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Local Governments as an Integrative Organizer: The Policy Practice of Constructing Innovation Platforms in South China

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Abstract

Based on an in-depth study of one city district and four new investment projects in South China, this article analyses the implementation practice of innovation policy by Chinese local governments. It is found that at the regional level, innovation policy as practice is a highly mixed-up and integrated process composed of steps from targeting emerging industries, to constructing platforms, and to developing new clusters, during which the most important policy concept of "innovation platform" is used in a distinctive way by local governments to effectively foster regional innovation-oriented development. In general, the local government intervenes heavily in or even "manages" every step of the implementation process with specific policy approach and instrument. Managing regional development as a whole process of innovation, the entrepreneurial Chinese local government indeed plays a role of meso-level organizer equivalent to the innovation project manager in business sector. These new practical approaches of regional innovation development with Chinese characteristics can inspire other emerging and catch-up economies for their policy making in five aspects.

Keywords

regional innovation policy; innovation platform; policy as practice; local governments; China

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1. Introduction

China's recent innovative rise is characterized by the geographically clustered regional innovation systems around the major metropolitan areas such as Beijing-Tianjin-Hebei region, the Yangtse River Delta around Shanghai, the Pearl River Delta around Shenzhen and Guangzhou, etc., as well as a group of smaller but rapidly growing cities. It is evident that the Chinese government and its innovation-driven development strategy played an important role in building the national innovation system (Appelbaum and Parker, 2008; Guo *et al*., 2016; Prud'homme, 2016). However, less attention was paid to the fact that the Chinese central government has shifted the innovation governance model from national science programs to the local government policies, where the local governments are more responsible for building high-tech parks or zones, local infrastructures, and other physical supports related to innovation.

In fact, Chinese local governments are the "hidden-but-visible hands" behind China's remarkable innovation-driven development. They adopted policies for encouraging the co-location of public science institutions and innovative firms in high and new technology industrial zones and incentivizing universities and public research institutes to pursue the commercialization of S&T knowledge. They also strived to attract and capture technological and knowledge resources outside their own regions by integrating these resources in regional spatial planning, land development and urbanization construction (Wu, 2007; Wu, 2018; Zhang and Wu, 2019; Zhang, 2015). Research on the role of Chinese local governments and innovation policies has focused on both inputs such as patents and R&D expenditures and outputs such as firm performance and production outcome to evaluate the policy impact on regional innovation capacity and system evolution (Li, 2009; Yang, 2015; Boeing, 2016; Guan and Yam, 2015; Li and Georghiou, 2015; Wang and Wang, L., 2017). Some research also begins to reveal the planning, facilitating, and functioning roles of both central and local governments in industrial upgrading and innovation (Gruss and ten Brink, 2016; Zhang and Wu, 2019). But, due to difficulty in field access in China, most research has to assume that the innovation policy would be implemented eventually as stated by written document, leaving the process and practice of innovation policy by local government remaining to be a "black-box".

In terms of policy substance and instruments, the existing research is concentrated on the allocation and effectiveness of China's R&D subsidies, the use of procurement, and other financial incentives (Boeing, 2016; Li and Georghiou, 2015; Guan. and Yam, 2015; Guo, Guo and Jiang, 2016). While in practice, Chinese local governments have used widely some new policy concepts, such as innovation chain, innovation ecosystem, innovative cluster, innovative district, innovation platform, intelligent manufacturing system, etc. Among these emerging concepts and approaches of implementing regional innovation policy, "innovation platform" is undoubtfully a most popular one. For local government officials, innovation platform represents all kinds of organizations situated at the interface between science and industry, including "innovation alliances", "industry associations", "innovation service platforms", "program platforms", and "innovation centers", etc. These platforms often perform functions of technological R&D, incubating, facilitating, intermediating, and pro-actively contributing to science-industry transfer and interaction, by soliciting and combing openly the external resources from key actors, such as universities, research institutes, and industrial firms. Some rare research has highlighted the ideal types and functions in technology transfer of the Chinese innovation platforms (Zhang, Li, Liu, Xu, and Zhang, 2018; Conle, Zhao and ten Brink, 2020), but their direct implication in innovation policy has to be clarified by more empirical analysis.

It is against this backdrop that the article aims to explore how innovation policy is implemented by local governments in China, especially the policy relevance of the new experimentalist form of "innovation

platform" in regional innovation practice. Since Chinese innovation policy can be found more in the practice and conduct of local governments than in the planning documents or official statements made by State leaders and inspired by the management approach of "strategy as practice" (Bartels, 2018; Whittington, 1996 and 2006), innovation policy in this research is taken as practice and implementation process managed by local governments. Data and material were collected through participative observation in working during two years with one district government in Guangdong, a southern province in China. This district case in Southern China reveals that at the very local level, innovation policy as practice is a highly mixed-up and integrated process composed of steps from targeting emerging industries, to constructing platforms, and to developing new clusters, during which the most important policy concept of "innovation platform" is used in a distinctive way by local governments to effectively foster regional innovation-oriented development. In general, the local government intervenes heavily in or even "manages" every step of the implementation process with specific policy approach and instruments. Managing regional development as a whole process of innovation, the entrepreneurial Chinese local government indeed plays a role of meso-level organizer equivalent to the innovation project manager in business sector. These new practical approaches of regional innovation development with Chinese characteristics can inspire other emerging and catch-up economies for their policy making.

The remaining part of the article is organized in four sections. Section 2 reviews main literature on platform policy and presents our own policy model, as well as describing the methodology of this paper. Section 3 presents the main discovery on the practical approaches used by a Chinese local government following our process model of innovation policy. This section is based on a district case in South China as well as four detailed project cases within the district. Section 4 highlights five policy implications of the empirical findings to other developing economies in light of relevant theoretical discussions. Section 5 concludes the findings.

2. Platform Approach to Innovation Policy: Theory and Practice

Innovation platforms now refer broadly to a new organizational form underlying rationale of network effects and interactive learning, such as collaborative networks, associations, alliances, intermediary or boundary-spanning organizations, and incubators, etc. (Flanagan, Uyarra and Laranja, 2011). In this section, after identifying the research gap in existing literature, we propose a three-step policy model centered around the innovation platform as an instrument. We then detailed the methodology, especially for field work.

2.1. Literature review on platform approach to regional innovation policy

A large body of literature on innovation platforms discusses the importance of platforms for the development of regional innovation systems. Specific regions are important spaces for the emergence of new combinations of production factors, especially knowledge, as geographical proximity can help bridge distances (Boschma, 2005; Menzel, 2015). As an academic concept, a regional innovation system is a smaller-scaled national innovation system, with a geographical area larger than a city but smaller than a country. It contains economic, social, political, and institutional relationships among universities, research labs, venture capital banks, and government agencies responsible for various sectors that can generate collective learning processes within relevant technical or functional areas (Morisson and Doussineau, 2019). Regional innovation systems actually emphasize the spatial logics of co-location of innovation actors, such as externalities, agglomeration economies, and proximity effects. The perspective

of regional innovation systems has now shifted their focus from institutions at the national level to more local actors, institutions, capacities and interactions in innovation processes, such as "industrial clusters", "learning regions", "innovative milieux", creative cities and local territories, etc. Regional or local social networks and organized platforms can enable denser information flows, mutual learning and economies of scale among companies, private and public knowledge institutions, educational institutions, etc. Some innovation management authors like to refer here to the notion of "open innovation" (Chesbrough, 2003).

In terms of innovation platform policies, a lot of literature acknowledge that platform policies at the regional level can accompany the discovery process of innovation and entrepreneurship and support the formation and adaptation of complementary resources around cross-sectoral innovation platforms (Asheim, Boschma, and Cooke 2011), thus addressing various problems faced in regional innovation-driven development, such as lack of industrial and innovative capacity (Capello and Kroll 2016), lack of public sector entrepreneurs (Estensoro and Larrea, 2016), lack of innovation mediation (Pinto, Fernandez-Esquinas, and Uyarra 2015), lack of regional governance capacity (Kroll 2015), and significant difficulties in integrating private and public stakeholders (Estensoro and Larrea, 2016). However, even though "innovative platform thinking" (Harmaakorpi, Tura, and Melkas, 2011) has entered into regional policy debates, there are still limited empirical studies on platform policy models. In this regard, the leading research is the "Platform Approach to Regional Innovation Policy" proposed as a regional innovation policy model (Asheim, Boschma, and Cooke, 2011). It is an innovation platform method model elaborated by Harmaakorpi (2006) and collaborators, based on experiences of Scandinavian countries, particularly Finland's Lahti region. The model can serve to unlock the region's growth potential by connecting disparate but related knowledge fields and actors.

To use platforms as a tool to facilitating entrepreneurial discovery in regional innovation requires first of all a consideration of platform governance structure. In particular, it involves identifying who are responsible for coordinating the processes and activities of the platform. Possible stakeholder actors include governments, professional innovation intermediaries, and participants from diverse backgrounds who perform selected intermediary functions (Howells, 2006). Thus, platform provides an organized context for co-defining thematic priority areas and coordinating regional capacity development (Pekkarinen and Harmaakorpi, 2006), involving the creation of innovation networks and the pursuit of upgrading activities. Nevertheless, in the Platform Approach to Regional Innovation Policy, central or local government is only one of the actors participating in the platform and does not necessarily play a leading role.

In terms of substantive policy tools for innovation platforms, research focus has been on whether platforms should choose a top-down or bottom-up decision-making process, and about prioritization and coordination of change activities (Foray, 2018). Harmaakorpi (2006) analyzed how innovation platforms in Lahti Region of Finland identified priority areas and coordinated implementation. He found that the established platforms involved a wide range of stakeholders and experts from the private and public sectors who assess regional resources and capabilities with the aim of defining, in a bottom-up fashion, priority areas connecting industries, areas of expertise or megatrends (Harmaakorpi, Tura, and Melkas 2011; Uotila, Harmaakorpi, and Hermans, 2012). It is concluded that private or (quasi-) public "systemic intermediaries" from below actually managed platform discovery and implementation by acting as brokers and coordinators of interactions between regional innovation actors (van Lente *et al.*, 2003; Parjanen and Hyypiä, 2018; Janssen, Bogers, and Wanzenböck, 2020). While the existing literature has discussed the operation or initiation mode of platform policy, in general, except for the relatively complete model of "Platform Approach to Regional Innovation Policy", research by far has not yet proposed an

alternative model. The specific steps, methods and paths of how to operationalize the academic concept of platform into practical policy remain in a "black box". This paper will attempt to fill this research gap by building a platform policy model based on the cases from South China.

2.2. A platform-centered innovation policy model from South China

The driving force behind the regional innovation dynamics in China is local governments' various down-to-earth policy practice of implementing the national innovation-driven development strategy. The concepts of innovation chain, innovation ecosystem, and innovation platform were simply mentioned in the central government's policy documents as policy instrument frameworks, leaving the substantial content and operational approaches to be filled and concretized by local governments. The conventional division of policy responsibilities between the subnational and national levels is that the central government controls the areas of national interest (e.g., national defence, health, security) and allocates budget to R&D, especially to basic research, while the local governments oversee technological development, diffusion of existing technologies, and allocate budget to other types of innovation support. While the central government has launched innovation platforms at the national level, to support China's drive for indigenous innovation in specific techno-industrial sectors (Li, Deng and Sorensen, 2011), platform policies more commonly relate to the regional level.

For example, in South China, the local governments of Guangdong Province used numerous policies to support innovation, ranging from direct government investments, tax refunds, mediation, infrastructure, talent subsidies, and technology investments in leading new products, to government-sponsored research institutes for the generation and transfer of advanced technology, incubation of entrepreneurs, venture capital funds, training, and consulting services, etc. Moreover, a primary focus of innovation policy in Guangdong has been in the domain of building various "spaces" of innovation, such as development and economic zones, scientific parks, and industrial clusters, etc. In fact, after the Chinese central government intervened in cooperation with local governments by selecting the most promising special economic zones and science parks around the country and providing them with additional funding and support, regional governments continue to offer a range of complementary policies for these "spaces", including free land allocation, infrastructure, and facility support, as well as enhanced public services. Local governments in Guangdong often cluster "innovation platforms", including start-up firms, R&D facilities, university branches, incubators, training centers, quality control agencies, technology diffusion centers, testing laboratories, venture capital funds, and other extension services in industrial parks, science parks, and technology development zones of same location, in hoping to promote inter-firm and inter-institutional linkages, and to attract more R&D resources from other regions outside.

Platforms in Guangdong are not only treated explicitly as policy targets, but also used as a conceptual instrument by local governments for implementation. As policy targets, innovation intermediaries and incubators are the precedents of the so-called innovation platforms in China (Wang and Wang, 2017). Now the scope has extended to more organizational forms, including "innovation and research centers", "engineering centers", "innovation alliances", "industry associations", "science and technology service institutions", incubators, and other intermediary organizations. According to the strategic policy document "Construction Plan of Science & Technology Innovation Platform System of Guangdong" (2016), official "innovation platforms" include key labs (national and provincial levels), technological innovation centers (national and provincial levels), engineering technology research centers (national and provincials levels), and various forms of science and technology service platforms, such as technology

transfer platforms (technology transfer institutions; industry-university-research alliances; technology property rights exchange institutions), public service platforms (sectoral alliances of technological innovation; service centers of science and technology innovation; R&D and design service institutions; inspecting, testing, measuring and standards service institutions; and sectoral productivity promotion centers), and other innovation service platforms (innovation centers; makers spaces; incubation parks and bases; business schools; innovation and incubation centers within Hi-tech zones, specialized towns, and industrial parks; and science & technology thinktanks), etc. Guangdong has become the "homeland" of different innovation platforms in the strategic emerging industries.

Based on experiences of innovation policy implementation in Guangdong, especially project-level empirical materials from Naihai District, the overall Chinese policy approach to promoting and driving innovation-oriented development can be characterized as three staged but interwoven processes, with platform construction as its core part:

Targeting strategic emerging industries and breaking down the industrial development plan into concrete new projects. The planning activities in this stage go beyond the narrowly defined science, technology, and innovation policy, but mix up with sector and cluster development strategy.

Constructing innovation platforms. This is the core part of the whole policy practice. Local governments use the "platform" as a conceptual tool guiding the new projects to adopt the operational model as well as organizational form of platforms. Thus, the "innovation platform" has become a dominant policy guideline of local officials for innovation project selection and resource allocation. New projects are initiated, transformed, and constructed into platforms as much as possible.

Developing projects/platforms to form spatial clusters of development. The "platformization" of projects results in large number of new ventures functioning as innovation platforms, with multiple external linkages and multiple internal functions. A local government takes use of these projects and platforms to develop new local clusters by leveraging more industrial and knowledge linkages and resources. Although the efficiency of such a pragmatist policy approach is still questionable, it does create new actors of innovation and foster the more technology-based development in the region.

In this new innovation policy model, a certain Chinese local government not only takes care of the local environment and context for new projects, but also intervenes directly in every project stage during the whole process from industrial targeting, platform building, and cluster development, playing a role of innovation manager in business sector. The policy practice in local China is a mixture of the market-based, horizontal, and functional innovation policy approach, with the old-style promotional, vertical, and selective industrial policy approach. Figure 1 outlines the practice pattern of the innovation policy.

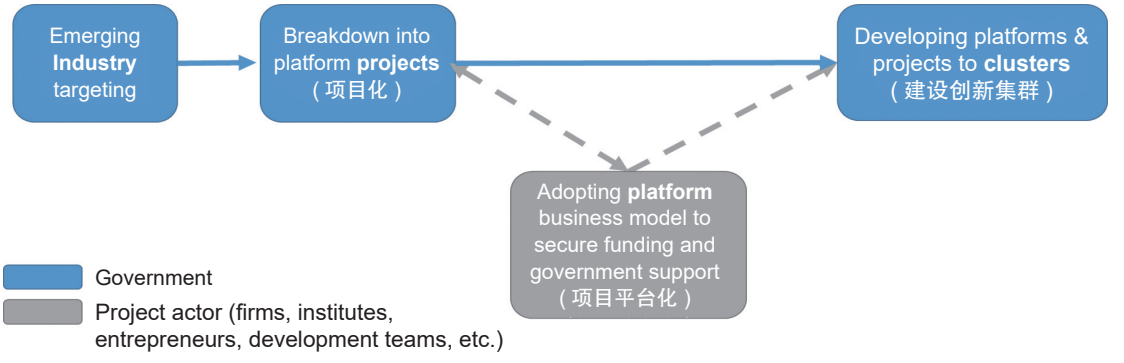

Fig. 1. Main processes of innovation policy implementation in Nanhai.

Compared to the Nordic "Platform Approach to Regional Innovation Policy" in Europe (Harmaakorpi, 2006; Harmaakorpi, Tura, and Melkas 2011; Uotila, Harmaakorpi, and Hermans, 2012), our definition of platform policy covers a broader scope, not only the platform construction itself, but also includes industrial targeting and clustering, which are traditionally regarded as areas of industrial policy and cluster policy. Additionally, our policy model from South China provides more operationalized steps for local authorities to follow and more detailed policy measures in each step, as illustrated by the four project cases in Section 3.

2.3. Field context and methodology

Geographically, the engine of China's innovation power now is fueled by regional innovation systems. Beijing is the center of technology innovation and has a large R&D talent pool. It is home to 26 of the 112 key national universities designated by the Ministry of Education and many research centers of global firms are headquartered in the Zhongguancun district of north-eastern Beijing. Shanghai has the largest concentration of life science companies with the R&D operations of 11 of the 14 largest global pharmaceutical companies, many in its Zhangjiang Science and Technology Park. There are also contract research organizations to serve both Chinese and global companies with trials and other outsourced services in Shanghai. As for Guangdong, its regional innovation system is mainly founded in the core metropolitan area of the Pearl River Delta, composed of Shenzhen together with other cities such as Guangzhou, Zhuhai, Dongguan, Foshan, Zhongshan, Huizhou, etc., all characterized by hardware innovation. The Pearl River Delta, traditionally known as the "world workshop in China", has become in recent years the most innovative manufacturing cluster, highlighted by the fast-growing strategic emerging industries such as IT, household appliances, LED lighting, robotics, and new energy vehicles and batteries, etc. Shenzhen had 11,200 high-tech companies of national scale, with high-tech sectoral industrial added value of 735.9 billion Yuan, accounting for 32% of Shenzhen total GDP. Shenzhen's export value has topped other cities in China for the last 30 years, with almost 50% being high-tech products. Compared to the rapidly developing new cities like Shenzhen, old cities in the Pearl River Delta like Guangzhou and Foshan have longer tradition of industrial and research activities but are all under transformation to develop more in emerging sectors and new technologies.

Our research design is inductive in nature with regional innovation policy implementation by Chinese local governments as research target. To have encompassing understanding of the policy process and identify any potential pattern, we focus on the case of local governments in Guangdong Province in taking its Pearl River Delta as research field. The Pearl River Delta, having built up one of the most dynamic regional innovation systems in China, is composed of nine prefectural cities and their subordinated districts or towns with the governments as the policymaker at each level of the administrative echelon.

Covering all the nine prefectural cities in the Pearl River Delta, our field observation is carried out mainly at the level of districts and towns, but also includes some cities of municipal level. Detailed observation was conducted to get a better picture of local policy practice and generate more general knowledge on how governments manage innovation and development in their administrative territories. From 2015 to 2019, we undertook a series of policy research and consultation projects with local governments, such as those of the Yuexiu District of Guangzhou, Longgang District of Shenzhen, Nanhai District of Foshan, Changping Town and Changan Town of Dongguan, Zhongshan City, and Huizhou City, etc. Many of our projects were entrusted and financed by local governments, so the field work was primarily organized by local officials. The empirical material and data, qualitative in nature, were collected principally by our field observation with moderate degree of participation. Such an approach

ensured full access to numerous government strategy plans, policy documents, internal reports, working records, and even sensitive information relating to industrial and technology activities, often embedded in discussions and perspectives of local officials in various occasions. Often attached to these documents are feasibility proposals and legal documents of projects and companies submitted to local governments for approval or financial aid. In addition to the documentary material, as part of the policy research, semi-structured in-depth interviews were carried out with government officials in relevant departments, managers of industrial firms, R&D organizations, and intermediate institutions to permit key themes to be drawn. Each interview lasted around 2 hours, led to follow-up discussion and particular issues to be explored in depth and was partially transcribed.

For the following section of the article, we pick up just Nanhai District as a case to focus on. Our choice of the district rather than municipal level as the unit of analysis stems from the nature of the country's policy process. In China, "policies are typically designed at the central, provincial and municipal levels, [whereas] counties and districts are responsible for their implementation on the ground" (Schubert and Alpermann, 2019). As we are interested in how innovation policy is implemented in practice, we consider the district to be the administrative level at which the policy process is deployed.

The choice of Nanhai was because numerous research platforms, public service platforms, incubation platforms, and industry-research-university alliance platforms have been established recently in the district, and we had direct access to a lot of project-level material and data which can be used for case-in-case analysis. In fact, our analysis strategy is a bottom-up process, i.e., we start with case analysis of four concrete platforms from their initiation to full operation, then we construct a general picture of how relevant policies are implemented on these platforms. For this reason, we adopt an embedded case study design to explain the regional implementation of innovation platform policies (Yin 2018). While our unit of analysis is at the district-level, we dig into specific innovation platform projects which are district policy targets. And in choosing the platform project case, we maximize their heterogeneity in terms of origin of shareholders, nature of activities, initial design, and size, in order to find their "platform commonalities". In the fieldwork, besides the interviews with senior Nanhai district government officials of the General Administration Office and the Science & Technology Department, we conducted interviews with four industrial firms and three innovation service institutions, representing different innovation platform types within the emerging industries. The multiple-method approach adopted makes triangulation possible, particularly the verification of testimony of the information gathered from interviews, which was triangulated with secondary material of local government guidelines, reports, and plans, as well as questionnaire survey findings accumulated previously by the local research team.

3. Practicing Platform-centered Innovation Policy: Nanhai District

Nanhai District is situated on the eastern bank of the Pearl River Delta, about 25 km from the provincial capital, Guangzhou. It has about 3, 032,000 inhabitants and a surface area of 1,074 square km. The district comprises one urbanized subdistrict and six towns. As one of the most dynamic urban areas in Foshan City, Nanhai District has an industrial output value of 174.612bn Yuan and a GDP of 317.662bn Yuan with a growth rate of 6.9% in 2019. Under the "Made in China 2025" master plan, Nanhai proposes to become the core area of a global-oriented national manufacturing innovation center, realizing a new combination of "world technology + Foshan intelligent manufacturing + global market", with objective to reach 1 trillion yuan in the total industrial output value of the entire region within 5 years. Since 2017,

focusing on the goal of "upgrading industrial parks, building new cities, and developing new economies", Nanhai launched the programme of "New Global Maker City" and used it as the general guideline for economic and social transformation and upgrading, to build Nanhai into an exchanging and cooperation nexus between global innovation resources and the Pearl River Delta manufacturing industry.

The following three subsections illustrate how the local innovation policy is implemented around the key practice of constructing platforms in Nanhai District.

3.1. Planning innovation platforms for targeting strategic emerging industries

The industries in Nanhai, specially manufacturing, are sparsely distributed across the whole district area. By the end of the 2010s, its industrial production accounted for 77% of the total GDP and the research and development expenditure accounted for more than 2.6% of it. With an output value of over 243 bn Yuan, the industrial sector of Nanhai District was composed mainly by metal products, electrical machinery and equipment manufacturing, automobile manufacturing (excluding FAW-Volkswagen), non-ferrous metal smelting and rolling processing industry, equipment manufacturing industry (general equipment, computer and communication, special equipment), and the "traditional" manufacturing industries (waste resource utilization, non-metallic minerals, furniture, rubber and plastic products, products industry, textiles, etc.). Holding the ambition to become a district with industrial output of trillion Yuan, Nanhai District has targeted five sectors as the main pillars of its "modern industrial system". The five inter-related sectors as shown in Figure 2 include high-tech manufacturing (machine and equipment, components, robots, materials for electronic components, software, sensors, and controlling machine), the new-generation electronic information industry (digital consumer electronics, IT, digital technology, telecommunication, and formed and fabricated materials; as well as big data, cloud platform, industrial internet, and artificial intelligence), new energy automobile industry, new material industry (including fuel cells, material measurement equipment, ingredients, metal molds, material manufacturing equipment, etc.), and high-quality service industry (mainly industrial finance, productive service industry, etc.). Figure 2 shows the designed industrial system in Nanhai District.

For implementing the strategy of new sector development, local governments usually breakdown the whole industrial planning into various projects. Thus, creation of new sectors is often operated as creating projects of new business ventures. To achieve the new goals of regional development in Nanhai, the local government hoped that the emerging sectors created by new projects can also benefit its "traditional" manufacturing industries for upgrading (non-ferrous metals, machinery equipment, textiles and garments, hardware, ceramics, etc.) through establishing supplier or user linkages. For example, the new projects in advanced equipment manufacturing industry based on robots and machine tools, combined with projects in electronic information industry, are expected to supply digital manufacturing systems to the firms in traditional sectors and promote their technological upgrading. At the same time, the new approach of industrial planning and targeting emphasized the innovation-driven aspect of sector development. Following the so-called principle of "fusion of industrial chain and innovation chain", the local government was able to integrate industrial policy and technology policy to identify and target more precisely the key industrial and technological areas of each identified emerging sector to develop.

The new approach of innovation-driven sector targeting started with detailed intra-sector value chain analysis of the planned industry in order to identify the different segments and linkages, from upstream suppliers of inputs and providers of specialized infrastructure, through manufacturers of complementary products and related industries, to downstream channels and customers. Value chain

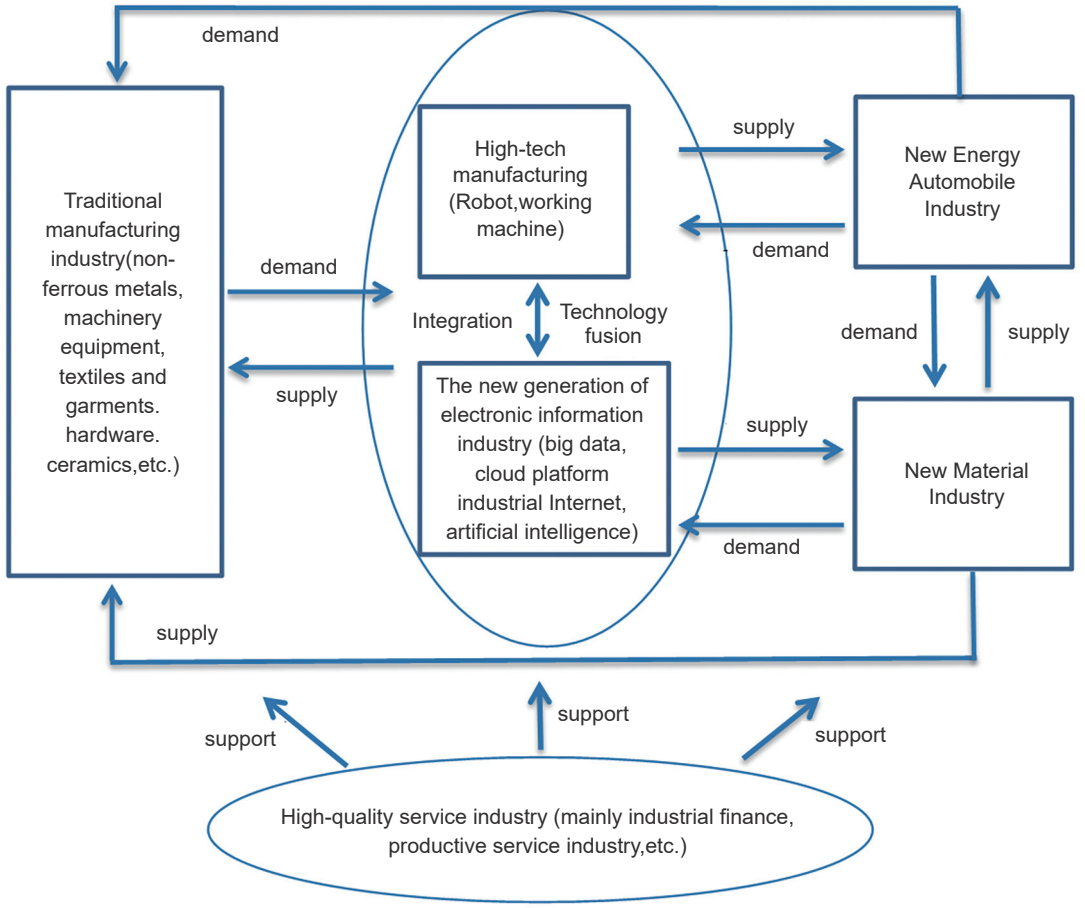

Fig. 2. Industry targeting in Nanhai (2 "high" + 3 "new").

analysis often resulted in redefinition of sector borders and refined targeting of specific segments as the development field. Many local governments chose the development of new energy, new materials, electronic information, and the bio-pharmaceutical industry as strategic emerging industries. Different from the traditional way of industrial planning, the new approach contained a parallel step called "deploying innovation chain according to targeted industrial chain". Based on each targeted emerging sector or segment, local governments had to identify and target the new technology areas or 'key enabling technologies' (e.g., advanced manufacturing, clean energy technology, ICT, nanotech, and biotech), the corresponding technological intensive activities (e.g., research, design, quality & test, training, information, technical support, and headquarter functions, etc.), and the actors or organizations (e.g., firms, entrepreneurs, research labs, universities, standards-setting agencies, think tanks, vocational training providers, and trade associations, etc.) as project sources and initiators. For example, Huizhou City identified new energy vehicle industry as a strategic sector and targeted specifically battery production and the manufacturing of other key components for new energy vehicles, such as motor management systems, on-board chargers, off-board charging equipment, drive motors, electronic control integration, and electric air conditioners, etc., as segments to develop. The city government therefore planned industrial clusters as the production and supporting base, and elaborated incentive measures to attract investments from heavyweight companies, OEM manufacturers, and technical teams of smart

mobility. Nanhai District set robot and advanced equipment as a strategic emerging industry and aimed to promote the development of integration and application of robots in assembly lines of local firms. It worked out specific policy packages, launched the call for projects in the field, and contacted actively with universities, firms, investors, technology teams, and research institutions to solicit their investment and engagements.

3.2. Constructing innovation platforms as business projects

For the Nanhai government, since the expected projects would be situated at the interface between the industrial targeting and technological activities planning, the platform was regarded as the most appropriate institutional and organizational form or business model to be adopted by projects for achieving the objective of creating new sector through applying new technologies. Platforms are various organizations having multiple functions internally and multiple linkages externally. Innovation platforms perform functions aimed at facilitating, intermediating, and pro-actively contributing to science-industry transfer and interaction. Therefore, the platform as defined by Nanhai has become an important precursor to the formulation of specific projects with policy support under new industrial targeting.

Among local governments in Guangdong, the concept of platform as a policy guideline was so prevalent that the Nanhai government almost pushed every new project to adopt the platform business model and become a platform project, then provided funding and other support to the project actors. From the standing point of project actors, they also knew that their projects would have more opportunities to get approval and resources from the government if the rolling out form is some kind of "platform". Thus, there was a variety of project actors willing to form an innovation platform, such as firms, technology centers, research institutes, universities, schools, technology teams, etc., public or private, national-level, provincial level, or city-level. And in terms of types of innovation platforms, they are not limited to 'intermediary' organization such as technology transfer center, but rather covering all kinds of new projects, including science and technology innovation service platforms (innovation alliances, industry associations, incubators, and technology intermediaries testing, intellectual property services, investment and financing, training, technology trade, technological information consulting, industry diagnostic, exhibition, etc.), research and technology development institutions (R&D laboratories, engineering research centers, university campuses, and new R&D institutes), and business and manufacturing firms which industrialize and commercialize the new technologies.

The platforms created as such normally have multiple functions, including R&D, engineering, new technology transfer and diffusion, production technology demonstration, testing services, technology business incubation, establishing alliances, providing training and education, financing and investment arranging, patent licensing, etc. But for the Nanhai local government, due to the lack of strong knowledge base in its region, the platform is important for implementing the innovation-driven development in four aspects.

1. Firstly, the platform is an institutional vehicle to attract investments from outside the region and leverage the external resources (talent people, knowledge and information, capital, equipment, etc.) to develop relevant technologies of the targeted sectors. These specific resources are often in the hands of State-owned enterprises, public universities, technological centers, private enterprises, overseas returnees, etc., located elsewhere.

2. Secondly, platforms themselves can become master platforms to attract further resources. As a

platform could bring various linkages and interactions with different sectors and technological fields, they have the potential to become the immediate innovation environment for other projects and to be transformed into transcending ecosystems which accommodate more platform projects.

3. Thirdly and most importantly, since these "innovation platforms" are embedded and integrated in the whole course of developing the strategic emerging industries, often they not only provide normal technology, information, and manpower support to industrial firms, but also engage themselves more and more directly in the technology development and manufacturing operation like business firms. A platform can easily evolve to become a business firm as the main body of an emerging sector, so the development of platforms has also become the rise of industrial sectors themselves. The essence of the innovation platforms is the emergence of new projects that integrate scientific and technological resources from various stakeholders (government, industry, academia, research, capital, service provider, and user, etc.) to realize the creation of the targeted new sectors through industrialization of scientific and technological outcomes.

4. Finally, as innovation platforms is a multi-functional organization transcending different sectors, their growth can have many possible prospects and bring to the region industrial specialization and differentiation in the future.

This "platform as project" approach in Nanhai District has been widely used by other local governments in the Pearl River Delta of Guangdong. In fact, project-based platform formation is the primary policy target when innovation policy is implemented in Nanhai, as shown by the four cases below.

Project Case 1: Daji New Material Technology

Daji New Material Technology (Daji) was a private company that invested in Nanhai between 2018 and 2019. The company owned some new material technologies for spraying amorphous alloys and nanocrystalline alloys, as well as some technologies for producing cold spraying equipment. Thus, the business line of Daji spanned across the fields of new materials and advanced equipment manufacturing. The entrepreneurial team of founders was composed of a serial entrepreneur who had already created several private ventures in Shenzhen, a marketing specialist, a retired production engineer, and a scientist from the Hunan Metallurgy Material Institute, which is neighboring to Guangdong Province. In fact, the public-owned Hunan Metallurgy Material Institute is the technology source of Daji.

Daji got the exclusive license from the Hunan Metallurgy Material Institute for implementing some patented technologies in production. Daji was attracted by Nanhai's huge aluminum profile industry and furniture industry, which provide a potential market for the application of the new metallurgical material technology, and its overall environment of industrializing scientific and technological achievements. Initially, Daji's venture plan was just a factory producing and processing hard materials and new alloy materials for mold producers in local mechanical industry. However, the local government thought that the project had bigger potential and hoped that the project could have more substance of "technical innovation", especially the possibility to establish a research and development laboratory and the ability to contact and mobilize technology resources outside the region. The local government emphasized that the current government-funded and supported projects should focus on "innovation platforms" and technology-intensive industries, rather than simple manufacturing plants.

While the patented alloy material production technology was licensed from the Hunan Metallurgy Material Institute, Daji did have its own patent: an emerging cold spray technology. By introducing,

digesting, and absorbing Russia's advanced cold spraying technology, Daji had developed a new type of cold air power spraying device, and had completed the drawing design of the new cold spraying equipment. However, to completely realize the industrialization of this new technology, Daji needed to carry out further downstream R&D activities and promotion of cold spray technology products and services to potential users. Daji needed the information on requirements of technical specifications from potential customers, including graphene coating, electronic packaging coating, porous ceramic inner wall coating, and packaging material metal coating, etc.

Daji's proprietary new cold spray technology and the specific equipment R&D plan aroused great interest from the local government. The Nanhai District Government decided to support Daji's investment project and establish it as a local platform for industrial upgrading and technological innovation, in condition that the venture should have the form of platform organization, involving multiple actors or stakeholders, open to the whole mold industry, and attracting more resources from outside in the future. After many rounds of discussions with the local government, Daji adopted eventually these policy instruction and requirement. Thus, the initial manufacturing project with some new technology elements was transformed into an "innovation platform", according to the local policy definition. The Nanhai local government approved the project and provided a financial aid of 50 million Yuan as a first-stage investment. The project got other policy supports, including listing the project in local industrial upgrading program and subsidizing the team members individually through a local Talent Recruitment Program. The realized investment of Daji project included the following main structures and functions of platform:

A die steel original metal production plant: manufacturing parent metal to be used in mold production and casting processes. This was the initial project plan.

An R&D lab: planning to undertake systematic research and testing in order to produce various functional coatings with stable performance; planning to detect local firm's demand of wear-resistant and anti-corrosion coating products, provide coating samples and online testing of their wear-resistant and anti-corrosion performance, and build preliminary reputation among client firms based on actual usage.

An amorphous alloy process demonstration plant: using the owned-designed equipment and production line to demonstrate Daji's proprietary process technology of cold spray; attracting more clients to purchase Daji's products and technical service; developing professional and technical training sessions.

An alliance of mold industry: initiated by Daji in partnership with other firms in Nanhai's mold industry, with endorsement and support of the local government, to promote networking and cooperation among local firms in the fields of technology and market development.

An investment fund in mold industry: when conditions were met, the local government would support Daiji with other capital investors in setting up a sectoral venture fund to invest in new technologies emerging from the broader ecosystem.

Daji's investment project reformulated as an innovation platform was supposed to have amplified and spilled over effects of industrial upgrading over the whole mold production chain, from upstream raw materials to downstream metal parts. Externally, the Daji project would establish technological and knowledge linkages with various research centers other than the Hunan Metallurgy Material Institute, and specialized supplier relationship with 3D printing factories from a cluster in Shenzhen. Functioning as a platform, the Daji project thus would become an organizational carrier of integrating local value chain of mold production and leveraging external knowledge, technical and production resources in the district of Nanhai to achieve the goal of industrial upgrading. Figure 3 describes the overall model of Daji project as a platform.

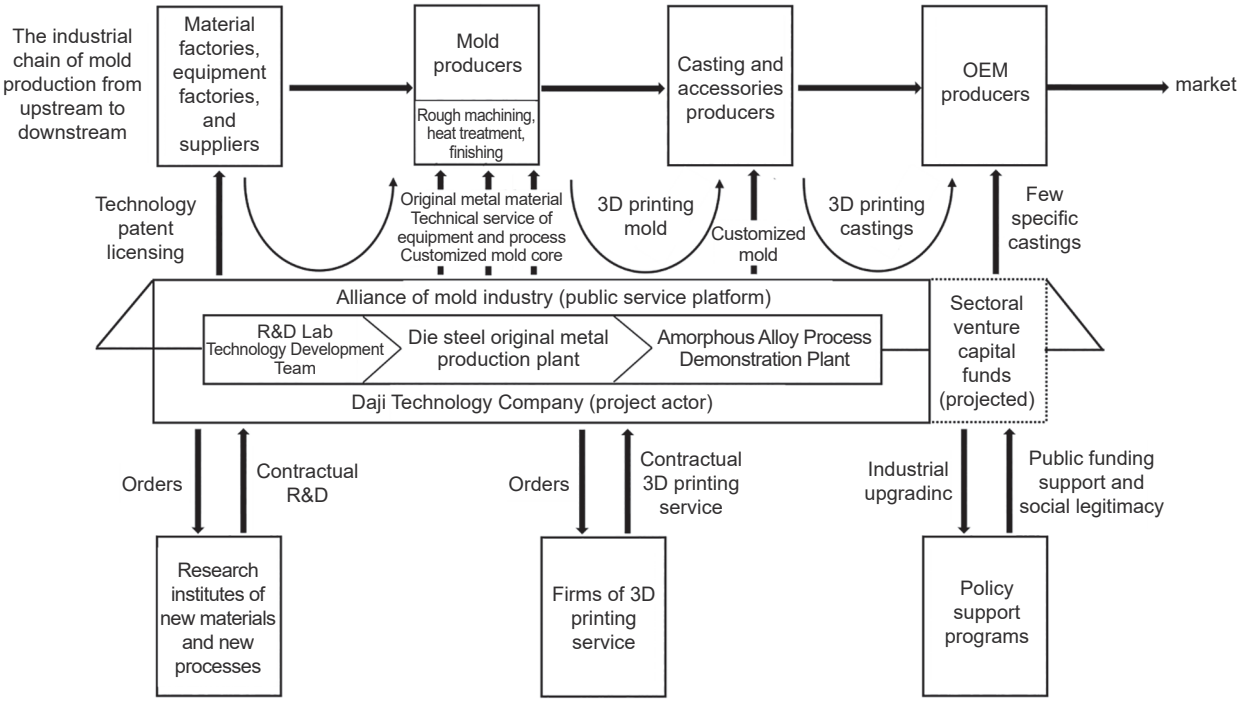

Fig. 3. The platform business model of Daji.

Project Case 2: Huashu Robotics

The project of Huashu Robotics was initiated by the Wuhan Huazhong Numerical Control Joint Stock Corporation (WHNC), a listed company owned by the Central China (Huazhong) University of Science and Technology, thus belonging to the kind of State-owned firm. Huazhong Science and Technology University has been a leader in China in machine tool and CNC systems research and established WHNC in 1994. WHNC was awarded the official label of High and New Technology Firm in 2009, then engaged in patenting between 2009 and 2013. In 2013, it established its first manufacturing firm in Chongqing, then the firms in Foshan (Nanhai) and Quanzhou followed in 2015. Now WHNC has altogether nine manufacturing bases and the Foshan branch has eventually become WHNC's headquarters, having four R&D centers in Foshan (Nanhai), Suzhou, Quanzhou, and Xiangyang (Hubei Province). WHNC has occupied almost all industrial robotic segments and its sales volume was the second biggest in the Chinese market.

The original investment intention of WHNC was to establish a pure platform composing a testing service center and a robot startup incubator. After being informed by the local government that another university was launching a much bigger incubation platform in exactly the same industrial segment, WHNC abandoned this initial project idea. The local governments from both Foshan municipal level and Nanhai district level suggested to WHNC that it should focus on robot manufacturing and indigenous innovation by taking the regional advantage in manufacturing activities. The governments promised to give full support if WHNC established a new platform based on strong R&D and manufacturing activities. Therefore, in August of 2015, WHNC established in Foshan two robot manufacturing companies, and then shortly afterwards co-established with the Foshan government an R&D institute called the Foshan Institute of Intelligent Equipment Technology. The two robot manufacturing companies were engaged in

R&D integration, production, sales and service of industrial robots and core parts of robots, receiving the title of High and New Technology Firm in 2017. In terms of technology and product development, their manufacturing activities relied on the Huazhong University of Science and Technology, WHNC and the Foshan Institute of Intelligent Equipment Technology. The R&D institute was within the factory site. The products developed by the R&D institute were industrialized in the manufacturing companies. Later it became the R&D headquarters of WHNC, with more than 100 R&D personnel.

Local governments deeply got involved in turning the project of Huashu Robotics into an innovation platform. Foshan municipal government invested a lump sum of 150 million Yuan, including a 3-year founding budget for the R&D Institute, which was required to be responsible for its loss after three years. In return, the Foshan government got a share of 10% of the two manufacturing companies of WHNC. The Nanhai district government allocated a piece of land with fiscal subsidy to the project. The R&D institute was established as a public institution belonging to the government, thus having a way to access public funding for its R&D activities. The R&D institute was later granted the label of New R&D Institute, which could enjoy corresponding policy support. The Huashu Robotics project was formulated from the original idea of an incubator to a powerful industrial platform composed of manufacturing facilities, R&D center, and robot utilization service and engineering activities. Through the channels of the local government, the R&D institute developed technical cooperation with universities including the Guangdong University of Technology concerning machine vision cloud system. The manufacturing companies also had access to the Robotics Industry Park established by the Foshan government, where small firms could rent manufacturing services. Figure 4 highlights the cooperation between WHNC and the local government on the Huashu Robotics industry innovation platform.

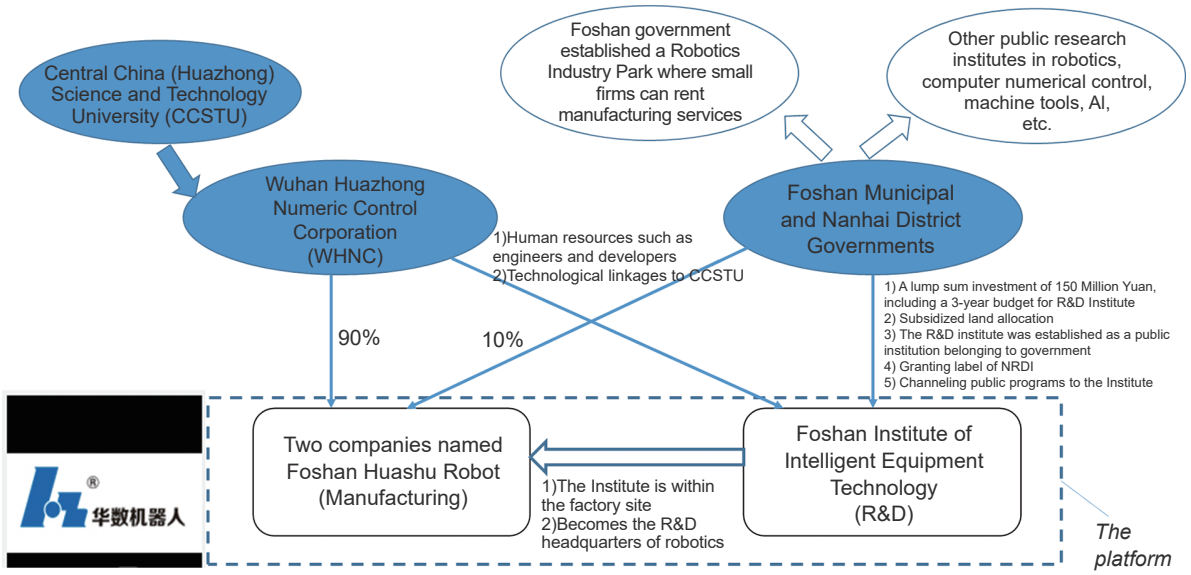

Fig. 4. The platform organizational model of Huashu Robotics.

Huashu Robotics as an innovation platform created industrial, technological and knowledge linkages across the region. In the rapidly growing domestic market, it gained manufacturing clients – mostly electrical appliance manufacturers, mobile phone or computer manufacturers in Shenzhen, and automakers as well as firms in the local polishing industry in Foshan. It cooperated with many universities in R&D. For example, it cooperated with the Huazhong University of Science and Technology in developing core kinematics and

dynamics algorithms; with the Guangdong University of Technology in visual cloud system; and with the Beijing Aerospace Cloud Network. Meanwhile, it also cooperated with many vocational schools, such as the Huacheng, the Nanhai Xinxing, and the Foshan Institute of Technology, to set up laboratories equipped with Huashu robots, where students of these educational institutions could have training from Huashu R&D staff. The good performers would be enrolled in Huashu Robotics.

Project Case 3: New R&D Institute of the Guangdong University of Technology (GURD)

The official name of the new R&D institute of the Guangdong Technology University (GURD) is the Foshan-Nanhai-Guangdong-Technology-University CNC Equipment Cooperative Innovation Institute. It was established in 2013 as a public institution by cooperation of five parities: the Guangdong Provincial Science and Technology Department, the Foshan Municipal Government, the Nanhai District Government, the Foshan High-tech Zone Management Committee, and the Guangdong Technology University. The management system of GURD was a division of responsibility under the leadership of the board of directors, which was mainly responsible for discussions and decisions on major issues. From the very beginning, the institute was designed as a public innovation service platform jointly run by the "government-industry-university alliance". The goal of GURD was set to integrate local technology resources, financial resources, and local industrial experience to guide and support manufacturing enterprises in emerging sectors, not limited simply to technology transfer.

GURD received strong government financial aid and policy assistance in all aspects. Its location was within the territory of the Nanhai District Government, which provided guidance for the planning and development of the park. The Foshan High-tech Zone Government was responsible for the implementation of specific policies and measures of the project. In the early stage of platform creation, the Nanhai District Government was responsible for the provision of the park land and factory site and invested 120 million Yuan in hardware and equipment. The government also provided strong support in connecting with talents, enterprises, and funds for the incubated firms and research teams. After the institute received the title of New R&D Institute, it received R&D project funds of 5 million Yuan. To projects, the local government even gave direct policy assistance in project establishment, investment, and bank assistance loan arrangement. At cluster level, all-layer governments recommended projects and technical teams to the platform, assisted in attracting investment, and promoted it nationwide. The Nanhai government set up evaluation indicators for the institute, including the number of projects, the number of talents, the number of patents, and ventures' output value, etc., and conducted regular inspections to monitor the performance of GURD. As the most comprehensive innovation platform established in Nanhai District, GURD performed the following main functions: incubation, applied R&D, technology services, human resources development, and training.

GURD created multiple linkages in regional industrial sectors and integrated various resources. GURD established multi-level relations with governments and obtained public financial support for projects. GURD applied for more than 30 government-sponsored projects, including 5 national-level projects including the project of crowd service platform for integrated application of industrial robots, and more than 40 provincial and municipal projects including the Guangdong Semiconductor Intelligent Equipment and System Integration Innovation Center, and more than 10 projects at the municipal level.

While the channel of linking to government was project financing, the way that GURD established its contacts with local firms was to set up platform organizations for specific industries, with the purpose of clustering industries in Foshan, and coupling with more semi-public institutions such as industry

associations. In 2017, with the support from the Guangdong Provincial Manufacturing Innovation Center, GURD took the lead of creating the Guangdong Innovation Center of Semiconductor Intelligent Equipment and System Integration. As the first integrated innovation center in Foshan City, it gathered resources from more than 10 leading industrial firms, universities, and research institutions. The center's project of developing equipment of chip manufacturing drew attention of more than 25 firms in semiconductor, including Huawei.

As the most important knowledge linkage to GURD, the Guangdong University of Technology made contributions in terms of platform operation, technical support, and talent recruitment in the early stage of GURD development. The Guangdong University of Technology sent teachers and professors to take charge of the management and operation of the institute, including building operational structure and personnel recruitment. GURD also established a national post-doctoral joint training program with the Graduate School of the Guangdong University of Technology and signed a post-doctoral training agreement. GURD widely cooperated with schools of mechatronics, automation, and computer, and trained more than 300 postgraduate and undergraduate students. In almost every function of the platform, GURD leverage the resources of the Guangdong University of Technology for cooperation: ten crowdsourcing platforms with individual professors, 3D printing technical personnel training and professionalization with the School of Continuing Education, and incubation of outstanding entrepreneurial teams with the Institute of Innovation and Entrepreneurship, etc.

Project Case 4: Leaguer Science Park

Foshan Leaguer Science Park (Leaguer Park), or more broadly the Leaguer (Foshan) Innovation Center, was established by Leaguer Technology Group, a subsidiary specialized in technology services of the Research Institute of Tsinghua University. As a public institution, the Research Institute of Tsinghua University had to carry out business operation through its firm vehicle Leaguer Technology Group, a State-owned enterprise. Thus, Leaguer Park was in fact under the unified management of the Research Institute of Tsinghua University. Like GURD, from the very beginning Leaguer project was to build a multi-functional platform, with incubation as key business (Figure 5). The project was introduced by the Foshan municipal government to the Nanhai district government, which provided land, initial investment, and other policy support to Leaguer Park at the initial stage of platform construction. Leaguer Technology Group was responsible for the operation of Leaguer Park as it was built up and would be eventually responsible for its profits and losses in the long run. So far, Leaguer Park still relied on government financial support and had not achieved to make profits.

Both Leaguer Technology Group and Leaguer Park invested in the incubated projects. Since Leaguer Technology Group had strong scientific and technological background and understood better the relevant technology and prospects of the project, normally Leaguer Park would just follow Leaguer Technology Group to make the investment decision and its unified risk control management.

Some regional industrial linkages were created through Leaguer Park. As a large-scale incubator, Leaguer Park accommodated projects in emerging fields such as intelligent manufacturing, new materials, intelligent equipment, electronic information, and biomedicine. For example, a food machine developed by one project was awarded by the Pearl River Talent Program and was used to manufacture durable and ready-to-eat food; another incubated project developed an advanced equipment that could be used for filtration; and a product team from the Tsinghua University developed a new type of packaging material. Besides the products developed by incubated projects, Leaguer Park had its own team

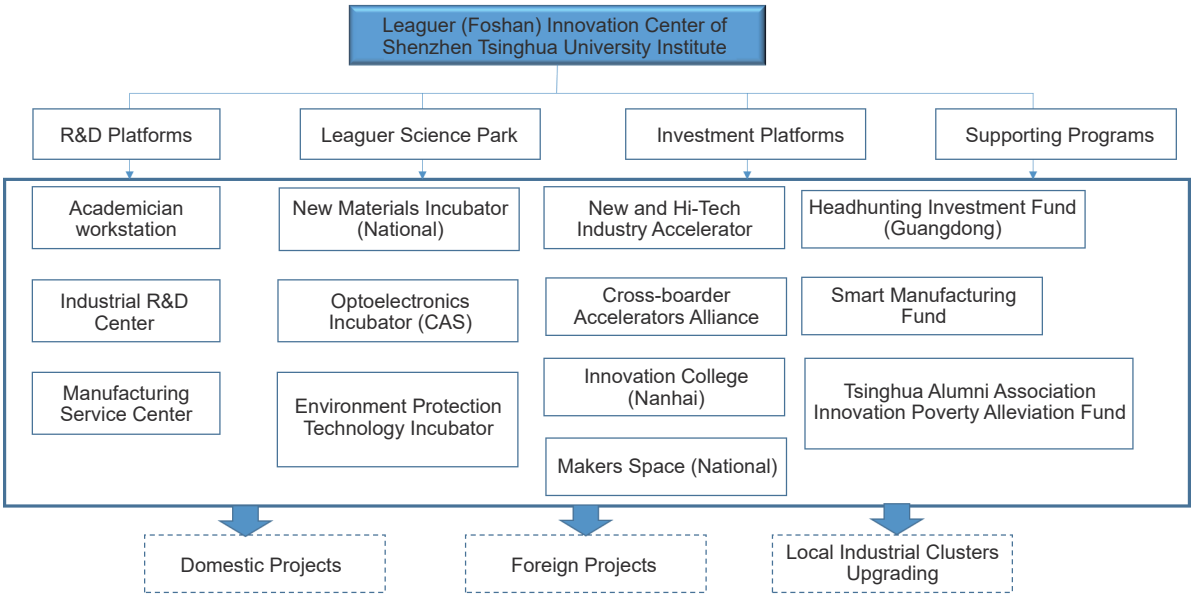

Fig. 5. The platform structure of Leaguer Park.

providing technology services to serve local firms in traditional sectors. Since local firms were relatively conservative in terms of implementing innovation, the industry-research cooperation projects were only formed gradually. Besides ties with the local industrial firms, Leaguer Park also searched for various linkages with research centers, investment institutions, and other technology service organizations. Since the R&D force of Leaguer Park was still weak, it had to count on relations with universities and institutes, especially the Tsinghua University. Leaguer Park offered training courses to students and entrepreneurial teams through creation of an internal business school. Some overseas professors were invited to give lectures. Local governments played an important role to bring to Leaguer Park more contacts with universities, venture investors, and even other incubators in the region.

3.3. Growing innovation platforms to industrial clusters

The above project cases demonstrate that in Nanhai, new projects were developed eventually to become new ventures functioning as innovation platforms (Table 1). For local governments, the quantity of projects matters, because the more there are platform projects, the more the development is regarded as being driven by innovative activities, such as R&D, venture incubation, and technological services, etc., and the more the new projects contribute to the creation of new industrial system as planned. In fact, Nanhai attracted many projects like these cases. From 2017 to 2019, the whole district received more than 1,000 projects with investment above 10 million Yuan each. Nanhai District has 955 national-level high-tech firms. The number of national-level in-house technology centers of firms has increased from 1 to 4, the number of provincial-level in-house technology centers has increased from 30 to 65, and the number of municipal-level in-house technology centers has increased from zero to 59. According to local statistics in 2018, there were 188 provincial engineering technology research centers, 282 municipal engineering technology research centers, and 417 district engineering technology research centers. 45% of industrial firms and all big firms with sales of 500 million Yuan in Nanhai have established in-house R&D institutions. There were 8 provincial-level new R&D institutions and 14 technology transfer centers. There were 25 technology business incubators and 12 makers' spaces. Among them, there were 6 national-level

technology business incubators, 8 national-level technology business incubation units, 15 district-level technology business incubators, and 16 district-level technology business incubation units. Furthermore, there were 6 national-level makers' spaces, 9 provincial-level makers' spaces, and 160 city-level and district-level innovation and entrepreneurship teams.

Table 1
Cases Summary of Projects Becoming Platforms.

	Daji Material	**Huashu Robotics**	**GURD**	**Leaguer Park**
1.Initial actors of project	A team of private entrepreneurs	State-owned firm of Huazhong University of Technology	Guangdong University of Technology, Provincial Government, Municipal Government, District Government, Hi-Tech Zone Government	State-owned firm of Tsing-hua University
2.Initial science and technology resource	Hunan Provincial Institute of Metallurgical Materials	Huazhong University of Technology	Guangdong University of Technology	Tsinghua University
3.Original design of project	A manufacturing firm using patented technologies	An incubator in robot industry	An alliance of government, industry, and university	An incubator for new technologies
4.Realized venture as platform	An R&D- and manufacturing-focused innovation platform with multi-functions and multi-linkages	An R&D- and manufacturing-focused innovation platform with multi-functions and multi-linkages	An incubation- and R&D- focused innovation platform with multi-functions and multi-linkages	An incubation- and R&D- focused innovation platform with multi-functions and multi-linkages
5.Government financial aid and policy support	- initial financial support - integration in official program - integration in local industrial park - linkages to others	- capital contribution - initial financial support - land allocation - label of New R&D institute - linkages to others	- capital contribution - initial financial support - land allocation - label of New R&D institute - integration in official programs - linkages to others	- land allocation - initial financial support - integration in official programs - linkages to others
6.Main structures and functions as established platform	- manufacturing - applied R&D - production demonstration - industrial association - venture capital fund (plan)	- applied R&D - manufacturing - technical services - technical training	- incubation - applied R&D - technical services, including technology brokerage - technical training - venture investment - industrial association - platform of platform (carrier)	- incubation - venture investment - technical services - professional training - platform of platform or innovation carrier (plan)
7.Linkages established to industrial sector	- linkages with the whole value chain of local mold industry - linkage with 3D printing clusters in Shenzhen	- industries of electrical appliance, mobile phone, and computer in Shenzhen - industries of auto parts and polishing in Foshan	- all kinds of traditional industries in Foshan and Guangdong - industries of robot, 3D printing, semi-conductor, machine vision, and intelligent equipment in Foshan	- all kinds of traditional industries in Foshan and Guangdong - industries of new materials, intelligent equipment, electronic information, and biomedicine in Foshan
8.Linkages established to knowledge base	- Hunan Provincial Institute of Metallurgical Materials - research institutes in the field of metallurgical materials	- Huazhong University of Technology - national and local research institutes - local vocational schools	- Guangdong University of Technology - Guangdong Provincial Manufacturing Innovation Center	-Tsing-hua University - via overseas offices of Leaguer Technology Group
9.Clustering approach	Located in industrial park to be part of industrial cluster	Located in industrial park to be part of industrial cluster	Constructed as a S&T park to cluster more projects	Constructed as a S&T park to cluster more projects

When these projects and platforms are carried out, there are always issues of geographic and spatial dimensions to be considered for local governments. Foshan and Nanhai governments will collect the projects and deploy them at specific locations to form industrial clusters and realize regional development. Traditionally, there have been many industrial clusters in Nanhai, in the sectors of ceramics, textiles and clothing, and aluminum. These clusters comprise almost all the upstream and downstream firms in the industrial value chains, and 90% of parts and components can be sourced locally. Nanhai district has 2 national demonstration zones of industrial cluster (textile, hardware), 4 national demonstration zones of well-known branded cluster (aluminum, underwear, electric light source, ceramics), and 5 provincial demonstration zones of industrial cluster (textile, aluminum, hardware, home appliances, underwear). In addition, there are 685 village-level industrial parks in Nanhai. Emerging clusters are in formation covering sectors such as optoelectronics, creative industry, E-commerce, and biopharma, etc.

At the project level, local government adopted three ways to develop projects and platforms to form larger scaled industrial clusters.

1. One is clustering projects of the same or related sectors in the same zones or parks, then fostering the interaction of various teams, projects, and institutions within the same zones or parks to form local clusters. For example, the Daji New Material Technology Project was located in the New Material Industrial Base of Nanhai, and the Huashu Robotics Project was located in the Songxia Industrial Zone of the Nanhai Science, Technology & Industrial Park. Both clusters were endorsed by the local government. The projects then could profit from the infrastructure development of the zone and the linkages with other institutions.

2. The second approach is that when the project itself is an innovation platform in nature, the government supports the execution of the project in terms of infrastructure construction and becoming a spatial and organizational "carrier" of all kinds of innovation projects. With the help of the zone authorities or district governments, various kinds of innovation platforms such as makers space, incubators, forums, alliances, technology transfer center, and even science parks, etc., can become themselves the infrastructure or foundation of industrial clusters. Leaguar Science Park is such an example.

3. The third approach of developing projects and platforms to become industrial clusters is that when the project itself is both an "actor" and a "carrier" of innovation, government supports the implementation of the project more on establishing various external linkages and customized policy measures to promote the project as a cornerstone of future cluster. For example, as a government-industry-university alliance, GURD was a heavyweight project combing different functions of incubator, R&D institute, investment company, and technical service firm, etc. Local governments gave supports to its site construction, financial operation, personnel recruitment, and external linkages to access resources, in hoping GURD can bring out a cluster or several clusters in the fields of robots, 3D printing, semi-conductor, and intelligent equipment. The last two approaches make the platform potentially an industrial cluster.

The platform provides the fundament for formulating sectoral transcending linkages and interactions across a range of technologies, actors, and industries. The large number of projects, platforms, and then clusters connected to each other in Nanhai eventually created multiple mass effects on regional innovation development. The first effect is industrial upgrading of traditional sectors. The traditional manufacturing in Nanhai has long been based on private ownership and a lot of hidden champions in industrial segments across the country and the world. Most of them are small- and medium-sized firms, situated at the low end of the industrial value chain, with insufficient investment in technological transformation to intelligent manufacturing and low-level production technology. Path dependence makes many firms

encounter difficulties in technological upgrading. Platforms link these traditional industries to the emerging advanced manufacturing sectors by interactions and continuous flows of technology, markets, information, talents, capital, and equipment, etc., stimulating the renewal of traditional firms. The second effect is that new platforms in Nanhai, as both actors and carriers of innovation, not only help existing sectors transform, but also create a series of new sectors. The platforms as innovation carriers, such as incubators, accelerators, and science parks generate new clusters in advanced manufacturing and ensure the momentum of the industrial cluster is continuously established on new ventures. The platforms as innovation actors that are in or related to a specific industrial field, including innovative ventures, R&D institutions, university scientific research institutes, technology centers, and various science and technology intermediary service agencies, etc., together with the innovation carriers, are engendering region-specific "innovative clusters" in Nanhai. They are networks integrating technology, knowledge, talents, and business projects at the levels of township or district, with local governments as critical nods and paths of linkages of the whole web, together constructing the regional advantage.

4. Chinese Entrepreneurial Local Governments: Policy Implications to Emerging and Catch-up Economies

What can other developing countries or catch-up economies learn from the platform-centered innovation policy in China? As a local government, the practical experience of Nanhai district is highly attached to the particular government and policy system in China which is simultaneously centralized and regionalized. So other countries searching for innovation-driven development will have difficulty to emulate exactly what China has done. There is no panacea to achieve similar economic or technological output with the input of the same policies. But, at the operational level, the policy approaches practiced by Chinese local governments may provide some heuristics, especially when they are highlighted by more general thinking.

4.1. Targeting regional innovation policy

Innovation takes place primarily in local milieus with a concentration of knowledge, talents, and entrepreneurs. The recent policy experienced by Chinese entrepreneurial local governments reveals the importance of creating regional clusters for a country's innovativeness. Emerging and catch-up economies shall pay more attention to regional innovation system and policy. Regional innovation system approach acknowledges the role and impact of the public sector and policy support, preferably in public-private partnerships, in developing capacity for knowledge creation and exploitation in the context of regions. Subnational governments are conceived to have responsibility to influence a variety of actors, state and non-state, individual, networked and corporate, that may be involved in policy processes.

Certainly, the conduct and creativity of local governments are profoundly shaped by local conditions and each local government should have its own innovation policy approach addressing specific challenges, problems and opportunities found in each type of region. Chinese local governments have found out their own way to leverage and valorize specific knowledge-assets in the country and achieved the so-called "constructed regional advantage" (Asheim and Coenen, 2006). But there exist many other policy strategies and tools which can also be useful for regional innovation, such as regional path transformation, place-based strategies, smart specialization, policy learning strategy, regional autonomy, knowledge bases, and regional governance, etc. (Asheim, Grillitsch and Trippl, 2016). Local authorities can take measures to build technopoles and science hubs, to re-vitalize areas by making investments

in new technology-based firms, and to foster "agglomeration effects' and 'interactive learning' by developing industrial districts and clusters (Soete, 2007).

4.2. Focusing on practice and process of policy implementation

In general, innovation policy emphasizes policy instruments or tools which are the active means by which policy is implemented – the programs, organizations, rules, and regulations which affect policy outcomes. They can change over time and across space whether in terms of rationales, goals, or implementation methods (Flanagan, Uyarra and Laranja, 2011). Traditional innovation policy instruments include various financial and tax measures for sponsoring basic and applied research, stimulating complementary business R&D, encouraging investment in new technology-based firms, and reinforcing intellectual property protection, etc. More recent innovation policy tools emphasize diffusion policy including building technological service infrastructure, building science and technology parks, investing venture capital and other forms of entrepreneurship stimulation, and developing the interaction between university and industry. Other innovation policy instruments include public procurement, promoting learning organizations, and promoting consumer learning, etc. (Schot and Steinmueller, 2018). As for instruments of regional innovation policy, the instruments cover science and technology parks building, formation of formal and informal innovation networks such as clusters, alliances, competitiveness poles and competence centers, innovation advisory services for existing firms and start-ups; innovation vouchers, schemes for talent attraction and retention, and funding for research infrastructure. Specifically, the policies that aim to improve the coordination and alignment among different actors in innovation systems often involve funding conditionality, e.g., research funding on the condition of participation with other organizations in a network. Such conditional funding can be applied to university, corporate, and public research laboratory funding (Edler and Fagerberg, 2017).

Chinese local governments make use of all these policy tools without debating on which one is optimum in the plan. Instead, they implement policy tools in a pragmatist way and integrate them in a complete implementation process that they believe adapted to local circumstances. During the process, local governments' organizational capabilities, implementation procedures, administrative structures, and officials' knowledge on how to manage innovation projects in practice are discovered and built up. To a large degree, it is rather the implementation process as a management practice by local government officials than the central government's planned innovation policy that constitutes the regional innovation dynamics in China. Meanwhile, because of the experimental and practical nature of regional innovation policy in China, there is little consideration of the efficiency in policy choice. The effectiveness and quantity of results are more important than quality and efficiency. Local governments pursue agglomerate effects at regional level, and they achieved to have critical mass of platforms and clusters.

4.3. Using innovation "platforms" in a distinctive way

At organizational level, innovation platforms are defined as hybrid institutions which operate at the intersection of the university, industry and government institutional spheres and synthesize elements of each sphere in their institutional design. They include technology transfer offices in universities and government research laboratories, industrial liaison offices, business support institutions (science parks, business and technology incubators, start-up accelerators), and financial support institutions (public and private venture capital firms, angel networks, seed capital funds, and so on). Boundaries of these hybrid organizations become looser and innovation processes require greater sharing of tasks and

knowledge (Ranga and Etzkowitz 2013; Etzkowitz and Leydesdorff, 2000). The Chinese policy definition of innovation platforms is not far away from this academic conceptualization, even it is enlarged to more activities and organization.

It is at the policy level that the concept of "innovation platform" gains its Chinese characteristics. First, Chinese local governments use the platform as a guideline, or "policy compass" in Chinese term, to direct their focus on project development. The platform concept is traditionally used either to describe generic technologies such as software and biotechnology, that have potential applications across a wide range of industries, or modular developments in automotive, where a limited number of platforms can be used to build a large variety of car models. A platform approach generates a context better equipped to exploit multipurpose and generic technologies (Asheim, Boschma, and Cooke, 2011; Content and Frenken, 2016). If the European approach of innovation platforms is more about the combination and alignment of knowledge (Tödtling and Trippl, 2005), the Chinese local governments use the idea of "platform" as a policy guideline or framework to promote new path of regional development. Pushing all kinds of projects to adopt as much as possible platform business models and functions is the key part of current innovation policy in China. New projects are encouraged or even required by local governments to become eventually innovation platforms.

Secondly, since platforms are often trans-sectoral, Chinese local governments use them as future industrial generators for nurturing sectoral specialization or differentiation in the region. This approach is very similar to the Regional Development Platform Method (Harmaakorpi, 2006; Harmaakorpi, Tura and Melkas, 2011), where innovation platforms for regional development must fulfil certain conditions: (i) important regional enterprises must be among the exploiters of building platforms, (ii) the new platforms must be able to create new business activity, (iii) there must be actors strong enough for each sector, (iv) it must be possible to name responsible organizations and people for each sector of the new platform, (v) the actors of the new platform should be able to agree on common goals and a course of action, (vi) the actors of the new platform should be able to name a credible "owner" for the platform.

Thirdly, once established, innovation platform is often used by Chinese local governments as a carrier or platform, a "handler" in Chinese word, to implement a broad mix of policy measures and instruments over a specific industry, a knowledge base or a mode of innovation. The core idea of policies regarding innovation platforms is upgrading and renewing regional economies by stimulating connections between industries and knowledge bases (Cooke, Laurentis and Tödtling, 2007; Asheim, Boschma and Cooke, 2011; Asheim, Grillitsch and Trippl, 2016). Platform policies create more scope and flexibility on the one hand, and the need for connectivity and the creation of systems on the other. In the Chinese context, since policy "handler" means the combination of both target (actor) and concrete context (carrier) to whom various relevant instruments can be applied, innovation platforms thus become ideal platforms for experimenting new policies. The Chinese practice corresponds exactly to the academic notion of policy platforms which highlights the articulation of an array of instruments including and integrating key components from several policy domains, and various actors, agencies and structures engaged as 'carriers' (Asheim, Boschma and Cooke, 2011).

4.4. Adopting the approach of holistic innovation policy

A major challenge for policymakers is to streamline the interaction of different levels of governments in order to improve the efficiency of innovation policy. Regions and localities are also increasingly creating their autonomous innovation agencies to implement regional innovation strategies which require the development of new institutions and national-regional coordination tools (Guimon, 2014). As the

responsibility for the different components of the innovation system is distributed across different areas of the government, a "holistic" perspective on policy is necessary for effective coordination between different parts of the government, such as the ministries responsible for knowledge creation, skills-production, finance and so on. This fundamentally horizontal and interdepartmental nature of innovation policy calls for a "whole-of-government" approach. It depends on the establishment of efficient government machinery able to ensure the needed coordination, as well as a powerful coordinating body at the center of the government allowing innovation policy to have a pervasive influence (Braun, 2008; Fagerberg and Srholec, 2009; Edquist and Leif (Ed.), 2008). From this perspective, the Chinese approach of regional innovation policy is very integrative or holistic. Local governments at different levels, from zone, to town, to district, to city, to region, and to province, etc. are all mobilized and coordinated to participate in the whole process of regional innovation-oriented development, working from the micro level of project operation to the mesa and macro level of cluster, urban, and industrial development. This Chinese "whole-of-government" approach is due to its highly consolidated hierarchical system of administration.

Moreover, innovation policy is by nature intersectoral and multidimensional. It is important to integrate and co-ordinate policy areas like R&D policies, educational policies, regional policies, and even macro-economic policies when formulating innovation policies (Edquist, 2018). Regional innovation policy requires addressing a "regional innovation system" instead of single determinant or actors, so it is often under the form of "policy package" or "policy mix" integrating actions in various functional areas – education, trade, investment, finance, and science (Vonortas and Aridi, 2012; World Bank, 2010). This "policy mix" approach suggests the intentional combination and interaction of relevant programs and instruments within a particular region. It promotes the integration of the fundamental practices, processes and mechanisms determining effective regional innovation outcomes, going beyond the more piecemeal approaches within 'traditional' regional innovation policy (Flanagan et al., 2011; Borrás and Edquist, 2019). Chinese local governments practice the "policy mix" actively in innovation. They usually use simultaneously all kinds of functional policies in various fields, such as science, education, research and development, technology, industry, labor, finance, fiscal, even infrastructure and urbanization development in a supplementary and multidimensional way. The policies and instruments may be overlapped in targeting the same projects or platforms, but since no one knows what the optimum situation shall be, effectiveness is prioritized over efficiency concern.

4.5. Becoming a super manager of regional innovation development

Clustering and networking are important factors in constructing regional innovation advantage (Moulaert & Sekia, 2003). However, the proximity of various firms does not itself yield innovative results. Platforms are actively created regional multi-actor network nods or even innovation networks themselves. They can become the concrete actions in running the regional innovation systems, as well as lead the way to new regional paths. By constructing numerous innovation platforms with various project actors, Chinese local governments in fact create innovation networks with enough critical mass allowing the emergence of regional industry or groups of industries. They do not stay at the planning level of macro environment or institution building but are engaged in transforming projects to platforms and further developing platforms to local clusters and networks. Thus, the resulted regional innovation network is very much like the Taiwanese network in the theory proposed by Amsden and Chu (2003). For the non-Asian economies, what may be learnt is not the whole government-based network, but the powerful role of local governments as a super "manager" during policy implementation process, who actively searches,

mobilizes, and integrates financial, technological, market, and organizational resources often beyond simple project boundaries to achieve the regional innovation development.

5. Conclusions

Based on an in-depth study of one city district and four new investment projects in South China, this paper argues that Chinese local governments and their policy implementation practice do play a key role in constructing and developing innovation platforms, which are regarded as a cornerstone in the regional innovation system (Asheim, Boschma, and Cooke, 2011; Asheim, Grillitsch, and Trippl, 2016). In fact, Chinese local governments behave as an "integrative organizer" in managing and coordinating regional level innovation processes. This finding contributes to the growing literature on innovation platform by proposing a three-step policy model of using platforms as a central mechanism to facilitate and promote regional innovation-driven development. The proposed model, especially the underlined policy instruments, can have wide policy implications to the central or local governments. For example, the ideas of fusing industrial and innovation chains to target emerging industries, obliging new projects to adopt platform business models, transforming platforms to real industrial players, and sourcing projects from different types of organizations (firm, university, association, and entrepreneur, etc.). It is also found that local governments can use cluster policy to grow the invested platform projects to a larger scale to have regional effects.

By far, the innovation policy practice of Chinese local governments can only supply some heuristic approaches, far from the "best practice". There is no such innovation policy, and each region shall find its own "tailor-made" approach addressing the specific challenges, problems, and opportunities (Tödtling and Trippl, 2005). More questions shall be raised regarding the relevance of the Chinese experience to the fundamental problematics in innovation theory, about innovation system, innovation platform, and regional policy, etc. More empirical research shall be carried out to cover other regions and localities in Guangdong and other provinces in China. Although the Pearl River Delta presents a typical example of how local governments practice innovation policy and what the processes are inside the implementation "black box", questions like why the same "constructing-platform" approach is less effective in remoted regions persist. These questions are related to a broader policy background, such as spatial deployment of platforms, thickening situation of innovation ecosystems, and integration of clusters with various levels of urbanization and infrastructure development, etc., topics well beyond the scope of this article but worth further research.

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