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Regional Innovation Policy Analysis in China: The cases of Beijing and Shenzhen

PEILIN WEI
egi15pwe@student.lu.se

Abstract: This thesis makes a study on how regional innovation policies facilitate economic development in different regions of China from 2000 to 2014. To analyze this question, it chooses Beijing and Shenzhen as two case studies and describes regional innovation policies from two perspectives: new path development perspective and smart specialization perspective. Our results find that Beijing as a core region selected path creation to develop economy while Shenzhen as an old industrial region promoted path branching. In addition, both of regions made efforts to develop institutional variety and institutional integration.

Key words: regional innovation policy, new path development, smart specialization, core and old industrial regions

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1 Introduction

1.1Background

Globalization is a process where people, firms, and governments from different countries could be connected and integrated. That is to say, an international network is built during this process. In general, it is driven by technology transfer, international trade, and foreign direct investment. Since 2001, when China entered WTO, the globalization process has accelerated. From one hand, it facilitated the technological upgrading and economic transformation of China, which laid a good foundation for future development. However, from the other hand, it also means that China would face fiercer competition in the global market. In this situation, strengthening national and regional competitiveness and economic performance has become an important issue. It is widely accepted that innovation, learning, and knowledge are key factors in promoting economic growth and competitive ability both at the national level and regional level (Trippl & Todtling, 2005). In the globalizing economy, innovation activities (product innovation, process innovation, and organizational innovation) play a key role in all types of regions (Lagendijk, 2000; Lundvall & Borras, 1999; Maskell et al., 1998). And continuous innovation will have a positive influence on sustainable competitiveness. Therefore, innovation has always ranked the first in policy formulation process. For China, in the mid-2000s, it proposed "indigenous innovation" *(zizhuchuangxin)* as a driver to improve technological innovation and capabilities (Yang, 2015). What's more, different regions may have different environment, situations, features and prerequisites for innovation, therefore, it is difficult to find one "best practice" innovation policy that could be used in all types of regions (Cooke et al., 2000; Isaksen, 2001; Nauwelaers & Wintjes, 2003). Trippl and Todtling (2005) argues that different places will present different performance in innovation activities. As a result, it is important to analyze innovation policy from

a placed-based perspective. In this situation, it is essential to make a study on regional innovation policies that pay more attention to innovation in different regions. Through the study of regional innovation policies, we could evaluate how they promote regional innovation performance and economic development.

1.2 Aim and Scope of Study

The aim of the thesis is to make a study on how regional innovation policies facilitate economic development in different regions of China during the period 2000 to 2014. In this thesis, we would study innovation policies at a regional level and choose Beijing and Shanghai as two types of regions. In addition, to conduct our research, we analyze regional innovation policies from two perspectives: new path development perspective and smart specialization perspective. The reason we choose this period is that it was a time in which China began to integrate into the world economy and faced intense competition from other countries. Therefore, it had a strong desire to stimulate innovation, national and regional competitiveness.

1.3 Contribution of Study

The Contribution of the thesis could be illustrated from two aspects. Firstly, it analyzes innovation policies from a place-based perspective and tries to find the similarities and differences in innovation policies in two types of regions. Although there are a lot of research on innovation policies of China before, most of them focus on the national level. There is little research on the innovation policy of different types of regions in China. Secondly, we analyze regional innovation policies from new path development perspective and smart specialization perspective. Through these two perspectives, the thesis put emphasis on the fact that regions differ in their abilities to cause regional industrial change. What's more, it also argues that institutional variety and integration have a significant effect on innovation performance.

1.4 Outline of the Thesis

The thesis is structured into six sections, that is, introduction, literature review, methodology, data collection, case analysis on regional innovation policies, discussions and conclusion.

Section 1 presents the introduction which includes the background, the aim, and scope of the study. Contribution and limitation are also described.

Section 2 provides the literature review which aims to give an overview of the theoretical background on regional innovation policies. In the section, it covers the definition of regional innovation policy, rationales for regional innovation policies, path development, RIS types and smart specialization.

Section 3 describes the methodology that will be used in the study. In this thesis, quantitative approach and qualitative approach will be combined to analyze the economic development and regional innovation policies. In the quantitative approach part, descriptive statistics will be presented.

Section 4 shows the data of chosen indicators that will be utilized to complete the analysis.

Section 5 makes two case study analysis about regional innovation policies. One is Beijing, the other is Shenzhen. In the section, new path development and smart specialization theories are applied to the case study.

Section 6 discusses the similarities and differences in innovation policies of Beijing and Shenzhen

Section 7 makes a conclusion and illustrates future research on the topic.

The purpose of this section is to describe the study and present research questions. In the next section, literature review and theoretical background about regional innovation policy will be discussed.

2 Literature Review and Theoretical Background

2.1 Definition of Regional Innovation Policy

Innovation is a process where new products and new production processes will be discovered, experimented and adopted (Dosi,1988). It is always considered as the engine of economic growth. According to Lundvall & Borras (1997), innovation policy refers to the elements of science and technology policy that could promote the development of new products and new processes in the market. Compared with national innovation policies that pay more attention to territories or incorporation of the regional dimension, regional innovation policies put increasing emphasis on regions (OECD, 2011).

2.2 Rationales for Innovation Policy

In the past few years, the most popular viewpoints on the innovation system approach argue that market failures and structural system failures hinder the innovation activities. From the market failure perspective, it believes that the public good character of knowledge and technology and spill-over problems will bring socially sub-optimal investment in R&D. What ‘s more, due to the information asymmetries, financial investors are uncertain about the high-tech outcomes, which may lead to the undersupply of funding on R&D.

From the structural system failures perspective, it argues that innovation is a process that involves in interaction and cooperation. That is to say, it is a non-linear process and can not happen in isolation. It requires the interaction between different institutions, such as firms, research institutes, financial organizations, government, regulations, culture and so on. However, when the interaction of mechanisms can not function effectively, structural failures (infrastructural, institutional, interaction and capability failures) will take place (Woolthuis et al. 2005). When the system failures idea is utilized at a regional level, three primary types of defects will make the appearance, that is, fragmentation, organizational thinness and

negative lock-in (Isaksen, 2001; Todtling and Trippl, 2005). Fragmentation always discusses the lack of linkages and networks between different actors. In this situation, the interactive learning and knowledge exchange will be hindered. Organizational thinness refers to the absence of necessary components of the regional innovation system, such as a lack of research institutes, which will reduce the local learning dynamics (Maskell & Malmberg, 1999). Negative Lock-in usually takes places in a mature industry. In this field, stable input-output networks have been established and production process has been standardized. In this situation, firms may find it difficult to adapt to the changes in the markets and technologies, which may lead to a low competitiveness. Therefore, it is important for the government to carry out policies to optimize the structure of innovation system so as to stop the structural failures.

Recently, efforts have been made to widen the idea of system failure. More scholars have paid attention to the strategic challenges of transformative change. In this situation, an extended system failure notion "transformational system failure" was put forward. Compared with the market failures and structural system failures arguments that are limited to proposing the structural deficiencies in the innovation system, transformational system failure points out a multi-level perspective on the long-term transitions. It identified that there are failures in stopping the transformative change process from happening in an expected way. It is the complement to structural system failures, including directionality failure, demand articulation failure, policy coordination failure and reflexivity failure (Weber & Rohracher, 2012).

Although these frameworks provide a variety of understanding on the deficiencies in the innovation process, it was partially valid and useful to explain the new path development. The structural system failure framework mainly pays attention to the existing innovation systems

and is confined to addressing the factors that impair innovation as a prerequisite for the development of new path. What's more, it also has deficits in explaining what impedes the transformation of the entire innovation system. The recent explanatory of transformational system failures makes an attempt to consider the innovation system from a more dynamic perspective, however, it also has disadvantages. Firstly, some of the described deficiencies are severely repetitive. Secondly, it can not clearly illustrate in what situations they will occur.

Therefore, in the thesis, place-based system failure framework will also be used to explain the rationales for regional innovation policies. It mainly provides insights on the obstacles of regional structural change by combining the failures to break with existing structures and failures to grow new development paths. All these failures may have a relationship with actors, networks, and institutions. With regard to actors, strong capabilities of them are the main barrier to break with old paths. When the technological changes reduce the value of existing capabilities, strong capabilities that are always established by vast investments in different areas will bring cognitive lock-in (Grabher, 1993). By contrast, weak capabilities will have a negative influence on the growth of new paths, which holds a similar explanation as organizational thinness argument (Isaksen, 2001; Todtling & Trippl, 2005). In regards to networks, failures to break with existing paths are caused by strong connectivity and correlation in old paths. However, weak connectedness and interdependencies will limit interactive learning so as to hinder the development of new paths. When it comes to institutions, negative institutional lock-ins will take place in old industrial regions (Isaksen, 2001; Todtling & Trippl, 2005; Hassink, 2010). In old industrial regions, institutions have already built strong alignment, therefore, it is difficult to break with existing structures. On the contrary, weak institutional alignment and integration will restrict new paths development.

As the thesis will illustrate regional innovation policies from new path development perspective and smart specialization perspective, in the following part, we would like to give a detail description about path development.

2.3 Path Development

Based on the previous research, Grillitsch and Trippl (2016) have proposed six pivotal forms to account for the idea of path development, that is, path extension, path upgrading, path modernization, path branching, path importation and path creation.

2.3.1 Path Extension

Path extension always takes place through the incremental innovations in existing industries, which means that the existing regional industrial structures will be continued. In this situation, the regional economy may gradually decrease, even stagnate because of the lack of renewal capacities and regional industries will experience path exhaustion and negative lock-in. The innovation activities of firms will decline and mainly follow the well-established and limited technological paths. This phenomenon may be a reflection of strong connectedness among regional actors but with weak interaction to the external field. In such a case, the competitiveness of local firms will reduce and radical innovation is difficult to occur.

2.3.2 Path Upgrading

Path upgrading refers to a process where regional path develops by participating in the industrial transformation in the global production networks. The regional industries may enter into path upgrading through the improvement of specialized skills and technologies so as to increase the value chain in the global cooperation system. For example, in the globalization process, developed regions transferred a variety of labor-intensive manufacturing industries to the less developed regions so that they can upgrade the current industries to higher value-added ones.

2.3.3 Path Modernization

Path modernization indicates that due to the organizational innovation and new technologies, existing industrial path develops to a new direction. It is a basic intra-path change. For example, the laser technology is applied to the forest industry (Foray, 2015) and organizations are established in creative industries (Grabher, 2001).

2.3.4 Path Branching

Path branching denotes a process where new industries develop based on existing related industries. A key point for the path branching is that a variety of incumbent firms enter into new industries by utilizing their existing relevant knowledge and competencies. What's more, during this process, related technological variety plays an important role. The higher the amount of related variety, the more chances there are for regional branching. This is based on the fact that the transfer of knowledge needs cognitive proximity. That is to say, regional actors need to share similar knowledge so as to ensure efficient communication (Nooteboom, 2000). However, too much cognitive proximity may let actors miss new knowledge and bring negative lock-in. Therefore, diversified but related capabilities will stimulate knowledge transfer so that path branching will happen.

2.3.5 Path importation

Path importation captures the idea that the established industries do not exist in the region before, however, they are not new to the world. In general, path importation occurs through foreign firms and foreign direct investment. It depends on the situation that the extraneous companies could present a good performance in the region. That is to say, they can bring advanced value-added products and build a close connection with regional actors so as to help themselves better adapt to the regional economy.

2.3.6 Path Creation

Compared with other path development, path creation reflects the most wide-ranging industrial changes in a region. It means that entirely new industries (normally high-tech or knowledge intensive industries) appear due to the scientific discoveries and technological innovation. New path creation usually relies on research and is concentrated on the commercialization of new findings. It strives to develop through the shaping of new companies and spin-offs. Path creation usually needs high-quality infrastructure, effective institutional changes, efficient network interaction, new and creative knowledge organizations.

According to the arguments of scholars, six types of path development will be applied in different regions. Therefore, in the next part, we would like to discuss three main regions and try to make a combination between path development and regions.

2.4 Types of Regions

Isaksen and Trippl (2016b) distinguish three main RIS types, that is, organizationally thin RIS, organizationally thick and specialized RIS and organizationally thick and diversified RIS. The concept of RIS was firstly developed by Cooke (2001). It captures the idea that innovation activities are stimulated by the social and open interaction between different actors. In other words, innovative firms depend on the regional networks, cooperating not only with firms but also with educational bodies, research institutes, and government organizations. The connection between these institutions has a significant influence on the knowledge production, diffusion, and innovation and therefore contributes to the regional economic growth. In brief, the characteristics of RIS could be understood from three perspectives. Firstly, the innovation system is an open and social system. Secondly, a variety of institutions is involved in the system. Thirdly, the

cooperation and linkage between these organizations facilitate the regional development.

According to the basic features of RIS, organizationally thin RIS are typical for peripheral regions while organizationally thick and specialized RIS are usually found in old industrial areas. To the metropolitan regions, organizationally thick and diversified RIS are popular.

2.4.1 Organizationally Thin RIS: Peripheral Regions

Peripheral regions are often characterized by the problems that strong actors and dynamic clusters lack. In these areas, the level of R&D and product innovation are relatively low. Most of the attention is paid to incremental innovation and process innovation (Cooke et al., 2000). Due to the low R&D activities, the barriers for industrial changes in peripheral regions are the weak capabilities of regional firms and weak innovation network between actors. In addition, the number of training facilities, research and educational institutions is also not sufficient, which means that knowledge agglomeration is thin. Therefore, policy makers in peripheral regions could develop path importation that can attract diversified institutions from external world to the region so that new knowledge and technology can be achieved. However, for this area, path branching is not a proper choice. The argument is based on the fact that path branching requires a solid foundation in existing industries, which do not apply to the peripheral regions.

2.4.2 Organizationally Thick and Specialized RIS: Old Industrial Regions

The major challenges that old industrial regions face are the negative lock-ins in traditional industries. Compared with peripheral regions, where dynamic clusters usually miss, old industrial regions have strong specialization in mature industries. They are always described as “centers of continuity” (Isaksen & Trippl, 2016b). Meanwhile, the

knowledge generation and distribution system are highly developed, which means that it is difficult to abandon existing paths and create entirely new ones. Generally speaking, process innovation dominates the regions and innovation activities usually follow the mature and traditional technological track (Cooke, 1995). As for the network deficiencies to industrial change, too rigid inter-firm networks between well-established actors have been documented. In this situation, players will be blinded to seek new opportunities for path development. Due to the above characteristics, most of the industrial regions prefer to choose path extension rather than develop new forms of paths (Isaksen & Trippl 2016b). However, some regions will strengthen the research input and establish a variety of educational bodies in order to improve the exploration ability of the region, which could lay the foundation of path branching.

2.4.3 Organizationally Thick and Diversified RIS: Core Regions

The characteristics of core regions are identified by the fact that there are a variety of firms, educational bodies and support organizations, which lay a good foundation for the regional structure change. What's more, the networks in the core regions are open and diversified. However, challenges to new path development also exist in core regions. In general, unbalanced exploration and exploitation abilities are the main reasons. Universities and companies in core regions may have significantly scientific exploration abilities, however, it is difficult for them to commercialize findings. In other words, the capabilities to exploit new knowledge are relatively poor. Because of these features, path creation is a good option for the core regions, which can be realized by improving exploitation capacities and strengthening support for knowledge commercialization.

After the description of path development theories, in the following part, smart specialization theories will be presented.

2.5 Smart Specialization

2.5.1 Smart Specialization Dynamics

Smart Specialization (RIS3) is a strategic and place-based approach applied in regional innovation policy. It is a process where research and innovation strategies are identified priorities in the regional development policy so that the regions could establish "place-based" competitive advantages and complete economic transformation driven by innovation (Landabaso, 2014). According to the approach, different regions have different conditions and different kinds of innovation and knowledge will bring diversified competitiveness. It also recognizes that multiple institutional forms will facilitate various economic activities. Relying on the previous work, Foray (2014) came up with the argument that three processes (entrepreneurial discovery, entry and accumulation, structural economic changes) will reveal in the smart specialization dynamics. The entrepreneurial discovery process is a bottom-up process in which participants from the diversified environment (firms, universities, public administrators) are identifying promising technological and market opportunity and producing information about new potential activities (Foray, 2015). With the attraction of new and interesting opportunities, more and more entrepreneurs will enter the new fields of economic activity. In this situation, spillovers and agglomeration effects will take place, which lay a good foundation for spin-offs and further firm development. Due to the accumulation of knowledge, resources, networks and competencies, structure changes will happen and new paths will develop in the region. Therefore, in the smart specialization approach, entrepreneurs play an important role. They guide an entrepreneurial discovery process that brings spillovers and accumulation effects, which finally result in a regional structure change.

During the entrepreneurial discovery process, highly collaboration is required. Therefore, a variety of regional stakeholder groups needs to be involved, such as organizations, universities, firms and other associations. In other words, institutions, from a have a regional perspective, have a significant influence on promoting smart specialization dynamics. Among a series of institutional studies, two complementary dimensions, institutional integration and institutional diversity, have been put forward. Therefore, in the following part, we would like to build connections between institutional integration, institutional diversity and smart specialization dynamics.

2.5.2 Institutional Integration and Diversity

The institutional integration puts emphasize on the fact that institutions may facilitate interactions between different social groups. In a region, if relevant institutions can strengthen networks and collaborate with each other effectively, the institutional integration can be promoted. A high degree of institutional integration can facilitate the exchange of knowledge and interactive learning processes (Sotarauta, 2015; Strambach and Klement, 2012). Apart from institutional integration, institutional diversity also acts a necessary part in regional dynamics. It refers to the agglomeration of different types of actors such as firms, research institutes, public administrators and so on.

There are strong reasons why smart specialization dynamics could benefit from institutional integration and diversity. It can be illustrated from two aspects. That is, (1) firstly, why do institutional integration and diversity could stimulate entrepreneurial discovery process? Secondly, (2) why do these two institutions dimensions facilitate spillovers and accumulation effects?

For the first question, the nature of entrepreneurial discovery process is the combination of different types of knowledge, which are usually distributed in a variety of institutional fields. That is to say,

institutional variety brings knowledge diversity that becomes the precondition for radical innovation and branching into the new market. Besides institutional variety, a certain extent of institutional integration is also needed to support the transfer of knowledge and interactive learning among different institutions (Sotarauta, 2015; Strambach & Klement, 2012). Etzkowitz (2012) argues that the more the cooperation and networks between firms and universities, the higher innovativeness and competitiveness there are in the regions. In brief, entrepreneurial discovery process requires the combination of different types of knowledge, which are possessed by individuals from different institutions and connected by networks, collaboration and mobility.

Turning to the spillovers and accumulation effects, it is argued that when the regions are diversified, it is not easy for the powerful agencies to dominate regional policies and protect their vested interests so that negative lock-in will not happen (Boschma, 2015; Grabher, 1993; Neffke et al., 2010). What's more, the coordination of various actors and the equipment of specialized resources will be stimulated by institutional integration. In this situation, spillovers and accumulation effects will be triggered.

In short, the relationship between institutional variety and integration is synergetic, which facilitates the entrepreneurial discovery and agglomeration processes together.

The section aims to present a detail description on new path development, three types of regions and smart specialization. The next section will describe the research design and selected methodology that will be used to discuss the research question in the thesis.

3 Methodology

3.1 Research Design

Case Study

The research design lays a good foundation for data collection and analysis (Bryman and Bell, 2011). Case study is a widely used research design that aims to give an in-depth explanation about issues in specific situation and content. In this thesis, two case studies, Beijing and Shenzhen, will be outlined so as to indicate what type of regional innovation policy are used to facilitate economic development in different regions. As we discuss before, regions could be divided into three categories: peripheral regions, old industrial regions and core regions. The reason we choose Beijing as our one case study is that it is the political, cultural and S&T center of China, which means that a variety of institutions cluster in Beijing. In addition, it always ranks higher in regards to regional GDP. Therefore, it is the most representative example to study the innovation policy in a core region of China. We choose Shenzhen as the other case study is based on the fact that it initially was an experimental area for reform and open-up policy. Due to the industrial transformation from Hong Kong and Taiwan, it became the center of low-cost production. However, because of the increasing labor cost, Shenzhen have to add higher value to traditional industries. By developing innovation policies, Shenzhen ranked top three in terms of innovation dynamics that is only less than that of Beijing and Shanghai (Chinese Academy of Social Sciences, 2014). Therefore, it is a representative old industrial region in China.

3.2 Research Method

In the thesis, descriptive statistics with specific indicators will be offered. Both qualitative and quantitative approach are presented to analyze the innovation situations in Beijing and Shenzhen.

3.2.1 Quantitative Approach

Descriptive statistics is generally used to provide the basic characteristics and summaries of the data in the research study.

Combined with graphics analysis, descriptive statistics gives the quantitative description in a feasible way.

For the description of social-economic development part, descriptive statistics with chosen factors on a regional level will be summarized to present the economic performance of different regions. With regard to regional innovation policy part, descriptive statistics together with graphic analysis both on a firm level and regional level will be presented to identify the diversified regional policy and make a linkage to the theories.

3.2.2 Qualitative Approach

What's more, some parts of the regional innovation policy need to present through qualitative approach. The information is mainly from Beijing and Shenzhen government research report. In addition, in the discussion part, the qualitative approach will be used as well to identify the similarities and differences between regional innovation policies in different regions. Furthermore, the qualitative information will also be discussed to build a connection between case studies and theoretical background.

The aim of the section is to present the methodology that will be used to analyze the economic development and regional innovation policy in Beijing and Shenzhen. The next section will discuss the data that will be used in the thesis.

4 Data Collection

To evaluate how regional innovation policy promotes the economic development in Beijing and Shenzhen, published secondary data will be used. In this thesis, data will be gathered mostly from Beijing statistical yearbooks and Shenzhen statistical yearbooks, which are published every year by Bureaus of Statistics of Beijing and Shenzhen so as to provide general information about social-economic development and innovation activities. Moreover, the sources will also come from Tianjin statistical yearbooks, Hebei statistical

yearbooks, Guangdong statistical yearbooks, science parks annual report, publicly available information (mainly from the official website), firms annual report, Beijing Municipal Science & Technology Commission and Shenzhen Municipal Science & Innovation Commission.

To discuss the social and economic development of Beijing and Shenzhen from 2000 to 2014, the data of GDP, a total number of population and GDP per capital will be applied.

With regard to innovation activities, the data of R&D expenditure, patent and R&D personnel will be collected, both at the city level and the firm level. However, due to the limitation of the secondary data, R&D expenditure performed by universities and research institutes, R&D expenditure performed by large-medium sized enterprises, R&D expenditure performed by small sized enterprises, will be analyzed from the year 2009. In addition, for Baidu, we select the year 2003 as the beginning because it is the first year that Baidu started to publish its official report. Meanwhile, for Huawei and ZTE, we select the year 2006 as the beginning. What's more, the number and size of high-technology firms, the output value of high-technology industries and the number of educational bodies are also be used to reflect technology development and knowledge diffusion (Table1).

Notion	Indicator	Source
Social-economic development	GDP	Beijing, Shenzhen Tianjin, Hebei and Guangdong Statistical Yearbooks
	Total number of population	
	GDP per capital	
Innovation activities	R&D expenditure	Beijing and Shenzhen statistical yearbooks Firms annual report
	R&D expenditure as % of GDP	Beijing and Shenzhen statistical yearbooks
	R&D expenditure as % of total revenue	Firms annual report

	Patent application	Beijing and Shenzhen statistical yearbook
	Patent grant	Beijing and Shenzhen statistical yearbook
	R&D expenditure performed by universities and research institutes	Beijing statistical yearbook
	R&D expenditure performed by universities and research institutes as % of total R&D expenditure	Beijing statistical yearbook
	R&D expenditure performed by large-medium sized enterprises	Beijing statistical yearbook Shenzhen statistical yearbook
	R&D expenditure performed by large-medium sized firms as % of total R&D expenditure	Beijing statistical yearbook Shenzhen statistical yearbook
	R&D expenditure performed by small sized enterprises	Beijing statistical yearbook
	R&D expenditure performed by small sized enterprises as % of total R&D expenditure	Beijing statistical yearbook
	R&D personnel as % of total employment	Firms annual report
Technology development	Number of high-technology firms	Science Parks annual report
	Size of firms	Science Parks annual report
	Output value of high-technology industries	Shenzhen Municipal Science & Innovation Commission
Knowledge	Number of	Beijing Municipal

Diffusion	educational bodies	Science &Technology Commission Shenzhen Municipal Science & Innovation Commission

Table 1 Descriptive table of notion, indicator and source of the data

This section describes the data with chosen indications. In the next section, two cases will be analyzed to answer the research question of the thesis.

5 Case Study Analysis

5.1 Case Study on Beijing

The aim of our thesis is to make a study on how regional innovation policies stimulate economic development in different regions of China. Therefore, to answer this question, firstly, we will discuss the economic development of Beijing from 2000 to 2014.

5.1.1 Social and Economic Content of Beijing

Located in the northern part of China, Beijing is one of the most famous capital cities around the world and controlled directly by the national government. Beijing municipality is the center of Jingjinji metropolitan region (China national capital region) that is made up of Beijing, Tianjin and Hebei Province (Figure 1). It has already become the largest urbanized region in the northern area of China and forms the capability to compete with southern Pearl River Delta and eastern Yangtze River Delta.

Figure 1 Location of Beijing

According to the plan issued by Beijing Municipal Commission of Urban Planning, Beijing is designed as the educational, cultural and S&T center of China. It has a lot of institutions ranging from firms, universities, research institutes and science parks. The most representative ones among them are Tsinghua University, Peking University and Zhongguancun Science Park. From regional division we outline before, Beijing is the core region that is identified as diversified institutions and networks.

Because of the orientation, industrial production has been moved out of Beijing gradually since the 1990s. Meanwhile, to facilitate economic growth, the government of Beijing focuses more on the path creation in the Tenth, Eleventh and Twelfth Five-Year Plan (from 2000 to 2015). It tries to make the high-technology businesses become the primary force for the development of Beijing.

To evaluate the social and economic performance of Beijing, we will use three indicators: GDP, a total number of population and GDP per capital.

	2000	2003	2006	2009	2012	2014
GDP in million USD	45822	72568	117,649	176,130	259,121	309,142
Total number of population (10,000)	1363.6	1456.4	1601	1860	2069.3	2151.6
GDP per capital (USD)	2915	4202	6488	9799	13857	16278

Table 2 GDP, Total number of population, GDP per capital of Beijing (2000-2014) (in million USD)
Source: Beijing Statistical Yearbook (2015).
Note the population means that people always live in Beijing not people register in Beijing

From Table 2, some characteristics of social-economic condition of Beijing could be concluded.

(1) Both GDP and GDP per capital in Beijing have an increasing

tendency. On one hand, GDP has increased from $45822 million to $309,142 million with an annual growth rate of 13.6% during the period 2000-2014. On the other hand, the GDP per capital of Beijing reached $16, 278 in 2014, which was more than twice higher than the average level of China ($6758) (China Statistical Yearbook, 2015).

(2) The number of the total population has exceeded 10,000,000 in 2000. After 2012, it even surpassed 20,000,000. Beijing has already become the largest city by population and attracted a lot of people from different regions within China.

What's more, compared with other provinces in Jingjinji metropolitan region, Beijing always ranked the highest in terms of GDP per capital from 2000 to 2014, which reflects the fact that Beijing is the economic center of Jingjinji metropolitan region (Table 3).

	2000	2003	2006	2009	2012	2014
Beijing	2915	4202	6488	9799	13857	16278
Tianjin	2515	3702	6107	9069	13503	15251
Hebei	1100	1486	2418	3562	5302	5795

Table3 GDP per capital of Beijing, Tianjin and Hebei Province (2000-2014)
Source: Beijing Statistical Yearbook (2015), Tianjin Statistical Yearbook (2015) and Hebei Statistical Yearbook (2015).

From above analysis, we can find that Beijing shows a good performance in social and economic performance from 2000 to 2014. In the next part, we would make a deeper analysis on how the social and economic development could be facilitated by regional innovation policies. We will analyze it from path development perspective and smart specialization perspective.

5.1.2 New Path Development

As a core region, the municipal government of Beijing promoted path creation. As we described before, path creation represents the most radical innovation in a region. It refers to the appearance of entirely new industries. In this situation, to develop new industries, Beijing

enhanced innovation activities in order to stimulate the growth of science and technology (Table 4). From 2000 to 2014, the R&D expenditure has increased from $2257 million to $18388 million, which means that the annual growth rate of it arrived 15%. Meanwhile, the percentage R&D expenditure took in the total GDP also showed a rising trend (from 4.9% to 5.9%). It indicates that the innovation intensive of Beijing has improved gradually. In addition, the patent is by no means a necessary indicator to measure innovation. This fifteen-year period witnessed a rapid rise in the number of patent application and patent grant. During this period, the annual growth rate of patent application and the patent grant has reached 18.9% and 18.4% respectively. To 2014, 138,111 patents were applied, of which 74661 patents were granted.

	2000	2003	2006	2009	2012	2014
R&D expenditure	2257	3714	6275	9690	15411	18388
R&D expenditure as % of GDP	4.9%	5.1%	5.3%	5.5%	5.9%	5.9%
Patent application	10,344	17,003	26,555	50,236	92,305	138,111
Patent grant	5905	8248	11238	22921	50511	74661

Table 4 R&D expenditure and Patent of Beijing (2000-2014)
Source: Beijing Statistical Yearbook (2015)

As the educational center of China, a lot of universities and research institutes are engaged in research and development (Table 5). From 2009 to 2014, R&D expenditure performed by universities and research institutes took morn than 30% percentage in total R&D expenditure. Besides educational bodies, small sized enterprises are also actively involved in innovation activities. The R&D expenditure performed by small sized enterprises was higher than that of large and medium-sized firms.

	2009	2012	2014
R&D expenditure performed by universities and research institutes	3193	5202	6041
R&D expenditure performed by universities and research institutes as % of total R&D expenditure	33%	33.8%	32.9%
R&D expenditure performed by large-medium sized firms	1243	2372	2741
R&D expenditure performed by large-medium sized firms as % of total R&D expenditure	12.8%	15.4%	14.9%
R&D expenditure performed by small sized enterprises	2561	3735	3977
R&D expenditure performed by small sized enterprises as % of total R&D expenditure	26.4%	24.2%	21.6%

Table 5 R&D expenditure in different institutions (2009-2014)
Source: Beijing statistical yearbook (2010, 2014)

What's more, for Beijing, developing science parks is also a strategy to promote path creation. The most representative one is

Zhongguancun Science Park (ZSP) that is located in Haidian District of Beijing. It is also known as Chinese Silicon Valley. A lot of high-technology companies cluster in Zhonngguancun and play an important role in generating and spreading knowledge. In 2000, there were 6186 high-tech enterprises (Table 6). Till 2014, the number of high-tech enterprises has increased to 21,559. From 2006 to 2009, they decreased due to the financial crisis, but overall, there was an ascending trend. In addition, small and medium-sized companies are important sources for innovation development. During the period 2000 to 2014, although the percentage reveal a decreasing trend, over 85% of high-tech companies in Zhongguancun science park were small and medium size.

	2000	2003	2006	2009	2012	2014
Number of high-tech enterprises	6186	12030	18149	17355	20000	21559
Large enterprises	180	372	706	1253	1897	2556
Small and medium-sized enterprises	6006	11658	17443	16102	18103	19003
SMEs as % of total high-tech enterprises	97.09%	96.91%	96.11%	92.78%	90.52%	88.14%

Table 6 Enterprises statistics of Zhongguancun (2000-2014)
Source: Zhongguancun annual report (2000, 2003, 2006, 2009, 2012, 2014).

Because of their small size, these high-tech SMEs often innovate through cooperation and interaction with nearby firms, research institutes and universities. For example, high-technology firms in ZSP have built close networks and relationships with Chinese Academy of Science, Peking University and Tsinghua University. This phenomenon is consistent with the theory we outline before, that is,

path creation often requires effective interaction and creative knowledge institutions.

By promoting path creation, IT companies has developed significantly. By late 2014, among the top 10 Internet companies in China, six are in ZSP (Table 7)

Rank	Name	Location
1	Tecent	Shenzhen
2	Alibaba Group	Hangzhou
3	Baidu	Beijing
4	JD.com	Beijing
5	Sohu	Beijing
6	Qihoo 360	Beijing
7	Xiaomi	Beijing
8	NetEase	Hangzhou
9	Suning	Nanjing
10	Sina	Beijing

Table 7 Rank of Internet companies in China (2014)
Source: Zhongguancun annual report (2014)

And the most representative one among them is Baidu that was built in Zhongguancun Science Park in 2000. Till now, it has become the number one Chinese language search engine and number one internet traffic site in China. Baidu is a company that is committed to remaining the China's innovation leader, therefore, it pays much attention to research and development. In Table 8, we will use the data of R&D expenditure and total revenue obtained from Baidu Annual Report to discuss its research activities.

	2003	2006	2009	2012	2014
R&D expenditure	0.75	10	61	334	1012
Revenue	6	107	645	3233	7109
R&D expenditure as % of total revenue	12.5%	9.3%	9.5%	10.3%	14.2%

Table 8 R&D expenditure and total revenue of Baidu (2003-2014)
Source: Baidu annual report (2003, 2006, 2009, 2012, 2014).

From Table 8, we can find that both R&D expenditure and Revenue of Baidu had a rapid growth during this period. From one hand, the R&D expenditure increased from $0.75 million in 2003 to $1012 million in 2014, which means that the annual growth rate of it reached 82.3%. From the other hand, there was 80.4% annual increase in terms of total revenue. In addition, the R&D expenditure accounting for total revenue of Baidu always kept a high level. In 2014, it arrived 14.2%, which was far beyond other internet companies in China.

What's more, it is a company that could combine cooperation and competition. It not only establishes networks and connection with its suppliers and customers through vertical collaboration but also formulates collaborative arrangements with its competitors through horizontal collaboration.

Apart from new path development, smart specialization is another important component of regional innovation policy, which considers a variety of stakeholder groups. As we discuss before, institutions affect smart specialization through variety and integration. From one hand, institutional variety focuses on the accumulation of different types of actors, such as firms, research institutes and universities. From another hand, institutional integration refers to the cooperation and networks between these different groups. These two complementary institutional dimensions have synergetic effects on developing smart specialization dynamics. Firstly, they will motivate entrepreneurial discovery process, then bring spillovers and agglomeration effects, finally trigger industrial structure change.

Therefore, in the next part, we will discuss smart specialization from institutional variety and institutional integration perspective.

5.1.3 Smart Specialization: Institutional Variety and Institutional Integration

As the educational and S&T center of China, Beijing not only established Science Parks, but also developed various universities and

research institutes (Figure 2). Till 2014, it has owned the largest educational and scientific concentration in China.

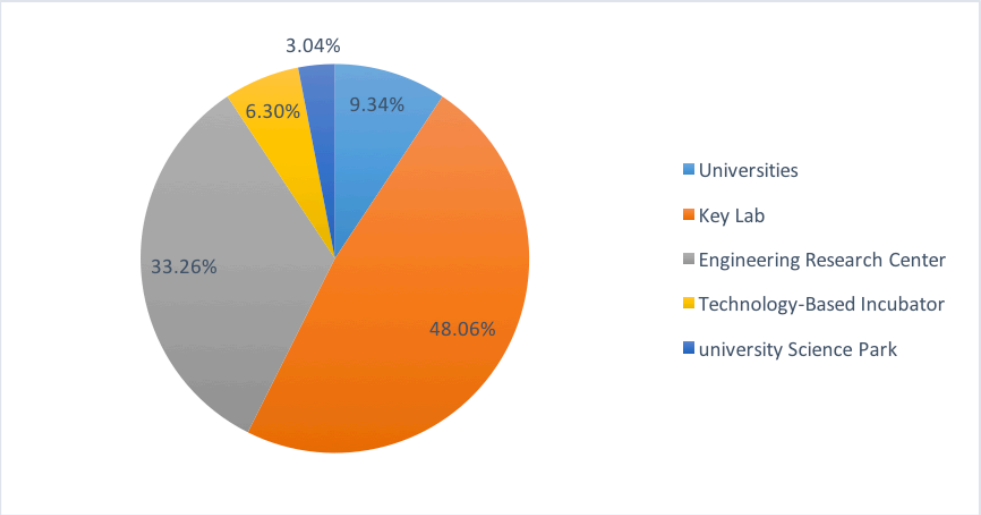

Figure2 Institutions in Beijing (2014)
Source: Beijing Municipal Science and Technology Commission (2014)

As can be seen from the Figure 2, five constituents have clustered in Beijing, which offer key technology and skills and play pivotal roles in knowledge creation, accumulation, diffusion and application. Among them, the number of key labs is the highest (458), accounting for 48.06% of all innovation carries. Next is engineering research centers (317) that take the percentage of 33.26%. The amount of universities, technology-based incubators and university science parks is 89, 60 and 29, which occupy 9.34%, 6.30% and 3.04% respectively. Beijing is also famous for its universities. In 2014 university ranking, eight of top 100 universities of Asian Pacific universities are located in Beijing (QS University Rankings Asia, 2014). Among them, the most prominent research universities are Peking University and Tsinghua University. There are 29 key labs in PKU and 42 key labs in THU (Table 9).

	Peking University	Tsinghua University
National Lab	1	1
State Key Lab	8	13
National Engineering Lab	2	11
Key Lab of Ministry of Education	18	17

Table 9 Key Institute of in PKU and THU (2014)
Source: official website of PKU and THU

Besides different types of actors, Beijing is also characterized by the close interaction and connection between them. For example, Tsinghua Science Park was built in 1994 as an incubator to strengthen the connection between Tsinghua University and industry. In the science park, THU built achievement transformation institutes so as to transfer original technology to firms and realize commercialization and industrialization. What's more, based on the market demand, firms in the park can also seek applied research support from THU. They could employ professors and postgraduate students as part-time workers. In this situation, firms could complete significant technological innovation by using university's technical and intellectual resources. Till 2014, it has developed a space of 770 thousand square meters. It attracted and incubated more than 1200 firms and collected 30000 researchers (http://www.tuspark.com). To enhance the networks and collaboration with research institutes, a variety of multinational firms established the R&D center in Tsinghua science park, such as Sun Microsystems, Schlumberger and NEC. It was also the headquarters of Tsinghua University Enterprises involving Tsinghua Tongfang, Tsinghua Unissoft and Tsinghua Zhicheng. The university spin-off firms play an important role in commercializing scientific research and financing start-ups run by alumni.

From above analysis, it is obvious that Beijing is a core region with a high degree of institutional diversity and integration.

After discussing Beijing's innovation policies, in the following part, we would like to make a case study on Shenzhen.

5.2 Case Study on Shenzhen

Similar to Beijing, before we make analysis on regional innovation policies, firstly, we would like to use the descriptive statistics method to give a general introduction about the social-economic development of Shenzhen.

5.2.1 Social and Economic Content of Shenzhen

Located in the northwest of Hong Kong, Shenzhen was just a small fish village with a population of 320000 (Shenzhen Statistical Yearbook, 2015). Since 1978, the Chinese government has implemented the reform and open-up policy so as to follow up the world trend and take part in the world economy. In this situation, Shenzhen was selected to become the first special economic zone, which means that it was given the policy privilege to be a free trade zone. It was also designed to realize two goals. One is to be the experiment of market-oriented economy. The other is to carry on the transformation of manufacturing in Hong Kong. Unlike the inland regions, the land and property of Shenzhen were treated as economic assets and developed involving individual participation, not just the public goods under planned economy. What's more, it also possessed inexpensive labor and geographical proximity. It is situated in the coastal area of Guangdong province and keeps the main channel for imported and exported goods between inland China and the world (Figure 3)

City	Sample size
Dongguan	569
Guangzhou	323
Huizhou	258
Jiangmen	161
Qingyuan	608
Shenzhen	516
Zhaoqing	273
Zhongshan	333
Zhuhai	185

Figure 3 Location of Shenzhen

Due to the privileges and advantages, Shenzhen attracted a variety of labor intensive manufacturing industries shifting from Hong Kong and Taiwan. It established an export-led network gradually and had a significant growth from just a small village to a manufacturing center that was considered as "a workshop of world factory" at that time (Sit and Yang, 1997). However, as Shenzhen grew, it also faced challenge. With the development of economy, labor price increased rapidly. Therefore, it lost cost advantages gradually. That is to say, Shenzhen, as an old industrial region, can not continue to remain successful by producing low-cost assembly and developing low manufacturing industry transforming from Hong Kong. It need to achieve endogenous innovation and develop regional innovation policies in order to complete the industrial upgrading. In this situation, the government of Shenzhen develops path branching and establishes a variety of research and educational institutions to facilitate economic development and innovation activities. Similar to Beijing, we also use GDP, total number of population and GDP per capital to describe the economic growth of Shenzhen (Table10).

	2000	2003	2006	2009	2012	2014
GDP in million USD	31,702	51,966	84,254	120,148	187,992	231,910
Total number of population (10000)	701.24	778.27	871.1	995.01	1054.74	1077.89
GDP per capital (USD)	4521	6677	9672	12075	17824	21515

Table 10 GDP, Total number of population, GDP per capital of Shenzhen from 2000-2014
Source: Shenzhen Statistical Yearbook (2015).
Note the population means that people always live in Shenzhen not people register in Shenzhen

From Table 10, we can see that the GDP in Shenzhen has increased from $31,702 million in 2000 to $231,910 million in 2014, which means that the average growth rate of GDP in Shenzhen has reached 14.2% per annum. At the same time, the number of population also achieved a rapid growth (from 7,012,400 to 10,778,900). As for GDP per capital, it exceeded $20000 in 2014 with a 11% annual growth rate. In addition, compared with other cities in Pearl River Delta, Shenzhen always hold the number one position in GDP per capital from 2000 to 2014 (Table 11).

	2000	2003	2006	2009	2012	2014
Shenzhen	4521	6677	9672	12075	17824	21515
Guangzhou	3714	5565	9122	11505	15349	18620
Dongguan	1982	3214	5677	7100	8827	10233
Zhuhai	4025	5186	7564	9861	13887	16889
Huizhou	2011	2443	3551	4803	7410	9226
Zhongshan	2185	3439	6128	7849	11260	12852
Jiangmen	1862	2208	3313	4493	6091	6701
Foshan	2932	4081	7303	10390	13158	14727
Zhaoqing	1076	1342	1975	3269	5362	6637

Table 11 GDP per capital of cities in Pearl River Delta (2000-2014)
Source: Shenzhen statistical yearbook (2015) and Guangdong statistical yearbook (2015)

All of the above factors indicate that Shenzhen has already become the economic center of Pearl River Delta and engine of Chinese economic growth.

In the following part, we will also use new path development theory and smart specialization theory to discuss Shenzhen's economic development.

5.2.2 New Path Development

Different from Beijing that is a core region and promotes path creation to stimulate economic development, Shenzhen is an old industrial region and develops economy through path branching. That is to say, it tries to develop new industries based on existing related industries. To promote path branching, Shenzhen made efforts to improve R&D

inputs (Table 12). From 2000 to 2014, the R&D expenditure experienced an increase from $697 million to $9276 million with an annual growth rate of 19%. At the same time, R&D expenditure accounting for the total GDP went up as well from 2.2% to 4.0%. With respect to the annual growth rate of patent appilcation and patent grant, the former was 21.5% and the latter was 23%. Compared with Beijing, we could find that although the absolution number of R&D expenditure, paternt application and grant of Shenzhen was lower than that of Beijing, the annual growth rate of these indicators of Shenzhen was higher. In other words, similar to Beijing, Shenzhen also put a lot of energy into science and technology development.

	2000	2003	2006	2009	2012	2014
R&D expenditure	697	1207	2766	4051	7078	9276
R&D expenditure as % of GDP	2.2%	2.3%	3.3%	3.4%	3.8%	4.0%
Patent Application	4431	12361	29728	42279	73130	82254
Patent Grant	2401	4937	11494	25894	48662	53687

Table 12 R&D expenditure and Patent of Shenzhen (2000-2014)
Source: Shenzhen statistical yearbook (2015)

As an economic special zone, the policy and regulations of Shenzhen is relatively open, which means that there is less direct intervention from central authorities. In this situation, Most of the R&D expenditure in Shenzhen are concentrated in firms, especially in large and medium sized firms (Table 13).

	2009	2012	2014
R&D expenditure performed by the large-medium sized enterprises	3482	6362	8002
R&D expenditure total in Shenzhen	4051	7078	9276
R&D expenditure performed by the large-medium sized enterprises as % of total R&D expenditure	86.0%	89.9%	86.3%

Table 13 R&D expenditure performed by large-medium sized enterprises (2009-2014)
Source Shenzhen statistical yearbook (2010, 2015)

From Table 13, we can find that from 2009 to 2014, more than 85% of Shenzhen's R&D was conducted by firms. In 2012, it reached a peak at 89.9%. Although there was a decrease trend from 2012 to 2014, R&D expenditure performed by the enterprises still took 86.3% percentage. In other words, the R&D expenditure performed by the universities or research institutes occupied less than 15%, which marked an obvious difference from Beijing. In addition, it also shows that the R&D input in Shenzhen was heavily concentrated in large firms.

Apart from improving R&D expenditure, the government of Shenzhen also established industrial parks to draw high-technology firms and promote path branching. In 1996, Shenzhen High-tech Industrial Park (SHIP) was built (Li, 2005). It involves a variety of industries and attempts to develop traditional industries by taking advantage of high technology (Shenzhen Industrial Park Net, 2005). To 2013, the size of SHIP has already reached 11.5km^2 and comprised five sectors, that is, information and communication technology, new material and new energy, advanced manufacturing technology, bioengineering and environmental protection technology (Figure 4). Among them, the

information and communication technology took the highest percentage in terms of output value, which amounted to 87.87%.

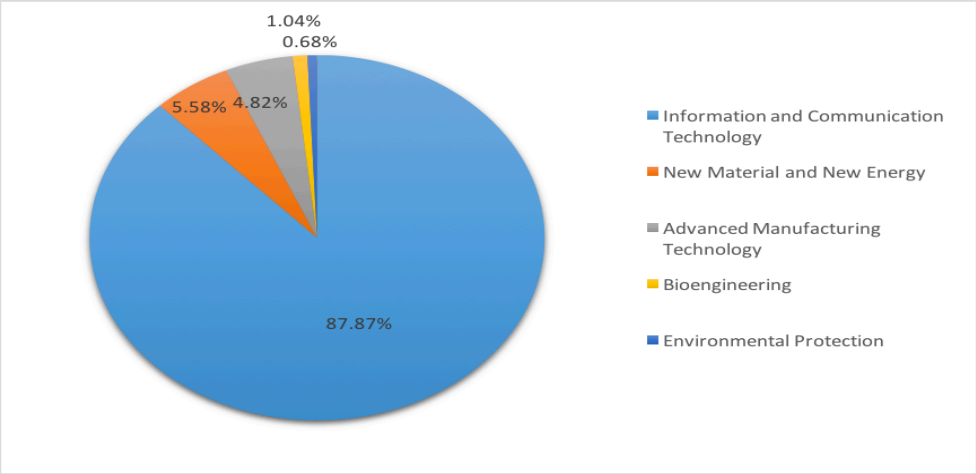

Figure 4 Output value of high technology industries in Shenzhen (2013)
Source: Shenzhen Municipal Science & Innovation Commission

As we discuss before, path branching usually occurs based on existing related industries. That is to say, related technological variety plays a significant role in path branching. The reason is that related variety could provide an opportunity for the diffusion of similar knowledge. As an old industrial region, in the past few decades, Shenzhen was called "the window of Chinese electronic industry". A lot of electronic enterprises clustered in Shenzhen, which laid a good foundation for the development of information and communication technology.

In the area of information and communication technology, the most representative example in Shenzhen is Huawei that is based on completely indigenous innovation. Till now, it has become the leading IT innovator of China and the main driving force of Shenzhen's growth (Table 14)

	2006	2009	2012	2014
R&D expenditure	851	1933	4361	5920
Revenue	8504	21,603	35,350	41,768
R&D expenditure as % of Revenue	10.0%	8.9%	13.7%	14.2%
R&D personnel as % of total employment	48%	46%	47%	45%

Table 14 R&D expenditure and total revenue of Huawei (2006-2014)
Source: Annual report of Huawei (2006-2014)

From Table 14, we can find that Huawei made vast investment in research and development. During the period 2000 to 2014, more than 45% people were employed in R&D department. In regards to R&D expenditure, it increased from $851 million to $5920 million in nine years. In 2014, it occupied 14.2% in total revenue. Although the percentage R&D expenditure took in total revenue has declined from 2006 to 2009 due to the effect of financial crisis, it was still higher than 8%.

As innovation activities take place increasingly from networks and interaction between different actors, such as firms, research institutes and governments. Apart from path branching, the municipal government of Shenzhen also developed institutional variety and institutional interaction to strengthen innovation performance. Therefore, in the following part, we would like to present regional innovation policy in an old industrial region from smart specialization perspective.

5.2.3 Smart Specialization: Institutional variety and Institutional integration

Apart from building office parks to promote path branching, Shenzhen established educational bodies as well. In the early 1980s, Shenzhen University was built and in 1993, Shenzhen polytechnic, a

technology-based college was established. Moreover, it also attracted Tsinghua University, Peking University, Chinese Academy of Engineering to build research institute in SHIP. With the acceleration of globalization, Shenzhen faced more competition from other countries. According to Trippl and Todtling (2005), knowledge and learning are key points in stimulating competitiveness both at national level and regional level. In this situation, in 2000, the municipal of Shenzhen established "virtual campus" to attract more universities and research institutes to come to Shenzhen. The concept of virtual campus could be understood from two aspects. From one hand, it is a logical concept which means that various universities will be connected through network. From the other hand, it is a geographical concept which illustrates that branches of the famous universities throughout the world will locate in Shenzhen so as to provide cooperative opportunities between firms, universities and venture capitals. Under the incentive of governmental policy, from 2000 to 2013, 57 universities located branches in virtual campus including six Hong Kong universities and seven foreign universities. What's more, 151 key labs and 207 research centers are also built in virtual campus. (Shenzhen Municipal Science & Innovation Commission). Till 2014, Shenzhen has become a city with a variety of institutions (Figure 5).

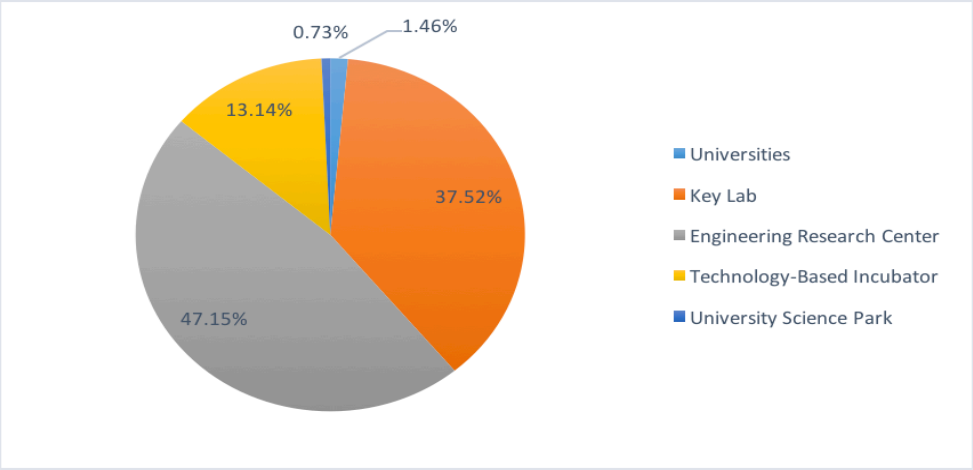

Figure 5 Institutions in Shenzhen (2014)
Source: Shenzhen Municipal Science & Innovation Commission (2014)

As is shown in the Figure 5, the number of engineering research centers was the highest (47.15%), which was followed by key lab (37.52%), technology-based incubator (13.14%), Universities (1.46%) and university science park (0.73%). Although the total number of institutions of Shenzhen is lower than that of Beijing, Shenzhen still shows a good performance in institutional variety.

In regards to institutional integration, the government of Shenzhen made efforts to establish networks between firms and research institutes through university science park (virtual campus). Till 2011, the space of the science park has arrived 350 thousand square meters. What's more, it incubated 791 high-tech enterprises, completed 1367 university-enterprise cooperation projects and commercialized 1247 scientific achievements (Shenzhen Municipal Science & Innovation Commission).

From above analysis, we could find that Shenzhen, an old industrial region, chose path branching to change the industrial structure by establishing a variety of educational bodies and enhancing network between different actors.

Based on the characteristics of economic development and innovation policies of Beijing and Shenzhen, in the following section, we would like to make a discussion.

6 Discussion

In the fifth section, we made analysis on economic performance and regional innovation policies of two different regions—Beijing and Shenzhen. The former represents for a core region, that is, organizationally thick and diversified RIS while the latter represents for an old industrial region, that is, organizationally thick and specialized RIS. In this section, we would like to discuss the similarities and differences between these two regions.

6.1 Similarities

The similarities of economic development and innovation policies between the two regions could be illustrated from three aspects.

(1) Both of these two regions have good performance in economic development. According to the descriptive statistics, the GDP per capital of Beijing ranked the first among Jingjinjin metropolitan region. Meanwhile, Shenzhen also had a rapid growth in GDP per capital. It always held the first in GDP per capital compared with other cities in Pearl River Delta.

(2) The municipal governments of Beijing and Shenzhen made lots of efforts to improve R&D expenditure. For Beijing, its R&D expenditure accounting for total GDP has reached 5.9% in 2014, which was the highest among China. It shows that Beijing as a core region is identified as an innovation leader of China. For Shenzhen, the annual growth rate of R&D expenditure reached 19% from 2000 to 2014.

(3) Both of these two regions have a variety of institutions ranging from firms, universities, research institutes and technology-based incubators. In other words, either Beijing or Shenzhen could be characterized as institutional variety. In addition, they tried to establish networks and connection between different actors as well.

As for differences, they could be indicated from two aspects.

6.2 Differences

(1) Beijing is a core region of China, which means that the main option to develop new path is path creation. However, Shenzhen is an old industrial region, therefore, it promoted path branching to change traditional industrial structure.

(2) Compared with Shenzhen, the R&D expenditure performed by the universities or research institutes in Beijing took a higher percentage and small sized firms play a significant role in innovation activities. However, in Shenzhen, most of the R&D

expenditure are concentrated in firms, especially in large and medium sized firms. From one hand, it makes sure that R&D in Shenzhen pays more attention to market and user's need, however, from the other hand, it indicates that the municipal government of Shenzhen could provide more support to universities and research institutes' R&D expenditure in the future regional innovation policy. It is widely agreed that entrepreneurs and small size firms have great influence on innovation activities as well. Therefore, in the future, the municipal of Shenzhen could execute more policies on innovation of small enterprises.

7 Conclusion

7.1 Summary

The aim of the thesis is to make a study on how regional innovation policies facilitate economic development in different regions of China during the period 2000 to 2014. To achieve the purpose, we analyze the regional innovation policies from two perspectives: new path development perspective and smart specialization perspective. In addition, two different regions are chosen as our case studies. One is Beijing (a core region), and the other is Shenzhen (an old industrial region). Based on the descriptive statistics, we find that both of Beijing and Shenzhen showed a good performance in economic development. Beijing, the political, educational center of China, is characterized as a core region, which promoted path creation to develop economy and kept high degree of institutional diversity and integration. Different from Beijing, Shenzhen is an old industrial region. Therefore, it chose path branching to change industrial structure. In addition, the government of Shenzhen also make lots of attempts to improve institutional variety and institutional integration.

7.2 Limitation and future research

Unlike most previous research based on the national level, we study innovation policy at regional level. According to Isaksen and Trippl

(2016b), there are three main RIS types, that is, organizationally thin RIS (periphery region), organizationally thick and specialized RIS (old industrial region) and organizationally thick and diversified RIS (core region). However, due to the lack of data and different statistical standard, we choose two representative types of regions to make a research. Therefore, in the future, we hope that more data could be published by National Bureau of Statistics so that we could compare innovation policies of three different types of regions in China.

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Appendix I

The institutions of Beijing (2014)

Source: Beijing Municipal Science & Technology Commission (2014) http://www.bjkw.gov.cn

Universities	89	9.34%
Key Lab	458	48.06%
Engineering Research Center	317	33.26%
Technology-Based Incubator	60	6.30%
university Science Park	29	3.04%
Total	953	100.00%

Appendix II

the Output value of high-technology industry in Shenzhen (2013)

Source: Shenzhen Municipal Science & Innovation Commission (2013) The development of high technology industries in Shenzhen, http://www.szsti.gov.cn/info/data/2013/1

Information and Communication Technology	180,325	87.87%
New Material and New Energy	11,444	5.58%
Advanced Manufacturing Technology	9897	4.82%
Bioengineering	2142	1.04%
Environmental Protection	1402	0.68%
Total	205,209	100.00 %

Appendix III

The institutions of Shenzhen (2014)

Source: Shenzhen Municipal Science & Innovation Commission (2014) http://www.szsti.gov.cn/services/resources/list/

Universities	10	1.46%
Key Lab	257	37.52%
Engineering Research Center	323	47.15%
Technology-Based Incubator	90	13.14%
university Science Park	5	0.73%
Total	685	100.00%