal governance structure of colleges and universities; implement in-depth construction plans for key talents in universities, train a group of world-class scientists, technology leaders and innovative entrepreneurial teams; support high-level universities Conduct basic research and forward-looking research, build a number of domestic first-class advantageous disciplines and fields; accelerate the construction of high-level science and engineering universities, strengthen the training of scientific and technological engineering personnel; deepen the reform of university system and mechanism, improve the income distribution and title evaluation of university researchers , performance evaluation and other mechanisms to mobilize the enthusiasm of researchers for innovation and entrepreneurship

Secondly, government should introduce first-class universities from home and abroad to jointly run schools in Guangdong Province. All localities and universities in Guangzhou should be encouraged to strengthen scientific and technological exchanges and cooperation with internationally renowned universities, and introduce the world's top ranked domestic and foreign high-level universities to cooperate in Guangdong or independently set up institutions of higher learning. The municipal finance department shall set up special funds to subsidize the introduction of joint running colleges and universities. The joint running colleges and universities may enjoy the relevant policies of the state and the city, such as tax concessions for imported teaching facilities and equipment, preferential policies for high-level talents, and certain preferential policies for foreign teachers in the areas of housing, entry and exit, and admission of children.

Thirdly, Guangzhou government should encourage students to study abroad and return to development. Drawing on Singapore's experience in encouraging students to study

overseas and then return to Singapore for service, it is recommended that the government cultivate local innovative talents through the establishment of generous scholarships, research and train scholarships and research grants awards, select outstanding high school graduates and university students to study abroad, and encourage and subsidize outstanding students to study abroad; at the same time, implement a relaxed residence policy and a talent return plan to attract overseas and overseas talents to return home for development

Fourthly, innovative entrepreneurship education should be vigorously developed. The Guangzhou authority should actively cultivate the interest of young people in scientific research, set up professional courses in innovation, cover innovative entrepreneurship education in primary schools, middle schools, universities and other stages, and cultivate students' creative thinking, innovation and entrepreneurial spirit.

It should also establish a youth entrepreneurship fund to provide free entrepreneurship guidance to the society and a program to encourage young people to start businesses, and promote innovation and entrepreneurship among young people

H. Deepening Cooperation with Singapore's High-level Science, Technology and Innovation

Guangzhou and Singapore have closely linked geographical ties, strong economic complementarity, and a solid foundation for trade and technology cooperation. It is recommended that Guangzhou strengthen cooperation with Singapore in major projects in the fields of advanced manufacturing, modern service industry, finance and education, speed up the construction of Sino-New (Guangzhou) Knowledge City, comprehensively deepen cooperation in the fields of science and technology, education, culture, talent and tourism, further improve the long-term mechanism of exchanges and cooperation, promote Singapore as an important platform and bridgehead for the promotion of the Belt and Road Initiative in Guangzhou

Firstly, the construction of Sino-New (Guangzhou) Knowledge City must be accelerated. Guangzhou should focus on promoting the knowledge City intellectual property protection and service comprehensive reform pilot work, support the cooperation between domestic and foreign intellectual property institutions and Sino-new Guangzhou Knowledge City; plan the construction of Intellectual Property Service park to promote the systematic reform of Sino-new Guangzhou Knowledge City; promote the establishment and operation of the Singapore Center of Sino-New (Guangzhou) Knowledge City to provide "one-stop" convenient service.

Secondly, cooperation with research and education institutions in Singapore's university research institutions should be deepened. Relying on the Joint Research Institute of 3 schools of South China University of Technology, Nanyang Technological University and the Technical College of Munich, Germany, the focus is on electric travel,

water and the environment, smart grids, green energy and the sustainable development of the city and the development of joint research and talent. Relying on the Nanyang Research Institute in Foshan, Guangzhou should focus on developing international cooperation and postgraduate training in the fields of precision manufacturing technology, biomedical and bioengineering, material engineering and energy conservation and environmental protection in Singapore, and developing technological innovation around Foshan's pillar industries, transforming and promoting Singapore's high level of sci-tech achievements. The government should further introduce Singapore's quality education resources, support Singapore's leading universities to set up or jointly set up branch schools in Guangdong, and jointly carry out sci-tech management and policy, sci-tech innovation and entrepreneurship and other personnel education and training with Singapore.

Thirdly, the long-term mechanism of communication and cooperation should be established and improved. The authority should promote the establishment of a close exchange and cooperation mechanism between Guangzhou universities, scientific research institutions, innovation alliances, trade associations, community organizations and relevant institutions in Singapore, so as to enable the implementation of a number of major sci-tech achievements to Guangdong transformation and sci-tech projects on the ground ; through mutual hosting of Singapore-Guangzhou Cooperation Council, Cooperative Development Forum, high-level exchange visits and other means, high-level leadership, government officials, business media, sci-tech education from all walks of life exchanges and visits are encouraged to promote the two places to strengthen strategic cooperation in intellectual property protection, sci-tech research and development, finance, education and other fields.

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